GANDHI INSTITUTE OF ENGINEERING AND TECHNOLOGY UNIVERSITY, ODISHA, GUNUPUR

(GIET UNIVERSITY)

BACHELOR'S DEGREE PROGRAMME

B.Tech

BIOTECHNOLGY

Course Structure and Detailed Syllabus

For Student Admitted in

2019-2023

Academic Session

ACADEMIC CURRICULAR

2019 - 2023

GANDHI INSTITUTE OF ENGINEERING AND TECHNOLOGY UNIVERSITY, ODISHA, GUNUPUR

(GIET UNIVERSITY)

Curriculum, Syllabus and Course Structure

For

Under Graduate Degree Programme

In

Engineering & Technology

Regulation 2019

BIOTECHNOLOGY

Vision of the Department

To provide quality education in biotechnology with societal needs and to produce bio technocrats to cater the needs of academia, research and industry.

Mission of the Department

- To establish unique platform for graduate studies in biotechnology through lab to land learning.
- To create a conducive research environment in different areas of biotechnology pertinent to society, environment and industry.
- To educate the students to become a responsible citizen with ethical and moral values.

PEO-1:
To provide teaching in applied biology with technological advancement and to ascertain competence in designing of new experiments, tools and techniques with social relevance in the field of Biotechnology and allied sciences.

PEO-2:
To develop urge for advanced learning and to explore new areas of research in biotechnology to serve the society for sustainable development.

PEO-3:
To encourage the students for lifelong learning, career enhancement and enable them to evolve as an entrepreneur with high ethical values.

Programme Specific Outcomes (PSO):

PSO1: Ability to identify and analyze the problems related to biological fields and finding suitable solutions through application of knowledge and research in biotechnology Engineering.

PSO2: To design solutions for environment, industry and agricultural problems with appropriate biotechnological techniques.

Program Outcomes (POs)

Biotechnology Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage e in independent and life-long learning in the broadest context of technological change.

GANDHI INSTITUTE OF ENGINEERING AND TECHNOLOGY UNIVERSITY, ODISHA, GUNUPUR

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DEPARTMENT OF BIOTECHNOLOGY

I SEMESTER [FIRST YEAR]

SN	Sub Code	Name of the Subject	L	T	P	C
1	BBSBS1010	Engineering Mathematics-1	3	1	0	4
2	BBSBS1021	Engineering Physics	3	0	0	3
3	BESBS1034	Electrical And Electronics Engineering	3	0	0	3
4	BESBS1040	Programming For Problem Solving	2	0	0	2
5	BHSBS1050	Communicative English And Soft Skills	2	0	0	2
		TOTAL	**13**	**1**	**0**	**14**
		PRACTICAL				
6	BBSBS1121	Engineering Physics Lab	0	0	2	1
7	BESBS1132	Basic Electrical And Electronics Engineering Lab	**0**	**0**	2	1
8	BESBS1140	Programming For Problem Solving Lab	**0**	**0**	4	2
9	BHSBS1150	Communicative English And Soft Skills Lab	**0**	**0**	2	1
10	BESBS1161	Engineering Graphics And Dseign	1	0	2	2
11	BMCBS1170	Induction Program	0	0	0	0
		TOTAL	**1**	**0**	**12**	**7**
		TOTAL	**14**	**1**	**12**	**21**

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DEPARTMENT OF BIOTECHNOLOGY

II SEMESTER [FIRST YEAR]

SN	Sub Code	Name of the Subject	L	T	P	C
1	BBSBS 2010	Engineering Mathematics-II	3	1	0	4
2	BBSBS1022	Engineering Chemistry	3	0	0	3
3	BESBS 1033	Basics of Mechanics	3	0	0	3
4	BESBS 2040	Data Structures and Algorithms	2	0	0	2
5	BHSBS 2050	Communicative English and Technical Communication	2	0	0	2
		TOTAL	**13**	**1**	**0**	**14**
		PRACTICAL				
6	BBSBS1122	Engineering Chemistry Laboratory	0	0	2	1
7	BESBS1133	Engineering Mechanics Laboratory	0	0	2	1
8	BHSBS 2150	Communicative English and Technical Communication Laboratory	0	0	2	1
9	BESBS 2140	Data Structures and Algorithms Laboratory	0	0	4	2
10	BESBS 1162	Engineering Workshop	1	0	2	2
11	BMCBS2170	NSS/NCC/YOGA	0	0	0	0
		TOTAL	**1**	**0**	**12**	**7**
		TOTAL	**14**	**1**	**12**	**21**

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DEPARTMENT OF BIOTECHNOLOGY

III SEMESTER [SECOND YEAR]

SN	Sub Code	Name of the Subject	L	T	P	C
1	BBSBS 3010	Engineering Mathematics-III	3	1	0	4
2	BESCS 3051	Object Oriented Programming using JAVA	3	0	0	3
3	BPCBT 3020	Basics of Biology	3	0	0	3
4	BPCBT 3030	Biochemistry	3	0	0	3
5	BHSMS3061	Organizational Behaviour	2	0	0	2
6	BPCBT 3040	Microbiology	3	-	-	3
		TOTAL	**17**	**1**	**0**	**18**
		PRACTICAL				
7	BESCS3151	Object Oriented Programming using JAVA LAB.	0	0	2	1
8	BPCBT 3130	Biochemistry Lab	0	0	2	1
9	BPCBT 3140	Microbiology Lab	0	0	2	1
10	BPCTP 3170	Summer Industry Internship-I	0	0	0	1
11	BMCAU3082	Essence of Indian Traditional Knowledge	0	0	2	0
		TOTAL	**0**	**0**	**8**	**4**
		TOTAL	**17**	**1**	**8**	**22**

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DEPARTMENT OF BIOTECHNOLOGY

IV SEMESTER [SECOND YEAR]

SN	Sub Code	Name of the Subject	L	T	P	C
1	BESBT 4050	Fluid Mechanics and Hydraulic Machine	3	0	0	3
2	BHSBT 4060	Engineering Economics and Costing	2	0	0	2
3	BPCBT 4010	Molecular Biology	3	0	0	3
4	BPCBT 4020	Biostatistics	3	0	0	3
5	BPCBT 4030	Bio-analytical Techniques	3	0	0	3
6	BBCBT 4040	Upstream Process Engineering	3	0	0	3
		TOTAL	**17**	**0**	**0**	**17**
		PRACTICAL				
8	BPCBT 4110	Molecular Biology Lab	0	0	2	1
9	BPCBT 4120	Biostatistics Lab	0	0	2	1
10	BPCBT 4140	Upstream Process Engineering Lab	0	0	2	1
11	BPCBT 4130	Bio-analytical Techniques Lab	0	0	2	1
12	BPCBT4180	Minor Project-I	0	0	4	1
12	BMCBT4190	Environmental Sciences	0	0	0	0
		TOTAL	**0**	**0**	**12**	**5**
		TOTAL	**17**	**0**	**12**	**22**

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DEPARTMENT OF BIOTECHNOLOGY

V SEMESTER [THIRD YEAR]

SN	Sub Code	Name of the Subject	L	T	P	C
1	BHSBS5080	Human Values and Professional Ethics	2	0	0	2
2	BOEEI 5060	Process instrumentation	3	0	0	3
3	BPCBT 5010	Genetic Engineering and r-DNA Technology	3	0	0	3
4	BPCBT 5020	Immunology &Immuno technology	3	0	0	3
5	BPCBT 5030	Bio-chemical Reaction Engineering	3	0	0	3
6	BPCBT 5050	Industrial Microbiology and Enzyme Technology	3	0	0	3
7	BPCBT5040	Bioreactor Design and Analysis	3	0	0	3
		TOTAL	**20**	**0**	**0**	**20**
		PRACTICAL				
8	BPCBT 5110	Genetic Engineering and r-DNA Technology Lab	0	0	2	1
9	BPCBT5140	Bioreactor Design and Analysis Lab	0	0	2	1
10	BPCBT 5120	Immunology & Immunotechnology Lab	0	0	2	1
11	BPCBT5180	Minor Project-II	0	0	4	2
12	BPCTP5190	Summer Internship-II	0	0	0	1
		TOTAL	**0**	**0**	**10**	**6**
		TOTAL	**20**	**0**	**10**	**26**

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DEPARTMENT OF BIOTECHNOLOGY

VI SEMESTER [THIRD YEAR]

SN	Sub Code	Name of the Subject	L	T	P	C
1	BMCHS 6070	Dietetics and Nutrition	2	0	0	2
2	BOEBT6060	Optimization in Engineering	3	0	0	3
3	BPCBT 6010	Plant Biotechnology	3	0	0	3
4	BPCBT 6020	Bioinformatics	3	0	0	3
5	BPCBT 6030	Downstream processing Engineering	3	0	0	3
6	BPEBT 6040	Environment Biotechnology	3	0	0	3
7	BPEBT 6050	Nano biotechnology	3	0	0	3
		TOTAL	**20**	**0**	**0**	**20**
		PRACTICAL				
8	BPCBT 6110	Plant Biotechnology Lab	0	0	2	1
9	BPCBT 6220	Bioinformatics Lab	0	0	2	1
10	BPCBT6080	Minor Project-III	0	0	4	2
		TOTAL	**0**	**0**	**8**	**4**
		TOTAL	**20**	**0**	**8**	**24**

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VII SEMESTER [FORTH YEAR]

SN	Sub Code	Name of the Subject	L	T	P	C
1	BHSMS 7040	Entrepreneurship Development	2	0	0	2
2	BOEBT 7030	Animal Biotechnology	3	0	0	3
3	BPEBT 7010	Food Biotechnology	3	0	0	3
4	BPEBT 7020	Medical and Pharmaceutical Biotechnology	3	0	0	3
		TOTAL	11	0	0	11
		PRACTICAL				
5	BPCBT7180	Project Work-I	0	0	4	4
6	BPCBT7170	Summer Internship-III	0	0	2	1
		TOTAL	**0**	**0**	**6**	**5**
		TOTAL	**11**	**0**	**6**	**16**

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VIII SEMESTER [FORTH YEAR]

SN	Sub Code	Name of the Subject	L	T	P	C
1	BOEBT 8010	Protein Engineering	3	0	0	3
2	BOEBT 8020	Biomedical Instrumentation	3	0	0	3
3	BPEBT 8010	IPR, Bioethics and Bio safety	3	0	0	3
		TOTAL	9	0	0	9
4	BPCBT8180	Major Project-II	0	0	6	3
		TOTAL	**0**	**0**	**6**	**3**
		TOTAL	**9**	**0**	**6**	**12**

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DEPARTMENT OF BIOTECHNOLOGY

I Semester

Subject Code	Title of the subject	L	T	P	C	QP
BBSBS 1010	**Engineering Mathematics-I**	3	1	0	4	A

Course Educational Objectives

CEO1	To find critical points, and use them to locate maxima and minima
CEO2	To provide the standard methods for solving differential equations
CEO3	To study Fourier series and to express a function in Fourier series
CEO4	To use matrices, determinants and techniques for solving systems of linear equations in the different areas of Linear Algebra.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Implement the engineering problems using the concept of Partial differentiation and series and to understand its application.
CO2	Solve the initial value and boundary value problem of ODE related to SHM, Electrical circuit, Growth and Decay problem etc.
CO3	Execute the technique of Fourier series for learning advanced Engineering Mathematics.
CO4	Relate the tools of matrices and linear algebra including linear transformations, eigenvalues, diagonalization and orthogonalization in Engineering.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2													
CO2	2	2													
CO3	2	2													
CO4	2	2													
Avg.	2	2													

SYLLABUS

UNIT:1 MULTIVARIABLE CALCULUS [13 Hours]

Partial differentiation, Euler's theorem, Total derivative, Taylor's theorem two variable (without proof), Maxima and Minima, Differentiation under integral sign (Leibtinz rule).

UNIT:2 DIFFERENTIAL EQUATION-I [12 Hours]

Ordinary differential Equation: First order and first degree differential equations and its method of solving, Application to Electrical circuits and conduction heat and their solution.

Differential Equation-II

Linear differential equation of higher order and its different methods of finding solution (operator method). Second order liner differential equation and its solution: Euler Cauchy equation, solution by undermined coefficient method and variation of parameter. Modeling of electrical circuit with solution.

UNIT:3 Fourier series **[10Hours]**

Fourier series, Fourier expansion of functions of any period, Even and odd functions, Half Range Expansion.

UNIT:4 LINEAR ALGEBRA **[15 Hours**

Matrices, Types of matrices, Rank of matrix Eigen values and Eigen vectors, Cayley – Hamilton theorem(without proof), system of liner equation, Orthogonal matrices, Complex matrices, Hermitian and skew-Hermitian matrices, Unitary matrices,similarity of matrices. Quadratic forms and Canonical forms.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books

1. *Advanced Engineering Mathematics by E. Kreyszig, Tenth Edition, WilleyDifferential*
2. *Calculus by Santi Narayan and Mittal, S.Chand Publications*

Reference Books:

1. *Higher Engineering Mathematics by BS Grewal : Khanna Publishers, New Delhi.*
2. *Higher Engineering Mathematics by B.V.Raman, McGraw Hills Education*
3. *Advanced Engineer methods by N. P. Daly & Manish Goel.*

Subject Code	Title of the subject	L	T	P	C	QP
BBSBS1021	**Engineering Physics**	**3**	**0**	**0**	**3**	**A**

Course Educational Objectives

CEO1	To provide the students about the elementary features and the basic concepts of Physics and its applications to different physical systems.
CEO2	Students will be able to communicate these concepts clearly, develop problem solving skills and critical thinking.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Solve engineering problems using the concept of oscillation and wave mechanics and recognize the scientific application of Laser.
CO2	To analysis the structural properties of elemental solids
CO3	Determine gradient of scalar field, divergence and curl of vector fields and solve engineering problems on electromagnetism
CO4	Construct a quantum mechanical model to explain the behavior of a system at microscopic level.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1													
CO2	1	1													
CO3	2	1													
CO4	1	1													
Avg.	1.5	1													

SYLLABUS

UNIT:1 Interaction of Wave and Matter (12 Hours)

Introduction to Harmonic Oscillator, Waves and its Characteristics, Superposition of Waves, Interference by division of wavefront (Biprism experiment) and division of amplitude (Newton's Ring experiment). Introduction to Diffraction, types of diffraction.

LASER, spontaneous & stimulated emission, Einstein's relation, Ruby Laser and He-Ne Gas Laser, application of Laser. Optical fiber, Acceptance angle, Numerical aperture, Step index and Graded index fibers, applications of optical fiber.

UNIT:2Physics of Materials(12 Hours)

Crystallography, Crystal structure, crystal direction and plane, Miller indices, Interplanar spacing's, Reciprocal Lattice and its characteristics, Reciprocal Lattice of SC, FCC and BCC, Brillouin Zone, Bragg's law.

Energy bands in solids (conduction band, valence band and fermi level), Classification of matter on the basis of band theory.

UNIT:3Electromagnetic theory and wave (10 Hours)

Physical significance of grad, divergence and curl operators, Gauss divergence theorem and Stoke's theorem (no derivations), fundamental laws of electrostatics, magneto statics and electromagnetism, displacement current and conduction current, Maxwell's relations.

Electromagnetic wave and its characteristics, electromagnetic wave equation for free space in terms of **E** and **B**, electromagnetic energy, Poynting vector and Poynting theorem.

UNIT:4Quantum mechanics(12 Hours)

Introduction to dual nature: Black body radiation, photoelectric effect, Compton effect (qualitative idea only), de-Broglie's hypothesis, uncertainty principle & its application to non-existence of electron inside the nucleus and one dimensional harmonic oscillator, wave function and its characteristics, probability, normalization and expectation value, Schrodinger's equation & its application to one dimensional potential well, potential step and potential barrier (qualitative idea).

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books :

1. *Engineering Physics by D. K. Bhattacharya and PoonamTanden, Oxford University Press.*
2. *Engineering Physics, H K Malik and A K Singh, Tata McGraw Hill, MGH*

Reference Books:

1. *Materials Science &Engg., V. Raghvan, Prentice Hall of India.*
2. *Concepts of Modern Physics, A. Beiser, S. Mahajan, S.R. Choudhary, Tata McGraw Hill.*
3. *Lasers & Optical engineering, P Dass, Narosa Publishers, Springer Publisher.*
4. *Engineering Physics by B. B. Swain and P. K. Jena, KitabMahal,Cuttack*
5. *Quantum Mechanics by SatyaPrakash, KitabMohal, etc. KedarNath Ram Nath Publisher*

Lab Code	Name of the Lab	L	T	P	C	QP
BBSBS 1121	**Engineering Physics Laboratory**	**0**	**0**	**2**	**1**	

Course Educational Objectives

CEO1	Students will understand the basic principles of physics and their mathematical description.
CEO2	Students will be able to use the laws of physics and calculus to solve problems
CEO3	Students will be able to work together in collaborative groups to perform experiments, gather data and reach conclusions.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Understand the uses of various Basic Instruments for different Physical measurements.
CO2	Apply the Physical Laws and verify those using standard Experiments.
CO3	Organize experiments to determine different Physical quantities and analyze those for different application to Physical Systems.
CO4	Evaluate the magnitudes of Physical quantities systematically through experiments and design new experiments with the theoretical knowledge

List of Experiments:

1. Determination of Rigidity modulus of a material of a wire using Barton's apparatus (Static method)
2. Determination of Young's modulus of a material of a wire using Searle's apparatus
3. Determination of surface tension of water by capillary rise method.
4. Determination of acceleration due to gravity by using Bar/ Kater's pendulum.
5. Verification of laws of transverse vibration by using Sonometer
6. Determination of Young's modulus of a material by bending of beam method.
7. Study the characteristics of PN junction diode.
8. Study the characteristics of RC circuit.
9. Study the characteristics of BJT / FET.
10. Determination of grating element of a plane diffraction grating
11. Determination of wavelength of light by Newton's Rings apparatus.
12. Determination of dielectric constant by Leacher wire method.
13. Study of photoemission
14. Determination of wavelength of laser by Michelson Interferometer
15. Determination of coefficient of viscosity by Stoke's method.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	2													
CO2	1	1													
CO3	1	1													
CO4	1	1													
Avg.	1	1.25													

Subject Code	Name of the Subject	L	T	P	C	QP
BBSES1034	**Electrical And Electronics Engineering**	3	0	0	3	A

Course Educational Objectives

CEO1	Impart a basic knowledge of electrical quantities such as current, voltage, power, energy and frequency to understand the impact of technology in a global and societal context.
CEO2	This course provides comprehensive idea about DC & AC circuit analysis, magnetic circuit analysis, working principles of machines and common measuring instruments.
CEO3	Emphasize the effects of electric shock and precautionary measures. Improve the ability to function on multi-disciplinary teams.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Understand basics of Electrical Engineering and to solve complex electrical networks mathematically
CO2	Demonstrate basic laws and techniques to develop a working knowledge of the network theorems of analysis used.
CO3	Understand elementary knowledge of electromagnetism
CO4	Differentiate between DC and AC circuits and analyse them

SYLLABUS

Unit – I : DC Circuits **[8 hours]**

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

Unit - II: AC Circuits **[8 hours]**

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

Unit – III: Transformers **[6 hours]**

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Unit – IV: Electrical Machines **[8 hours]**

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

Unit – V: Power Converters **[6 hours]**

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Unit – VI: Electrical Installations **[6 hours]**

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books &Reference Books: :

1. *D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill,2010.*
2. *D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.*
3. *L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press,2011.*
4. *E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.*
5. *V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.*

CO-PO & PSO Mapping															
COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1											2	-	
CO2	3	2											2		
CO3	3	2											1		
CO4	3	3											1		
Avg.	2.6	2											1.33		

Lab Code	Name of the Lab	L	T	P	C	QP
BBSES 1132	**Basics of Electrical Engineering Laboratory**	0	0	2	1	

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Illustrate the transformers and single phase motors constructional features
CO2	Analyse various electrical quantities with combination of loads
CO3	Examine the characteristics of AC and DC machines
CO4	Distinguish the methods of speed control of DC motors

SYLLABUS

List of experiments/demonstrations:

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope).
3. Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
4. Transformers: Observation of the no-load current waveform on an oscilloscope (non sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics).
5. Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
6. Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents).
7. Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.
8. Demonstration of cut-out sections of machines: DC machine (commutator- brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.
9. Torque Speed Characteristic of separately excited dc motor.
10. Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections.
11. Torque-Slip Characteristic of an induction motor.
12. Generator operation of an induction machine driven at super synchronous speed.
13. Synchronous Machine operating as a generator: stand-alone operation with a load Control of voltage through field excitation.
14. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switchgear.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		1	2												
CO2		2	2												
CO3		1	2												
CO4		2	2												
Avg.		1.5	2												

Lab Code	Name of the Lab	L	T	P	C	QP
BBSES 1161	**Engineering Gaaphics and Dseign Lab**	**1**	**0**	**2**	**2**	**-**

Course Educational Objectives

CEO1	To know the basics of Engineering drawing
CEO2	To Practice different projection planes

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Prepare Orthographic projections of Lines
CO2	Construct Isometric Scale
CO3	Interpret Sections of various Solids including Cylinders
CO4	Draw projections of lines

SYLLABUS

Unit 1

1. **Introduction**: Introduction to Standards for Engineering Drawing practice, Line work and Dimensioning. **[1 – Sheets]**
2. **Co-ordinate system and reference planes:**Definitions of HP, VP, RPP & LPP. Selection of drawing size and scale. Representation of point and line. **[1 – Sheets]**

Unit -2

3. **Orthographic Projections :** Introduction, Definitions - Planes of projection, reference line, Projections of points in all the four quadrants, Projections of straight lines (located in First quadrant/first angle only),True and apparent lengths, True and apparent inclinations to reference planes. **[1 – Sheets]**
4. **Orthographic Projections of Plane Surfaces (First Angle Projection Only):** Introduction, Definitions– projections of plane surfaces–triangle, square, rectangle, hexagon and circle. **[1 – Sheets]**
5. **Projections of Solids (First Angle Projection Only):** Introduction, Definitions – Projections of right regular tetrahedron, hexahedron (cube), prisms, cylinders and cones in different positions.

Unit -3

6. **Sections and Development of Lateral Surfaces of Solids :** Introduction, Section planes, Sections, Section views, Sectional views, Apparent shapes and True shapes of Sections of right regular prisms, pyramids, cylinders and cones resting with base on HP. **[2 – Sheets]**

Unit -4

7. **Isometric Projection (Using Isometric Scale Only):**Introduction, Isometric scale, Isometric projection of tetrahedron, cones and spheres. **[1 – Sheets]**

Teaching Methods: Chalk& Board/ PPT/Video Lectures

TEXT BOOKS

1. *Engineering Drawing - N.D. Bhatt & V.M. Panchal, Charotar Publishing House, Gujarat.*
2. *Computer Aided Engineering Drawing - S. Trymbaka Murthy, -I.K. International Publishing House Pvt. Ltd., New Delhi*
3. *Engineering Drawing by N. S. Parthasarathy and Vela Murali Oxford University Press.*

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2		2	1					2						
CO2		2	3		2							2			
CO3	2		2	2							2				
CO4		1	3												1
Avg.	2.0	1.5	2.5	1.5	2.0				2.0		2.0	2.0			1.0

Course Code	Course Title	L	T	P	C	QP
BESBS1040	**Programming for Problem Solving**	**2**	**0**	**0**	**2**	A

Pre -Requisite:

Course Educational Objective

CEO1:To formulate algorithm, translate into program and then execute the programs for verifying its correctness.

CEO2: To analyze a problem for knowing its efficiency and decompose it into functions using divide and conquer approach.

Course Outcome

CO1	To formulate simple algorithms for arithmetic and logical problems and translate into programs.
CO2	To develop programs, understand and analyze its complexity.
CO3	To understand and develop programs using functions and recursions
CO4	To develop programs using pointers and structures and understand their functionality.

UNIT- I **(11 Hours)**

Introduction to Programming: Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) Idea of Algorithm: Steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudo-code with examples.

From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code

Arithmetic expressions and precedence. Conditional Branching. Writing and evaluation of conditionals and consequent branching.

UNIT- II **(11 Hours)**

Loops: writing programs and evaluation of loops

while, do-while and for loop, break, continue, nested loop

Arrays: Arrays (1-D, 2-D)

Basic Algorithms: Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

UNIT- III **(11 Hours)**

Character arrays and Strings: String handling operations, programs on strings, string handling functions.

Functions: Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference.

Recursion: Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series

UNIT- IV **(11 Hours)**

Pointers: Idea of pointers, Defining pointers, dynamic memory allocation, Use of Pointers in self-referential structures, notion of linked list (no implementation)

Structure: Structures, Defining structures and Array of Structures.

Teaching Methods: Chalk& Board/ PPT

Text Books:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

References:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

CO-PO & PSO Mapping															
COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3	2	1	1				2			2			
CO2	3	3	3	2	2										
CO3	2	2	2	2	2				2			2			
CO4	3	2	3	3	1							2			
Avg.	2.5	2.5	2.5	2.0	1.5				2.0			2.0			

Subject Code	Name of the Subject	L	T	P	C	QP
BHSBS1050	**Communicative English-I**	**2**	**0**	**0**	**2**	A

Course Educational Objectives

CEO1	To develop the communication skills and soft skills of the students
CEO2	To enhance the ability of the students to develop employability and entrepreneurial skills
CEO3	To enable students to develop intrapersonal and interpersonal communication skills
CEO4	To enable students to participate in group discussions without stage dear

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Understand the importance of effective communication for personal and professional development
CO2	Use correct vocabulary and grammar for effective communication in English
CO3	Apply ICT for professional communication
CO4	Develop a positive attitude towards people, organization, and life.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1						1				2					
CO2										2					
CO3						1				2					
CO4						2				2					
Avg.						1.33				2					

SYLLABUS

UNIT -1Importance of English for Communication in the 21st Century (10 hours)

1.1 Role of English in enhancing employability and entrepreneurial skills 1

1.2 The Nature and Scope of Communication 1

1.3 Objectives of Communication: Information, advice, suggestion, order, motivation, persuasion, warning, negotiation, decision-making, etc. through English Language skills, i.e., LSRW skills1 + 1

1.4 The process of communication and factors that influence communication: Sender, receiver, channel, code, topic, message, context, feedback, noise, filters and barriers (steps such as Ideation, Encoding, Transmission, Decoding, etc. need to be dealt with); Audience and purpose 1 + 1+ 1.

1.5 Types of Communication: General and Professional Communication; Formal and Informal Communication; Verbal and Non-verbal communication; Intrapersonal and Interpersonal communication; Written communication and Spoken communication. 1 + 1+ 1.

UNIT-2. English Vocabulary, Grammar & Usage (16 hours)

2.1 Synonyms and Antonyms 1 + 1

2.2 Words often confused 1

2.3 Technical terms and one word substitutes 1 + 1

2.4 Idioms and Phrasal Verbs 1 + 1

2.5 Correct Usage of Nouns, Pronouns, Verbs, Adverbs, Adjectives 1+1+1+1+1

2.6 Communicative use of the Passive Voice 1 + 1

2.7 Communicative use of Punctuation marks 1 + 1

UNIT-3. Introduction to Corporate Communication (15 hours)

1. Communication and Corporate structure:Organigraph; Communication network: Formal Communication network and Informal Communication network / Grapevine 1 + 1+ 1
2. Corporate Communication – Direction of Communication:Downward Communication, Upward Communication, Horizontal/Lateral Communication, Diagonal Communication1 + 1+ 1
3. Communication challenges in today's work place: Advances in technology; culturally diverse workforce; Team-based organizational Settings; how to overcome these challenges1 + 1+ 1
4. Information and Communication Technology (ICT) and the Corporate world:
Power point presentation using multimedia; Internet and Intranet; Fax; Teleconferencing; Videoconferencing; LaTeX 1 + 1+ 1
5. Corporate/Business etiquette:Good listening skills, proper dressing and grooming; proper handshake, mobile etiquette, table manners 1 + 1+ 1

UNIT:4 Soft skills for corporate readiness **(7 hrs)**

4.1 Importance of soft skills in personal and professional life 1hrs
4.2 Are we hardwired for success? 1hrs
4.3 Importance of developing a positive attitude 1hrs
4.4 Lateral Thinking 1hrs
4.5 Teamsmanship 1 hrs
4.6 Emotional intelligence 1 hrs
4.7 Leadership Skills 1 hrs

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books:

1. *An Introduction to Professional English and Soft Skills by B. K. Das et al., Cambridge University Press.*
2. *Communicative English for Engineers and Professionals by NitinBhatnagar and MamtaBhatnagar. Published by DK/Pearson.*
3. *Communication Skills by Sanjay Kumar &PushpLata , Oxford University Press*

Reference Books:

1. *Technical Communication , Principle and Practice by Meenakshi Raman &Sangeeta Sharma, Oxford University Press*
2. *Business Communication Today by Bovee, Courtland L., Thill, John V. Prentice Hall.*
3. *The Ace of Soft Skills: Attitude, Communication and Etiquette for Success by Gopalaswamy Ramesh and Mahadevan Ramesh. Pearson.*
4. *Oxford Guide to English Grammar by John Easthood. Oxford University Press.*
5. *365 Ways to Change Your World by Norman Vincent Peale by Orient Paperbacks.*

Course Code	Course Title	L	T	P	C	QP
BESBS1140	**Programming for Problem Solving Laboratory**	**0**	**0**	**4**	**2**	**A**

Pre -Requisite:

Course Educational Objective

CEO1: To develop programs for problems on different applications of array, functions, pointers and structure.

CEO2:To analyze different problems by comparing and implementing in programming.

Course Outcome

CO1	To understand operating system and its simple commands, writing programs, compilation, debug and execution process.
CO2	To develop programs using loop controls, arrays and understand the complexity using different programs.
CO3	To develop programs using functions and recursive function by decomposing a problem and analyze them.
CO4	To understand numerical problems, develop programs using pointers , structures and understand their functionality.

Tutorial 1: Problem solving using computers:
Lab1: Familiarization with programming environment
1) Introduction to OS: Before starting experiments explain the facilities and operations of OS.
2) Introduction to the C compiler, Compilation and Execution Process & writing simple programs.

Tutorial 2: Variable types and type conversions:
Lab 2: Simple computational problems using arithmetic expressions
1) WAP to input radius of a circle and Find the area, perimeter of it.
2) WAP to input two numbers and swap them without using intermediate variable.
3) Write a program to accept Fahrenheit and calculate its equivalent Celsius.

Tutorial 2: Variable types and type conversions:
Lab 2: Simple computational problems using arithmetic expressions
1) Write a program to input principle amount, no. of terms and rate of interest. Find simple interest.
2) WAP to input three unequal numbers and find the greatest using conditional operator.
3) Write a program to input a float value and display its integer part & fractional part separately.

Tutorial 3: Branching and logical expressions:
Lab 3: Problems involving if-then-else structures

1) Write a program to find the real roots of a quadratic equation when three co-efficient values are given.
2) Write a program to input a lower case alphabet and test whether it is vowel or consonant.
3) Write a program to find the greatest among three numbers.

Tutorial 4: Loops, while and for loops:
Lab 4: Iterative problems e.g., sum of series

1) Write a program to generate Fibonacci series of N numbers.
2) Write a program to find the greatest common divider of two positive numbers given.
3) Write a program to accept a positive integer and test it for palindrome or not.
4) Write a program to calculate the following sum:
Sum = 1-(x^2)/2! +(x^4)/4! – (x^6)/6! + (x^8)/8! – (x^10)/10!
5) Write a program to generate the following pyramid.

```
    1
  1 2 3
1 2 3 4 5
1 2 3 4 5 6 7
```

Tutorial 5: 1D Arrays: searching, sorting:
Lab 5: 1D Array manipulation

1) Write a program to accept 10 integers in to an array and find largest and smallest integers present in them.
2) Write a program to apply binary search on an array having elements in sorted order.
3) Write a program to accept 10 numbers in to an array and sort it using insertion sort in ascending order.

Tutorial 6: 2D arrays and Strings
Lab 6: Matrix problems, String operations

1) Write a program to input elements 4x4 matrix. Find the principal diagonal of them.
2) Write a program to input values into two matrices A(3x4), B(4x3). Perform matrix multiplication and display the resultant matrix.
3) Write a program to accept a string and test whether it is palindrome or not using string handling functions.

Tutorial 7: Functions, call by value:
Lab 7: Simple functions

1) Write a C program which contains three UDF's namely add(), subtract() and multiply(). Each function accepts two integers as their arguments and calculate and return the results
2) Write a program to create an UDF and test a number is prime or not.
3) Write a program to find the factorial of a given number using UDF.

Tutorial 8: Recursion, structure of recursive calls
Lab 8: Recursive functions

1) Write a program to find greatest common divisor of two integers using recursive functions.
2) Write a program to accept 10 elements into an integer array. Find the largest element present using recursive function.
3) Write a program to generate Fibonacci series using a recursive function.

Tutorial 9: Numerical methods (Root finding, numerical differentiation, numerical integration):
Lab 9: Programming for solving Numerical methods problems

1) Write a program to implement Newton-Raphson Method.
2) Write a program to implement Euler's method.

Tutorial 10: Pointers, structures and dynamic memory allocation
Lab 10: Pointers and structures

1) Write a program to create user defined function called swap having two integer pointers as its arguments and it has no return value. Call this function using call-by-address.

2) Write a program to store ‘n integers using dynamic memory allocation. Find the average value of the integers using a user defined function.

3) Write a program to input 11 cricket players’ details using a structure array having member’s player name, team name, batting average. Create a function which will display the player name whose batting average is >=30.

4) Write a program to create a structure for product having members like product code, price and quantity. Store N product details using dynamic memory and display them.

Teaching Methods: Chalk& Board/ PPT/Video Lecture

Text Books:

3. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
4. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

References:

2. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	3											
CO2	2	3			2				2			2			
CO3	2	1	2												
CO4	3	2		2					2			2			
Avg.	2.5	2.0	2.0	2.5	2.0				2.0			2.0			

Lab Code	Name of the Lab	L	T	P	C	QP
BHSBS1150	**Communicative English Laboratory-I**	**0**	**0**	**2**	**1**	

Course Educational Objectives

CEO1	To develop the vocabulary and usage skills of students by practice.
CEO2	To develop the communication skills of the students, especially Listening and Speaking skills.
CEO3	To enable students to participate in group discussions through proper listening and speaking.
CEO4	To enable students eliminate grammatical mistakes in speech and writing.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Memorize and explain a good range of vocabulary and usage.
CO2	Use grammar for effective speaking in GD and other formats of speaking
CO3	Able and defend in conversational and public speaking competencies.
CO4	Develop active listening and speaking skill in different real life situation

CO-PO & PSO Mapping

	PROGRAMME OUTCOMES												PSOs		
COs	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1										2					
CO2										2					
CO3										2					
CO4										2					
Avg.										2					

SYLLABUS

Phonetics &Listening Skills16 hours = 8 classes [2 listening tests x 10 marks = 20 marks]

Vowels, diphthongs, consonants, consonant clusters; The International Phonetic Alphabet (IPA); phonemic transcription; Problem sounds; Syllable division and word stress; Sentence rhythm and weak forms; Contrastive stress in sentences to highlight different words; Intonation: falling, rising, and falling-rising tunes; Listening to Newspaper reading/Video, etc.

Listening with a focus on pronunciation (ear-training): segmental sounds, stress, weak forms, intonation & Listening for comprehension. Reading of English daily newspapers and self-development books be integrated listening and speaking activities.

Speaking skills 16 hours = 8 classes [4 speaking tests x 10 = 40 marks]

- Topics for 1 minute, 2 minutes, and 5 minutes speaking
- Pictures, Quotations, Attitude-testing Questions may be used.
- Summarizing/responding to handouts, articles, books, magazines and newspapers.

Individual/Group presentations/discussion on given topics

Soft skills development 14 hours = 7 classes [4 assignments x 10 = 40 marks]

- Positive thinking (Teachers to engage game/activity-oriented classes)

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text/Reference Books:

1. *Business and Corporate Soft skills developed by Rai Tech. University (PDF available)*
2. *Spoken English (with CD). Sasikumar V and P V Dhamija. New Delhi: Tata McGraw-Hill Education Pvt. Ltd. (2nd Ed.)*

II Semester

Subject Code	Title of the subject	L	T	P	C	QP
BBSBS 2010	**Engineering Mathematics-II**	**3**	**1**	**0**	**4**	A

Course Educational Objectives

CEO1	To apply Laplace Transform methods to solve initial value problems for constant coefficient linear ODEs.
CEO2	To calculate the gradients and directional derivatives of functions of several variables
CEO3	To introduce the concept of Vector differentiation and integration that finds applications in various fields like solid mechanics, fluid flow, heat problems and potential theory
CEO4	To apply Laplace Transform methods to solve initial value problems for constant coefficient linear ODEs.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Solve Ordinary differential and partial differential equation by using Laplace transform and its application in Network theory, wave equation etc
CO2	Execute the technique of Fourier Integral and transform for learning in advanced Engineering Mathematics
CO3	Relate gradient, curl and divergence and its application in electromagnetic theory
CO4	Evaluate multiple integrals by using Green's, Stokes' and divergence theorem to give physical interpretation of the curl and divergence of a vector field

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2													
CO2	2	2													
CO3	2	2													
CO4	2	2													
Avg.	2	2													

SYLLABUS

UNIT:1 Laplace Transforms [15 Hours]

Laplace Transforms: Definition, existence of Laplace Transform, Properties of Laplace Transform, Evaluation of integrals by Laplace Transforms, Inverse transforms, convolution theorem, transforms of unit step function, unit impulse function, and periodic function.

UNIT:2 [12 Hours]

Introduction of Fourier transform and Fourier Integral, Simple application to ordinary differential equations by Laplace Transform,

UNIT:3 [10 Hours]

Vector differential calculus: vector and scalar functions and fields, Derivatives, Curves, tangents and arc Length, gradient, divergence, curl and their applications.

UNIT:4 [16 Hours]

Definition and evaluation of double integration and triple integration.

Vector integral calculus: Evaluation of line integral, Surface integral and volume integral and their application, Greens theorem, stokes theorem, Gauss theorem (without proof)

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books:

Advanced Engineering Mathematics by E. Kreyszig, John Willey & Sons Inc. 10th Edition

Subject Code	Name of the Subject	L	T	P	C	QP
BBSBS1022	**Engineering Chemistry**	3	0	0	3	A

Course Educational Objectives

CEO1	To impart the knowledge of application of chemical sciences in the field of engineering
CEO2	The course aims at elucidating principles of applied chemistry in industrial systems, Water treatment and engineering materials.
CEO3	To give detailed knowledge about the reactivity of metal with environment and it's Prevention from corrosion.
CEO4	To give an idea about fuel and its characteristics.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Identify suitable water treatments techniques for domestic and industrial purposes
CO2	Differentiate various types of corrosion, and gain knowledge on control measures associated with corrosion
CO3	Classify the different types of fuel, it's analysis and gain knowledge on fractional distillation of petroleum.
CO4	Understand various types of polymers, their preparation along with applications

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			2			1	2								
CO2			2			1	2								
CO3			2			1	2								
CO4			1			1	1								
Avg.			1.75			1	1.75								

SYLLABUS

UNIT:1 WATER TREATMENT **(12 Hours)**

Types of water, Impurities in water, Types of Hardness, Determination of Hardness by EDTA method, treatment of water for Domestic use, Water softening processes Lime-soda process, Ion Exchange method, Boiler feed water, Scale and Sludge, Caustic embrittlement, Priming and Foaming ,Removal of dissolved gases, Carbonate and phosphate conditioning, colloidal conditioning, Calgon conditioning, Desallination of brackish water by Reverse osmosis

UNIT:2CORROSION CHEMISTRY **(12 Hours)**

Introduction, Electrochemical cell, electrode potential E.M.F, Definition of corrosion, Types of corrosion: Dry corrosion and wet corrosion, Galvanic corrosion, Concentration cell corrosion, Factors influencing corrosion, corrosion control: Cathodic protection (Sacrificial anodic protection and Impressed current cathodic protection), Inhibitors, protective coatings: Galvanization and Tinning, Passivation.

UNIT:3FUEL TECHNOLOGY(12 Hours)

Introduction, Classification of Fuels, Calorific Value, Charcteristics of a good fuel, Types and analyses (Proximate and ultimate analysis) of coal, Dulong's Formula, Petroleum, (Extraction, purification and refining),Cracking(thermal cracking, catalytic cracking), Knocking, Antiknocking , Octane numbers, Cetane numbers, Unleaded and synthetic petrol, LPG and CNG, Combustion Numericals.

UNIT:4 CHEMISTRY OF ENGINEERING MATERIALS(12 Hours)

Introduction, polymer, Classification of polymers, Types of polymerization and mechanism, Plastics: Thermosetting and thermo plastic, PVC, PE,PS,PMMA, PTFE, Bakelite,Nylon-6,6,Nylon-6, Fiber reinforced plastic.

*ADD-ON COURSES: Conducting Polymer (Polyaniline, Polyacetylene),Polycarbonates Bio-Degradable and Non-Bio Degradable polymer, Nano composite.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books:

1Engineering chemistry by Jain & Jain, DhanpatRai publishing company (p) Ltd.

Reference Books:

1. *A Text Book of Engineering Chemistry by S.S.Dara,S Chand Publishers*
2. *A Text Book of Engineering Chemistry by SashiChawla,DhanpatRai Publishing house.*
3. *Text Book of Engineering chemistry, 2nd edition, by R.Gopalan,D.Venkapaya&SulochanaNagarajan, Vikas Publishing House Pvt.Ltd.*
4. *B. Tech Chemistry-II by P. K. Kar, S. Dash, B. Mishra kalyani publishers.*

Lab Code	Name of the lab	L	T	P	C	Q P
BBSBS1122	**Engineering Chemistry Laboratory**	**0**	**0**	**2**	**1**	

Course Educational Objectives

CEO	To train the students about the applications of chemical sciences in the field of engineering and technology

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Understand the basic methods of chemical analysis and instrumentations involved
CO2	Standardize of Chemicals
CO3	Estimate the hardness, ions in salts and compositions in ores.
CO4	Synthesizes the drugs and know about their applications

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			1			1									
CO2			2			2									
CO3			2			2									
CO4			2			2									
Avg.			1.75			1.75									

SYLLABUS

List of Experiments:

1. Determination of total hardness of water by using EDTA.
2. Determination of amount of NaOH and Na_2CO_3 present in mixture of two.
3. Standardization of $KMnO_4$ using sodium oxalate.
4. Determination of ferrous ion in Mohr's salt by standardised $KMnO_4$.
5. Determination of % of dissolved oxygen in given water sample.
6. Estimation of available chlorine in bleaching powder solution.
7. Determination of rate constant of acid catalyst Hydrolysis reaction.
8. Preparation of aspirin
9. Estimation of Zinc in brass.
10. To determine the strength of HCl and acetic acid from the mixture of acid by strong alkali (NaOH) by Conductrometry.
11. Preparation of nanoparticle.
12. Determination of partition coefficient of iodine in benzene and water.
13. Preparation and determination of pH of buffer solution.
14. To determine the molecular weight of polymer by viscosity measurement.

Subject Code	Title of the subject	L	T	P	C	QP
BBSHS 2061	**Communicative English-II**	**2**	**0**	**0**	**2**	A

Course Educational Objectives

CEO1	To develop the communication skills and soft skills of the students
CEO2	To enhance the ability of the students to develop employability and entrepreneurial skills
CEO3	To enable students to successfully participate in GDs and Pis
CEO4	To make students communicate effectively using technologies and techniques

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Understand the nature and scope of corporate communication and try to be industry ready
CO2	Able to use language skills for professional growth
CO3	Distinguish fact from opinion in reading passages from different text books
CO4	Create professional documents like Resume, Job Application letter for their career needs

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1										2					
CO2										2					
CO3										2					
CO4										2					
Avg.										2					

SYLLABUS

UNIT-1 Introduction to Technical Communication **[7 hours]**

1.1 Essence of Technical Communication 1

1.2 Nature and Scope of Technical Communication: 1 +1 +1

Technical Communication -- Interactive and Adaptable; Technical Communication -- Reader Centered; Technical Communication and teamwork; Technical Communication Has Ethical, Legal, and Political Dimensions; Technical Communication – its International and Cross-Cultural nature; Technical communication and use of ICT.

1.3 Need of Technical communication for career development 1

1.4 Computer Assisted Language Learning (CALL) – Self learning through use of technology, Effectiveness of CALL for developing English Language Skills; Use of Internet 1 +1

UNIT - 2 Career Communication **[17 hours]**

2.1. Career making: Setting Goals, SWOT analysis 1

2.3 Preparing a Résumé: Elements of a Résumé; Types of Résumés: Chronological Résumé, Functional Résumé; Use of job portals 1 +1 +1

2.4 Effective Job Application Letter/Cover letter 1 +1

2.5 Group Discussion 1 +1

2.6 Job Interview 1 +1 +1+1 +1

2.7 Effective Oral Presentation 1+1

2.7 Handling a Meeting 1+1

UNIT-3 Technical Approach to Reading **[8 Hours]**

3.1 Know your Reading speed; Advantages of speed reading 1

3.2 SQ4R Techniques of Reading 1+1

3.3. Techniques of Rapid reading: skimming, scanning 1+1

3.4 Understanding coherence and cohesion 1

3.5 Note taking, Mind maps 1+1

UNIT-4 Technical Writing **[14 hours]**

4.1 Writing a technical paper 1+1
4.2 Writing business letters – significance, purpose, structure and elements, layout; types of business letters 1+1+1+1
4.3 Memos 1+1
4.4 Business Reports and Technical proposals 1+1+1+1
4.5 Using the Social media for better communication 1+1

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books:

1. *Business Communication Today by Bovee, Courtland L., Thill, John V. Prentice Hall.*
2. *Technical Communication Today by Richard Johnson-Sheehan. Edition 5. Pearson.*
3. *Communicative English for Engineers and Professionals by NitinBhatnagar and MamtaBhatnagar. Published by DK/Pearson.*

Reference Books:

1. *Basic Communication Skills for Technology by Andre J. Rutherford, Pearson Education Asia, Patparganj, New Delhi.*
2. *Business Communication by Varinder Kumar and Bodh Raj. Kalyani Publishers.*
3. *A Textbook of English Phonetics for Indian Students by T. Balasubramanian*
4. *Technical Communication, Principle and Practice by Meenakshi Raman &Sangeeta Sharma, Oxford University Press.*
5. *How to Read better and Faster by Norman Lewis. 4th Edition. Publisher: Crowell.*

Subject Code	Name of the Subject	L	T	P	C	QP
BBSHS 2150	**Communicative English Laboratory-II**	**0**	**0**	**2**	**1**	

Course Educational Objectives

CEO1	To enable students to successfully participate in GDs and PIs
CEO2	To make students communicate effectively by classroom practice.
CEO3	To inculcate a sense of professionalism in students

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Memorize and explain a good range of vocabulary and usage
CO2	Use grammar for effective speaking in GD and other formats of speaking
CO3	Able and defend in conversational and public speaking competencies
CO4	Develop active listening and speaking skill in different real life situation

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1										2					
CO2										2					
CO3										2					
CO4										2					
Avg.										2					

SYLLABUS

1. Writing an Effective Job Application Letter/Cover letter	[4 hours]
2. Writing a winning resume and posting in job portals	[4 hours]
3. Group Discussion	[8 hours]
4. Job Interview	[8 hours]
5. Oral presentation	[6 hours]
6. Organizing a Meeting	[4 hours]
7. Note making and Note taking	[4 hours]
8. Memo writing	[2 hours]
9. Profiling a company	[4 hours]
10. Summarizing books/research paper/news report.	

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books:

1. *Business Communication Today by Bovee, Courtland L., Thill, John V. Prentice Hall.*
2. *Technical Communication Today by Richard Johnson-Sheehan. Edition 5. Pearson.*
3. *Communicative English for Engineers and Professionals by NitinBhatnagar and MamtaBhatnagar. Published by DK/Pearson.*

Reference Books:

(i) *Basic Communication Skills for Technology by Andre J. Rutherford, Pearson Education Asia, Patparganj, New Delhi.*

(ii) *Business Communication by Varinder Kumar and Bodh Raj. Kalyani Publishers.*

(iii) *A Textbook of English Phonetics for Indian Students by T. Balasubramanian*

(iv) *Technical Communication, Principle and Practice by Meenakshi Raman &Sangeeta Sharma, Oxford University Press.*

(v) *How to Read better and Faster by Norman Lewis. 4th Edition. Publisher: Crowell.*

Course Code	Course Title	L	T	P	C	QP
BBSES 2040	**Data Structures and Algorithms**	**3**	**0**	**0**	**3**	

Pre -Requisite:

Course Educational Objective

CEO1: Understand the object oriented concepts and to develop C++ programs for performing different operations on arrays, stack, Queue, linked list. Analyze the difference between them and understand different applications.

CEO2: Understand different searching and sorting methods and compare them in terms of performance and applications.

Course Outcome

CO1	Develop algorithms for performing different operations on 1D array, matrix, stack, Queue, analyze the difference between them and understand different applications.
CO2	Understand different searching and sorting methods, Linked lists and them compare them in terms of performance and applications.
CO3	Understand the Binary Tree and its memory representation; analyze Binary search Tree and its applications, compare the BST with AVL Tree and examine the advantages.
CO4	Design Heap Tree, observe its applications in sorting. Understand the memory representation of graph; analyze traversal methods and applications of graph. Analyze the Hashing techniques in compare with other sorting techniques.

Unit I **[11 hours]**

Basic concepts: Data abstraction, Algorithm specification, Memory Representation of 1D and 2D Array. Stack: Introduction to stack, basic operations and implementation of stack using arrays

Queue: Introduction to linear queue, basic operations and implementation of linear queue using arrays, circular queue, basic circular queue operations& Representation of Double ended Queue.

Applications on stack – Recursion, infix to postfix conversion, Evaluation of postfix

Unit II **[11 hours]**

Searching: Linear search and Binary search using linear array

Sorting: Bubble sort, Insertion sort, Selection sort, Quick sort, Bucket Sort using linear array.

Linked Lists: Basic operations of singly, doubly and circular linked lists, implementation of stack and queue using singly linked list.

Unit III **[11 hours]**

Trees: Introduction, Terminology, Binary Trees, Representation of Binary Trees using arrays and linked lists, Binary tree traversals, Creation of binary tree from in-order & pre-order sequences - Creation of binary tree from in-order & post-order

Binary Search Trees: definition, basic operations of BST (Searching, Insertion and deletion)

Introduction to AVL trees, Height of an AVL Tree, Balancing AVL tree by rotations after insertions and deletions of a data node.

Unit IV **[11 hours]**

Heaps: Introduction to binary heaps, definition of a Max-heap, Min-heap, creating Max-Heap, Applications: Heap sort, Priority queue.

Graphs: Definitions, Graph representation - Adjacency matrix, Incidence Matrix, adjacency lists, Graph Traversals (BFS & DFS), Single source shortest path algorithm (Dijkstra's Algorithm) Topological Sorting.

Hashing: Hashing Functions, Open hashing (chaining), closed hashing (Open addressing – linear probing, quadratic probing, double hashing), rehashing.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:

1. Gilberg and Forouzan: “Data Structure- A Pseudo code approach with C” by Thomson Publication.
2. “Data structure in C” by Tanenbaum, PHI publication / Pearson publication.
3. Pai: ”Data Structures & Algorithms; Concepts, Techniques & Algorithms ”Tata McGraw Hill.

Reference Books:

1. “Fundamentals of data structure in C” Horowitz, Sahani & Freed, Computer Science Press.
2. “Fundamental of Data Structure” (Schaums Series) Tata-McGraw-Hill.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	2											-	
CO2	3	2		2											
CO3	3	2	1		2							1		1	
CO4	3	3		1											
Avg.	2.75	2.0	1.5	1.5	2.0							1.0		1.0	

Course Code	Course Title	L	T	P	C	QP
BESBS 2140	**Data Structures using 'C++' Laboratory**	0	0	4	2	

Pre -Requisite:

Course Educational Objective

CEO1: Develop algorithms for performing different operations on arrays, stack, Queue, linked list. Analyze the difference between them and understand different applications.

CEO2: Understand different searching and sorting methods and compare them in terms of performance and applications. Understand and analyze Binary search Tree, AVL Tree, Heap Tree and their applications.

CEO3: Understand the memory representation of graph, its traversal methods and applications. Analyze the Hashing techniques in compare with other sorting techniques.

Course Outcome

CO1	Understand and implement the object oriented concepts by in developing the programs for different operations.
CO2	Develop programs for performing different operations on 1D array, matrix, stack, Queue, analyze the difference between them and understand their applications.
CO3	Design code for different searching and sorting methods and analyze their performance.
CO4	Develop the codes for different operations on Linked lists and compare with other data structures.

Lab1: introduction to OOPs (C++ features), cin, cout, object, class, Simple programs.

Lab2: Access Specifiers, inline, private, public, arrays of objects, programs on them.

Lab3: Experiment No.1

1) Write a C++ program to create a class called student to store your rollno, name, age. Create an array of object to input 5 students data and then display where age>=20.
2) Write a C++ program to create a class having methods for operations insertion, deletion and display to perform operations on 1D array of elements.

Lab4: Experiment No.2

Write a C++ program to create a class having methods: insertion, multiply and display for performing multiplication on a matrix of elements.

Lab5: Experiment No.3

Write a program using C++ to create a stack using class and perform:
(i) push operation (ii) pop operation (iii) display operation

Lab6: Experiment No.4

Write a C++ program that uses Stack operations to converting an infix expression into equivalent postfix expression.

Lab7: Experiment No.5

Write a C++ program to create a linear queue and perform the following operations: (i) insertion ii) deletion and iii) Traversal

Lab8: Experiment No.6

Write C++ programs that use both recursive and non-recursive functions to perform the linear & binary search operation for a Key value in a given list of integers.

Lab9: Experiment No.7

Write a C++ menu driven program to implement bubble sort, selection sort and insertion sort for a given list of integers in increasing order.

Lab10: Experiment No.8

Write a C++ program to implement quick sort to a given list of integers to sort in ascending order.

Lab11: Experiment No.9

Write a C++ program that uses functions to perform the following operations on linear linked list: i) Creation ii) Insertion iii) Deletion iv) Traversal

Lab12: Experiment No.10

Write a C++ program that uses functions to perform the following operations on Double linked list: i) Creation ii) Insertion iii) Deletion iv) Traversal.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	2												
CO2	3	2		2											
CO3	3	2	1		2							1			
CO4	3	3		1											1
Avg.	2.75	2.0	1.5	1.5	2.0							1.0			1.0

Subject Code	Name of the Subject	L	T	P	C	QP
BBSES1033	**Basics of Mechanics**	**3**	**0**	**0**	**3**	A

Course Educational Objectives

CEO 1	To know the basics of mechanical forces, stress and their compositions
CEO 2	Properties of various surfaces and particles

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Determine the resultant force and moment for a given force system
CO2	Analyze planar and spatial systems to determine the forces in members of trusses, frames and problems related to friction.
CO3	Calculate the motion parameters for a body subjected to a given force system.
CO4	Determine the deformation of a shaft and understand the relationship between material constants.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1													
CO2	1	2													
CO3	1	2													
CO4	1	2													
Avg.	1	1.75													

SYLLABUS

UNIT:1 STATICS OF PARTICLES(16 Hours)

Fundamental concepts and principles of engineering mechanics. Resolution of forces - Resultant of several concurrent forces - Free body diagram. Principles of transmissibility. Moment of a force - Varignon's theorem - Equivalent system of forces -Types of supports and corresponding reactions.

UNIT:2ANALYSIS OF TRUSSES AND FRICTION(12 Hours)

Introduction to Truss - Analysis of Trusses - Method of joints- Method of sections.
Laws of Friction - Angle of Friction-Angle of Repose-Ladder and Wedge Friction

UNIT:3PROPERTIES OF SURFACES(12 Hours)

Determination of first moment area of plane figures by integration – Determination of centroid of composite figures by using standard formula.
Determination of second moment area of plane figures by integration - Parallel and perpendicular axis theorems - Determination of area moment of inertia of composite figures by using standard formula - Polar moment of inertia - Radius of gyration.

UNIT - 4 - DYNAMICS OF PARTICLES (10 Hours)

Rectilinear motion: uniform velocity and uniformly accelerated motion Newton second law- D'Alembert's principle and its applications- work and energy equation- Impulse and Momentum - Impact of elastic bodies.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books:

1. *Timoshenko, and Young, "Engineering Mechanics", Tata Mc-Graw Hill Book Company.*
2. *S. S. Bhavikatti, "Engineering Mechanics", New Age International Publishers,*

Reference Books:

1. *Dr.Bansal.R.K, & Sanjay Bansal, "A Text book of Engineering Mechanics", Lakshimi publications.*
2. *A.K.Tayal, "Engineering Mechanics Statics And Dynamics", Umesh Publications*

3. *Rajasekaran.S, &Sankarasubramanian.G, "Engineering Mechanics", Vikas Publishing House Pvt Ltd, 2011.*
4. *Engineering Mechanics, (3ed edition) by Statics and Dynamics K.Vijaya Kumar Reddy and J Suresh Kumar, BS Publications.*

Lab Code	Name of the Lab	L	T	P	C	QP
BBSES 1162	**Engineering Workshop Lab**	**1**	**0**	**2**	**2**	**-**

Course Educational Objectives

CEO1	To practice engineering workshop tools
CEO2	Usage of workshop tools and applications

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Follow various safety precaution and use of various hand tools
CO2	Demonstrate the process configuration and basic mechanism of different machines like Lathe
CO3	Identify and apply suitable tools for machining process including facing
CO4	Prepare a job with a given dimension with the help of machining, welding practice.

SYLLABUS

Unit -1

1. **Safety Precaution:** To study the various Safety precautions in workshop.
2. **Fitting :**

(i) Study of different hand tools and Machine tools used in fitting.
(ii) Preparation of a male and female fitting job by using different hand tools.

Unit -2

3. **Machining:**

(i) Study of various components and working principle of lathe machine
(ii) Preparation of a cylindrical job by lathe (turning, Thread-cutting, knurling)
(iii) Study on Shaper and Milling Machine

Unit -3

4. **Welding Practice :**

(i) Hand on practice on Electric Arc Welding to prepare Lap Joint, Butt Joint, T- Joint and Corner Joint.
(ii) Study of Oxyacetylene Gas welding and Gas cutting.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Reference:

1. *Elements of Workshop Technology, Vol. I and II by Hajrachoudhary, Khanna Publishers*
2. Workshop Technology by WAJ Chapman, Viva Books
3. Workshop Manual by Kannaiah / Narayana, ScitechPublicaitons(P) Ltd.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	2	1										1		
CO2	2		1									1		1	
CO3		1	1												
CO4	2		2												
Avg.			1.25									1			

III Semester

Course Title						
Subject Code	Title of the subject	L	T	P	C	QP
BBSBS3010	**Mathematics-III**	**3**	**1**	**0**	**4**	**A**

Course Educational Objectives:

Prerequisite: Fundamentals of complex numbers, probability and calculus

CEO1: To test the nature of complex function

CEO2: To identify the different methods for complex integration

CEO3: To analyze error by using different methods.

CEO4: To know about different types of probability distributions.

Course Outcomes (Towards the end of the course students will be able to :

CO1	To know Analytic function and their properties.
CO2	To Evaluate Real Integrals by using residue integration method.
CO3	To apply numerical methods in Engineering Mathematical Problems
CO4	To investigate Probability distribution problems andleast square method to fit a curve and to evaluate the correlation coefficient and regression lines for the data.

UNIT I (12 Hours)

Complex Analysis:

Analytic function, Cauchy-Riemann equations, Harmonic Function, Complex integration: Line integral, Cauchy's integral theorem, Cauchy's integral formula.

UNIT II (8 Hours)

Taylor's series, Laurent's series, Singularities and zeros, Residues, Cauchy Residue theorem, Evaluation of real integrals .

UNIT-III (10 Hours)

Numerical methods:

Errors, Solving of algebraic and transcendental equations by using fixed point iteration and Newton-Raphson's method. : Newton divided differnterpolation,Lagrange interpolation ,Newton's forward and backward interpolation.NumericalDifferentiation,Numericalintegration:The trapezoidal rule, The simpson's rules, Ordinary differential equation: Modified Euler's method, Runge-kutta methods.

UNIT-1V (18 Hours)

PROBABILITY:

Random variables, Probability distributions, Mean and variance of distribution,

Binomial, Poisson and uniform distributions, Normal distribution,

Random sampling, Estimation of Parameters (maximum likely hood method),Confidence intervals, Testing of hypothesis ,Acceptance sampling ,Regression and correlation analysis, fitting of straight line by least square method.

Prescribed Books:

1. Advanced Engineering Mathematics by E. Kreyszig, Tenth Edition, Willey
2. Numerical Methods by jain and Iyengar.

Reference:-

1. Higher Engineering Mathematics by BS Grewal : Khanna Publishers, New Delhi.
2. Higher Engineering Mathematics by B.V.Ramana, McGraw Hills Education
3. Numerical Methods by Dutta and jena.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1										-			
CO2		-										1			
CO3		-										-			
CO4	1	-										1		1	
Avg.	1.0	1.0										1.0		1.0	

Subject Code	Name of the Subject	L	T	P	C	QP
BESCS3051	**Object Oriented Programming**	**3**	**0**	**0**	**3**	**A**

Course Educational Objectives

CEO1	The model of object oriented programming: abstract data types, encapsulation, inheritance and polymorphism
CEO2	Fundamental features of an object oriented language like Java: object classes and interfaces, exceptions and libraries of object collections
CEO3	How to take the statement of a business problem and from this determine suitable logic for solving the problem; then be able to proceed to code that logic as a program written in Java.
CEO4	How to test, document and prepare a professional looking package for each business project using java doc.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Analyze ,formulate and model problems using concepts of object oriented analysis and design and implement using Java.
CO2	Write programs using basic data types and strings, using loops, Array.
CO3	Analyze the problems and resolve run-time errors with Multithreading and Exception Handling techniques
CO4	Understand the power of generics and Collections Framework and Java.io package

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1											1		
CO2	3	2	2										1		
CO3	2	2	2										2		
CO4	2	1	2										1		
Avg.	2.4	2.4											1		

SYLLABUS

Unit – I **[12Hours]**

An introduction Object Oriented Programming, Features of Object Oriented Programming Introduction to Java. Difference between C/C++ and Java, Features of Java, First Java Program, Writing the java program, Compiling the program, JVM and its significance in executing a program?, Architecture of JVM. Understanding, Java Tokens, Datatypes, Operators, Control Structures and Arrays, Conditional Statements, Loops/ Iterators, Jumping Statements, Java Arrays, Multidimensional Arrays, Taking Input from keyboard, Command Line Arguments, Using Scanner Class, Using Buffered Reader class.

Unit - II **[12Hours]**

Laplace Transform & its Application: Introduction to Laplace Transform, Laplace transform of some basic functions, Laplace transform of periodic functions, Inverse Laplace transform, Application of Laplace transform: Circuit Analysis (Steady State and Transient).

Two Port Network Functions& Responses: z, y, ABCD and h-parameters, Reciprocity and Symmetry, Interrelation of two-port parameters, Interconnection of two-port networks.

Network Functions: Significance of Poles and Zeros, Restriction on location of Poles and Zeros, Time domain behaviour from Pole-Zero plots.

Unit – III [12 Hours]

Fourier Series& its Application: Fourier series, Fourier analysis and evaluation of coefficients, Steady state response of network to periodic signals, Fourier transform and convergence, Fourier transform of some functions.

Passive Filter: Brief idea about network filters (Low pass, High pass, Band pass and Band elimination) and their frequency response

Unit – IV **[12 Hours.]**

Network Synthesis: Realizability concept, Hurwitz property,

positive realness, properties of positive real functions, Synthesis of R-L, R-C and L-C driving

point functions in Foster and Cauer forms.

Network Topology: Graph of a network, Concept of tree, Incidence matrix, Tie-set matrix, Cut-set matrix, Formulation and solution of network equilibrium equations on loop and node basis

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Book:

1. *Programming in Java. Second Edition. Oxford Higher Education. (Sachin Malhotra/ Saurav Choudhary)*
2. *Core Java For Beginners. (Rashmi Kanta Das), Vikas Publication*

Reference Book:

3. *JAVA Complete Reference (9th Edition) HerbaltSchelidt*

Title of the subject						
Subject Code		L	T	P	C	QP
BPCBT3020	**Basics of Biology**	**3**	**0**	**0**	**3**	**A**

Course Educational Objective	
CEO1: To introduce the basic knowledge of biology and its application	
CEO2: To understand the functions of cell , cell division and principle of inheritance in living system	
Course Outcomes: On successful completion of the course students will be able to:	
CO1	Students will obtain knowledge of cell structure, function of cellular organelles, membranes, and biological molecules.
CO2	The undergraduate will understand the inter and intra molecular communication
CO3	Student have an idea about genetic diseases
CO4	Student will know the developmental aspects of plant and animals

UNIT:1 **15 Hours**

Structure & Chemical composition of cells: ultra structure of Cell (Prokaryotic and Eukaryotic), Cell Wall & Cell Membrane, Cell organelles: structure and function, Nucleus, cell inclusions, Molecular organization of chromosome (Nucleosome concept).

UNIT:2 **15 Hours**

Cell Cycle, Cell Divisions- Mitosis and Meiosis, Membrane transport & trafficking, mechanisms of protein sorting and targeting, intercellular communication and associated signaling pathways, cancer cell Biology (Cause, Cell Characteristics).

UNIT:3 **15Hours**

Principles of Inheritance: Chromosome theory of Heredity, Mendelism, Non-Mendelian Gene Interactions (Epistasis, Lethality, Pleiotropy), Polygenes and multiple allele, Allelic Complementation, Cytoplasmic Inheritance, Linkage and Crossing over, Chromosome mapping, Mutation and Chromosomal Aberration, Transposable elements, Genetic diseases in Human(Colour blindness, Haemophillia).

UNIT:4 **15 Hours**

Origin, evolution and diversification of life, natural selection, Types of selection (stabilizing, directional etc), Principles breeding in plants and animals. Population Genetics: Hardy-Weinberg's law, Genetic Equilibrium, Changes in gene frequency, gene flow, Genetic Drift, Effect of evolutionary forces on genetic equilibrium of a population. Developmental genetic with reference to Arabidopsis and Drosophila.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books : 1. Cell Biology, Genetics, Molecular Biology, Evolution & Ecology by P S Verma and VK Agrawal, S. Chand
2.Cell biology and Genetics by P K Gupta Rastogi Publication

Ref. Books :

1. Molecular Biology of the Cell 4th Edition Bruce Alberts
2. The Cell A Molecular Approach Geoffrey M Cooper. Boston University 2nd edition

CO-PO & PSO Mapping															
COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1														
CO2	1						2							1	
CO3	2	1						2					2		
CO4	2							2				2			2
Avg.	1.5	1.0					2.0	2.0				2.0	2.0	1.0	2.0

Subject Code		L	T	P	C	QP
BPCBT3030	**Biochemistry**	**3**	**0**	**0**	**3**	**A**

Course Educational Objective

CEO1: To provide the knowledge on macromolecules present in the cell.

CEO2: To have an idea about enzymes and their functions.

Course outcomes: At the end of the course, the student will be able to:

CO1	Obtain knowledge about the structure/function of biomolecules such as Carbohydrates, Proteins, Amino acids and Lipids.
CO2	Learn the basic structure of nucleic acidsandprinciple of bioenergetics.
CO3	Demonstrate the fundamentals of biochemical principles such as cellular metabolism, metabolic pathways and the regulation of biological/biochemical processes.
CO4	understand the different types of enzymes, hormones, vitamins, minerals and their functions.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	-	1		-	-	-	-	-	-	-	-	1		
CO2	1	2	1		1	-	-	-	-	-	-	-			
CO3		-			-	-	-	-	-	-	-	2		1	
CO4	2	1	-		1	-	-	-	-	-	-	-			1
Avg.	2.0	1.5	1.0		1.0							2.0	1.0	1.0	1.0

UNIT:1 **11 Hours**

Structure and Function of Carbohydrates: Monosaccharide, Oligosaccharides, Polysaccharides (Starch, Glycogen, Cellulose), Optical Isomerism, Structure and Function of Lipids: Saturated and Unsaturated Fatty Acids, Triacylglycerols, Phosphoglycerides, Sphingolipids, Waxes and Sterol. Structure and Function of Proteins: Amino acids, Peptide bond, Hierarchy of protein architecture, Ramachandran Plot.

UNIT:2 **11 Hours**

Structure and Function of Nucleic Acids: DNA, RNA, Double Helix Model of DNA, Denaturation and Renaturation of DNA. Structure and function of Hormones, Minerals and Vitamins. Principle of Bioenergetics: Bioenergetics and Thermodynamics, Phosphoryl group transfer and energy currency-ATP; Biological Oxidation and reduction reactions.

UNIT:3 12 Hours

Metabolism-I: Introduction to metabolic processes; Metabolism of Carbohydrates: Glycolysis, TCA Cycle, ETS and Oxidative Phosphorylation, Gluconeogenesis,Metabolism of Lipids: Anabolism (Saturated), Catabolism (α- Oxidation, β-Oxidation) and Energetics of lipid metabolism; Metabolism of Nucleic Acids: Catabolism and anabolism of purine and pyrimidine nucleotides. Photosynthesis: Light reaction and dark reaction.

UNIT:4 11 Hours

Metabolism-II: Metabolism of proteins: Biosynthesis of amino acids (role of precursors); Enzymes: Properties of Enzyme, Classification of Enzymes, Mechanism of enzyme action, Kinetics of enzyme action, Activation energy, Enzyme Inhibition, Coenzymes

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books: 1. Principle of Bio-Chemistry – Lehinger, Nelson and Cox

2. Biochemistry of Biochemistry by L. Stryer
3. Fundamentals of Biochemistry by A.C Deb

Ref. Books 1 Fundamentals of Biochemistry – Voet&Voet
2 Biochemistry, Rastogi, Tata McGraw Hill.

3 Fundamental of Biochemistry, Jain and Jain

Title of the subject						
Subject Code		L	T	P	C	QP
BHSMS3061	**Organizational Behavior**	**2**	**0**	**0**	**2**	A

Course Educational Objective
CEO1: To provide knowledge in organizational behavior.
CEO2: To provide knowledge on leadership quality and managerial skill.
Course outcomes: At the end of the course, the student will be able to

CO1	Understand the importance of organization and its sustenance.
CO2	Have knowledge on theories of motivation and perception.
CO3	Know the culture of organization.
CO4	Understand the importance of organizational change.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1											1	2	1
CO2	3	2	2										1	1	2
CO3	2	2	2										3	1	2
CO4	2	1	2										1	1	1
Avg.	2.4	2.4											1.5	1.33	1.33

UNIT:1 **[12 Hours]**

Fundamental of OB: Definition, scope and importance of OB, relationship between OB and the individual, evolution of OB, Theoretical framework (cognitive), behaviouristic and social cognitive, limitations of OB.

Attitude:importance of attitude in an organization, right attitude, components of attitude, relationship between behaviour and attitude, developing emotional intelligence at theworkplace, job attitude, barriers to change attitude.

Personality and values: definition and importance of personality for performance, the Myers-Briggs types indicator and the big five personality model, significant personality traits suitable to the workplace (personality and job – fit theory), personality tests and their practical applications.

Perception: meaning and concept of perception, factor Influencing perception, selective perception, attribution theory, perceptual process, social perception (stereotyping and hello effect).

Motivation: Definition& concept of motive & motivation, the content theories of motivation (Maslow's need hierarchy 7 Her berg's two factor model theory), the process (vroom's expectancy theory & porter (Lawler model), contemtary theories—equity theory of work motivation.

UNIT:2 **[12 Hours]**

Foundation of Group Behaviour: The meaning of Group & Group Behavior & Group Dynamic, Types of Groups, The Five –Stage model of group development.

Managing Teams: Why work teams, work teams in organization, developing work teams, team effectiveness & team building.

Leadership **:** concept of leadership, trait approach contingency leadership approach, contemtary, meaning and significance of contemtary leadership, concept of transformations leadership, contemtary theories of leadership, success stories of today's Global and Indian

leaders.

UNIT:3 **[12 Hours]**

Organizational Culture: Meaning & Definition of Organizational Culture, creating & sustaining Organizational Culture, types of Organizational Culture (strong vs. weak culture, soft vs. hard culture & formal vs. informal culture), creating positive Organizational Culture, concept of workplace spiritually.

UNIT:4 **[12 Hours]**

Organizational Change: Meaning, Definition & nature of Organizational change, type of Organizational change, Forces that acts as stimulants to change. Implementing Organizational change: how to overcome the resistance to change, approaches to managing Organizational change, Kurt Lewin's- three step model, seven stage model of change & Koter's Eight-step plan for implementing change, leading the change process.

UNIT:5

Facilitating change, dealing with individual & group resistance, intervention strategies for facilitating Organizational change, method of implementing Organizational change, developing a learning organization.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books 1. Understanding Organizational Behaviour, Parek, Oxford
2. Organizational Behaviour, K. Awathappa,HPH.

Ref. Books 1. ntroduction to Organizational Behaviour, Moorhead, Griffin, Cengage.
2. Organizational Behaviour, Hitt, Miller, Colella, Wiley
3. Organizational Behaviour, Robbins, Judge, Sanghi, Pearson

Subject Code		L	T	P	C	QP
BPCBT3040	**Microbiology**	**3**	**0**	**0**	**3**	**A**

Course Educational Objective

CEO1: To make the student learn about origin and evolution of microbes

CEO2: To make the student understand regarding structure and function of different microbial groups

Course outcomes: At the end of the course, the student will be able to:

CO1	Gain the knowledge about classifications, culture and identification of important microorganisms.
CO2	Understand the microbial growth, reproduction and process of nitrogen fixation.
CO3	Obtain the knowledge about food microbiology, human pathogens and their life cycle.
CO4	Learn about the antibiotics and microbiology of different Environment.

UNIT:1 11 Hours

Discovery of microorganisms,Theory of spontaneous generation, Identification of Microorganisms - A general account,Introduction to Microbial Kingdom- Bacteria, Viruses, Fungi,Classical and Modern approaches of microbial taxonomy; Classification of bacteria, fungi and Viruses; Methods of Microbiology- Culture media, Sterilization, Establishment of pure culture, Staining of bacteria (Gram's, Acid Fast, Capsule),

UNIT:2 12 Hours

Microbial growth and metabolism: Pattern of bacterial growth, Growth kinetics, Monod's Equation, Synchronous Growth and its Kinetics, Continuous culture and its growth kinetics, Cyanobacteria and nitrogen fixation, Microbial genetics: Organization of bacterial and viral genome, Plasmids ,Genetic recombination in bacteria (Transformation, Conjugation and Transduction), DNA repair mechanisms in bacteria, Transposons, Mutation in Microorganisms, Ames test for Mutagenesis

UNIT:3 12 Hours

Food Microbiology: Microbiology of foods, Types of microbes associated with food spoilage, Food preservation methods, Food poisioning, Microbiology of Milk and dairy products.Medical Microbiology: disease causing bacteria, virus and fungi; Basic concepts, action of pathogens, human pathogenic viruses and bacteria, Gram-positive and Gram-negative Bacilli of medical importance. Miscellaneous bacterial agents of disease; DNA and RNA viruses and their diseases, Fungal diseases. Life cycle of some important pathogens like- Malaria, hepatitis, filaria,

UNIT:4 10 Hours

Antibiotics-classification & mode of action, Therapeutic index. Environmental Microbiology: Microbiology of water, Microbiology of Air, Baceriological analysis of water, Microbiology of extreme environments (Halobacteria, Methanogens, Thermofiles).

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books 1.A text book by Micro biology by R.C.Dubey and D.K. Maheshwari, .S.Chand

2. A text book by Micro biology by Naveen Kango, I.K.International Publishing House Pvt. ltd.

Ref. Books1. Prescott's Micro biology by Michael J.Pelczar, JR, E.C.S.Chan, Noel R.Krieg. Indian edition

2. Prescott's Micro biology by JoanneM.Willey, Linda M.Sherwood and Christopher J. Woolverton

CO-PO & PSO Mapping															
COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	-			-	-	2	-	-	-	-	-			
CO2	2	1			-	-	1	-	-	-	-	2			
CO3	1	1			1	-	-	-	-	-	-	-	1		
CO4		-	-	-	2	-	1	1	-	-	-	-		1	1
Avg.	2.0	1.0			1.5		1.25	1.0				2.0	1.0	1.0	1.0

Subject Code	Name of the Laboratory	L	T	P	C	QP
BESCS3151	**JAVA PROGRAMMING LAB.**	0	0	2	1	

Pre -Requisite:

Course Outcomes

CO1	Apply the object-oriented concepts through Java language.
CO2	Demonstrate the concepts of polymorphism and inheritance.
CO3	Write Java programs to implement error handling techniques using exception handling
CO4	Develop solution for a real problem using Java programming.

CO-PO & PSO Mapping: ***Upon successful completion of this course, students should be able to:***

Cos	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1												
CO2	3	3													
CO3	3	2													
CO4	3	3	3												
Avg.															

List of Experiments

1. Introduction, Compiling & executing a java program.
2. Data types & variables, decision control structures: if, nested if etc.
3. Loop control structures: do, while, for etc.
4. Classes and objects.
5. Data abstraction & data hiding, inheritance, polymorphism.
6. Threads, exception handlings and applet programs
7. Interfaces and inner classes, wrapper classes, generics

Subject Code	**Course Title**	L	T	P	C	
BPCBT3130	**Biochemistry Lab**	**0**	**0**	**2**	**1**	

Course Educational Objective

In this laboratory, students will have the opportunity to do the analysis of different biomolecules through lectrophoreticy and chromatographic techniques

Analysis of different Enzymatic activity and assay

Course outcomes: At the end of the course, the student will be able to:

CO1	Student can lectro the protein and carbohydrate by spectrophotometry
CO2	Student can be determined the quality and quantity of nucleic acid.
CO3	The undergraduate will separate the biomolecules by chromatography techniques
CO4	Students can extract and study the activity and assay of enzymes

LIST OF EXPERIMENTS

1. Estimation of Protein using Lowry's Method
2. Estimation of carbohydrates
3. Estimation of DNA using DPA method
4. Estimation of RNA using Orcinol Method
5. Estimation of Saponification value of fatty acids/Oil
6. Separation of Amino acids by Paper Chromatography
7. Separation of Sugars by Thin Layer Chromatography
8. Separation of Proteins by lectrophoretic method.
9. Extraction of enzymes from bacterial culture.
10. Assay of Enzyme activity: Amylase/Protease

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	3	-	-	-	-	-	-	-	-	-			
CO2	2		1	-	-	-	-	-	-	-	-	-			
CO3	3	2		-	-	-	-	-	-	-	-	1	1		
CO4	1	2		-	-	-	-	-	-	-	-	-			1
Avg.	2.0	2.0	2.0									1.0	1.0		1.0

Subject Code	**Course Title**	L	T	P	C	
BPCBT3140	**Microbiology Lab**	**0**	**0**	**2**	**1**	
Course Educational Objective						
In this laboratory, students will have the opportunity to learn the sterilization and staining techniques						
know about the preparation of culture media, bacteria culture methods.						

Course outcomes: At the end of the course, the student will be able to:	
CO1	understand the micrometry and different staining techniques
CO2	do the preparation of media and its various method of sterilization
CO3	Isolate the microbes from natural sources and study the growth and culture technique.
CO4	Learn the antibiotic assay of microbes and different kinds of microscopy

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	3	-	-	-	-	-	-	-	-	-			
CO2	2		1	-	-	-	-	-	-	-	-	-			
CO3	3	2		-	-	-	-	-	-	-	-	1	1		
CO4	1	2		-	-	-	-	-	-	-	-	-			1
Avg.	2.0	2.0	2.0									1.0	1.0		1.0

LIST OF EXPERIMENTS

1. Micrometry: calibration of stage and ocular micrometer and measurement of dimension of microbial cells.
2. Staining of microbial sample (Gram's Staining, Endospore staining, Fungal staining)
3. Media preparation and sterilization (Slant, Stab and Broth culture)
4. Isolation of micro organisms from natural habitats (Air, Water, Soil & Milk)
5. Establishment of pure culture by streak plate and serial dilution method.
6. Study the bacterial growth curve using spectrophotometer and viability assessment.
7. Antibiotic assay and estimation of Zone of inhibition.
8. Chemical assay and MIC determination of antibiotics.
9. Biochemical assay of microorganisms (Starch Hydrolysis, Casein Hydrolysis and IMVIC test).
10. Microscopy: Study of Compound, Phase contrast and Fluorescence Microscopes.

IV Semester

Title of the subject						
Subject Code		L	T	P	C	QP
BPCBT4010	**Molecular Biology**	**3**	**0**	**0**	**3**	A

Course Educational Objective

CEO1: To provide the general knowledge on cell, cell cellular organs, and their function.

CEO2: To provide detailed knowledge about gene expression.

Course outcomes: At the end of the course, the student will be able to:

CO1	understand the organization and complexity of genome.
CO2	understand the mechanism of DNA replication, DNA repair and DNA recombination.
CO3	emphasize the molecular mechanism of transcription, protein synthesis and gene regulation in various organisms.
CO4	articulate applications of molecular biology in the modern world.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	-	1	-	-	-	-	-	-	-	-	-	1		
CO2	3	2	2	-	1	-	-	-	-	-	-	-			
CO3	2	-		-	-	-	-	-	-	-	-	2			
CO4	1	2	1	-	-	-	-	-	-	-	-	-			1
Avg.	2.0	2.0	1.33		1.0							2.0	1.0		1.0

UNIT:1 **15 Hours**

Genome Organization: Prokaryotes and Eukaryotes, Nuclear genome and Organellar genome, DNA as the genetic material, Central dogma of molecular biology, Genome complexity, C-value Paradox, Cot curve analysis, Repetitive DNA, satellite DNA;Cistron, Recon, Muton; Variants of gene- Split genes, pseudo genes, Overlapping genes and selfish DNA.

UNIT:2 **15 Hours**

DNA Replication: Models of DNA replication, Enzymology of DNA replication, Process of DNA replication, DNA replication at the telomere, Replication of Mitochondrial and Chloroplast genome, DNA repair, Homologous recombination and Holliday junction.

UNIT:3 **15 Hours**

Transcription: Transcription machinery (prokaryotes and eukaryotes), Transcription factors, Transcription process, m-RNA processing (Pre and Post transcriptional processing), m-RNA stability and nuclear transport, m-RNA editing.

UNIT:4 **15 Hours**

Translation: Genetic code, Translation machinery (t-RNA, Aminoacyl t-RNA synthetase, Ribosome), Translation process, Post translational modification of protein. Regulation of Gene expression: Constitutive and Induced gene expression, Operon model (Lac-operon and Trp-operon), Gene silencing, DNA methylation, Introduction to recombinant DNA technology.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books: 1.Molecular Biology of CellByLodish and Baltimore

2. Molecular Biology by Frefelder.
3. Gene VII by Benjamin Lewin

Ref. Books 1MolecularBiology. By Turner.

2. Molecular "Biology of Gene" – Watson

3. Genome by T.A Brown

Subject Code		L	T	P	C	QP
BPCBT4020	**Biostatistics**	3	0	0	3	A

Course Educational Objective

CEO1:To provide the basic knowledge on importance of biostatistics

CEO2:Analyses of biological data with various biostatistical tools to draw relevant conclusion

Course outcomes: At the end of the course, the student will be able to:

CO1	Get the concept on biological variables
CO2	learn the technique of analysis of data
CO3	have an idea about the distribution of data in natural condition
CO4	Design of experiment and draw samples without any biasness

UNIT:1 **15 Hours**

Introduction and definition of Biostatistics; Concept of variables in biological systems. Collection, Classification, tabulation graphical and diagrammatic representation of numerical data; Measures of central tendency: Mean, Median and Mode and their relationship; Measures ofdispersion: Range, Quartile deviation, Mean deviation, Standard deviation, Concept of standarderror, Coefficient of variation, Skewness and Kurtosis.

UNIT:2 **15 Hours**

Probability: Random experiment, events, sample space, mutually exclusive events, independentand dependent events; Various definitions of probability, addition and multiplication theoremsof probability, Random variables (discrete and continuous), Probability density functions andits properties; Probability distributions: normal, Binomial, Poisson and their application.

UNIT:3 **15 Hours**

Concept of populations and sample. Simple random sampling without replacement. Definition ofSimple random sample; Designing of Experiments-Random block design and Split plot design;Correlation and Regression, linear regression.

UNIT:4 **15 Hours**

Analysis of variance: One- way and two-way classifications with single observation per cell. Duncan's multiple range test; Tests of significance: Chi-square, student's t, z and f-distributions, their properties and uses.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books 1Biostatistics by P.N.Arora and P.N. Malhan, Himalaya Publishing house
2Introduction to biostatistics by P.K.Banerjee, S.Chand

Ref. Books 1Introduction to Biostatistics and Research methods by P.S.S SundarRao and J. Richard, PHI publication
2 Biostatistics BY MunjuPandey , Euro span Publisher.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	2	-	-	-	-	-	-	-	-	-			
CO2		2	-		-	-	-	-	-	-	-	1			
CO3	2	3		1		-	-	-	-	-	-	1	2		
CO4	1	2	1		-	-	-	-	-	-	-	-		1	
Avg.	1.66	2.0	1.5	1.0								1.0	2.0	1.0	

Subject Code		L	T	P	C	QP
BPCBT4030	**Bio-analytical Techniques**	**3**	**0**	**0**	**3**	A

Course Educational Objective

CEO1: To provide knowledge about bio instruments and their working principle.

CEO2: To learn the use of instruments and their application in research.

Course outcomes: At the end of the course, the student will be able to:

CO1	understand the working principle of spectroscopic and microscopic techniques like Mass s spectroscopy, NMR, IR, ESR and Electron microscopy..
CO2	acquire knowledge on various analytical techniques and instruments used for the separation and analysis of bimolecules.
CO3	learn and design different chromatographic techniques for separation of biological products.
CO4	understand the application of radioactivity in the analysis of biomolecules

UNIT:1 **11 Hours**

Spectroscopic techniques: Spectroscopic methods to study physicochemical properties ofBiomolecules,UV-Vis, IR, FTIR, Fluorescence, Mass Spectroscopy, NMR, ESR and X-ray crystallography. Principles of electron microscopy, preparation of samples, TEM and SEM.

UNIT:2 **12 Hours**

Electrophoresis: General principle of electrophoresis, support media (agarose and polyacrylamide gels), Agarose gel electrophoresis electrophoresis of proteins by SDS-PAGE, native PAGE, gradient gels, isoelectric focusing, two dimensional PAGE, Blotting Techniques: Southern, Northern and Western blot analysis. Polymerase Chain Reaction (PCR).Centrifugation: Basic principles of sedimentation (RCF), Types of centrifuge and centrifugation

UNIT:3 **12 Hours**

Chromatography: Principles of chromatography, distribution coefficient, retention time, Chromatographic methods for macromolecular separation- Paper, TLC and column chromatography, Partition chromatography, ion exchange chromatography, gel exclusion chromatography, affinity chromatography, normal phase and reversed phase chromatography, HPLC, Gas Chromatography

UNIT:4 **10 Hours**

Radioisotope Techniques: Radioactivity activity detection methods based on ionization (Geiger- Muller monitor), excitation (solid and liquid scintillation counting), autoradiography, safety aspects of handling radioactive material.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books 1 Principles and Techniques of Biochemistry and Molecular Biology, Wilson K. and Walker

J., Cambridge University Press (2005) 6th ed.

2. Biochemical Method-A Concise guide for students and researchers, Pingoud A.,

UrbankeC., Hoggett J. and Jeltsch A. Wiley-VCH Publishers.

Ref. Books 1Bioseparations: Science and Engineering, Harrison, R.G., Todd, P., Rudge, S.R. andPetrides, B.B. Oxford University Press (2006).

2. Molecular Spectroscopy, McHale, J.L., Prentice Hall (1998).

3. Microscopy and Microtechniques. Marimuthu, R., MJP Publishers (2008).

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	-	2	-		-	-	-	-	-	-	-			
CO2	3	-	-		2	-	-	-	-	-	-	-			
CO3	1	2	2		3	-	-	-	-	-	-	-	1		
CO4	2	1	-		-	-	-	-	-	-	-	2			1
Avg.	2.0	1.5	2.0		2.5							2.0	1.0		1.0

SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	C
BESBT4050	**FLUID MECHANICS & HYDRAULICS MACHINES**	**3**	**0**	**0**	**3**

Pre -Requisite: Physics, Thermodynamics, Mechanics, Mathematics

Course Educational Objectives

CEO1	To know the concept of fluid and its properties, manometer, hydrostatic forces acting on different surfaces and also problem solving techniques.
CEO2	To relate the basic laws of fluids, flow patterns, viscous flow through pipes and their corresponding problems.
CEO3	To analyze the hydrodynamic forces acting on vanes and their performance evaluation
CEO4	To evaluate of the importance, function and performance characteristics of hydro machinery

Course outcomes: At the end of the course, the student will be able to:

CO1	Explain various fluid properties and behavior of fluid in static and dynamic mode..
CO2	Apply basic fundamental theorems governing fluid flows i.e., continuity, energy and momentum and flow through pipes.
CO3	Exposed to the basic laws of fluids, flow patterns, viscous flow through ducts and their corresponding problems.
CO4	Analyze fully developed laminar and turbulent pipe flows and alsoapply mathematical definitions and equations in fluid flow.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1										2	1	-
CO2	2	2	3										1	1	1
CO3	2	3	2										-	1	-
CO4	2	3	3										1	-	1
Avg.	2.16	2.33	2.33										1.4	1.2	1.0

SYLLABUS

UNIT:1 (10 Hours)

Scope of fluid mechanics and its development as a science, Physical property of Fluid: Density, specific gravity, specific weight, specific volume, surface tension and capillarity, viscosity, compressibility and bulk modulus, Fluid classification.

Fluid statics: Pressure, Pascal's Law, Pressure variation for incompressible fluid, atmospheric pressure, absolute pressure, gauge pressure and vacuum pressure, manometer, and its classification. Hydrostatic process on submerged surface, force on a horizontal submerged plane surface, force on a vertical submerged plane surface. Buoyancy and floatation, Archimedes' principle, stability of immersed and floating bodies, determination of metacentric height.

UNIT:2 (10 Hours)

Fluid kinematics: Introduction, description of fluid flow, classification of fluid flow. Reynolds number, Acceleration of fluid particles, flow rate and continuity equation, differential equation of continuity, Mathematical definitions of irrotational and rotational motion. Circulation, potential function and stream function. Flow net

UNIT:3 (10 Hours)

Fluid dynamics: Introduction, Euler's equation along a streamline, energy equation, Bernoulli's equation and its application to siphon, venturimeter, orifice meter, pitot tube.

Flow through pipes: Major and minor energy losses, hydraulic gradient and total energy lines, pipes in series and parallel, equivalent pipes, water hammer in pipes

UNIT: 4 (10 Hours)

Impact of Jet: Introduction, Force exerted by the jet on a stationary and movable plate (vertical, inclined, curved)

Hydraulic turbines: Classification, Impulse and Reaction turbine; Tangential, Radial and axial turbine. Impulse turbine, Pelton wheel, bucket dimensions, number of buckets in pelton wheel, efficiency and performance curves.

Reaction Turbines: Francis turbine and Kaplan turbine, velocity triangle and efficiencies, performance curve. Function of draft tube and casing cavitation.

UNIT:5 (10 Hours)

Centrifugal Pump: Constructional features, vane shape, velocity triangles, Efficiencies, Pump Characteristic, NPSH and Cavitation. Positive displacement pumps: Reciprocating Pump, Working principle, Discharge, work done and power requirement, Slip, Indicator diagram.

Hydraulic Machines: Hydraulic press, hydraulic accumulator, hydraulic intensifier, hydraulic crane, hydraulic jack, hydraulic lift, hydraulic ram, fluid couplings, fluid torque converter and air lift pump

Teaching Methods: Chalk& Talk/ PPT/Video Lectures/Demonstration

REFERENCE BOOK:

1. M. White Frank, Fluid Mechanics
2. Cimbala John, CengelYunus, Fluid Mechanics
3. Chakraborty S, Introduction To Fluid Mechanics And Fluid Machines
4. Modi & Seth, Fluid Mechanics and Hydraulic Machines
5. M. White Frank, Fluid Mechanics

Subject Code		L	T	P	C	QP
BBCBT4040	**Upstream Process Engineering**	**3**	**0**	**0**	**3**	**A**

Course Educational Objective

CEO1: To provide the knowledge on fluid mechanics and their properties

CEO2: To understand the basic law of heat transfer

Course outcomes: At the end of the course, the student will be able to:

CO1	Describe the operation, as well as constriction and exploitation characteristics of machines for mechanical operations.
CO2	Solve simple radiation heat transfer problems
CO3	Make use of empirical equations to solve forced and natural convection heat-transfer problems
CO4	Design the distillation column

UNIT:1 **10 Hours**

Processing of particulates Properties and handling of particulate solids, size reduction equipments-working principles of crusher, grinder and pulveriser, screening and particle size distribution.

UNIT:2 **10 Horus**

Methods of analysis and description - fluid as a continuum, Classification of fluid. Fluid statics – basic equation - equilibrium of fluid element – Hydrostatic Pressure, Pressure measuring Devices. Flow in boundary layers. Its formation & growth in tubes & plates. Basic equations of fluid flow continuity, momentum & Bernoulli's equation. Flow measuring devices; Venturi, Orifice, Pitot tube &Rotameter.

UNIT:3 **10 Hours**

heat transfer, basic laws of heat transfer, Conduction: The Fourier heat conduction equation, Steady-state one dimensional heat conduction through plane wall, cylindrical wall, spherical wall and composite structures. Heat transfer from extended surfaces, critical insulation of thickness. Introduction to convection: Natural and forced convection, Natural Convection: Grashoff number, natural convection from vertical and horizontal surfaces. Forced convection, The convective heat transfer coefficient, Types of heat exchangers, log-mean temperature difference, energy balances, overall heat transfer coefficients

UNIT:4 **12 Hours**

Introduction to Mass transfer operations, moleculardiffusion in fluids, binary solutions, Fick's law, equation of continuity, steady state equimolal counter current diffusion, Stefan-Maxwell equation, diffusivity of gases and liquids,application of molecular diffusion, mass transfer coefficients, in laminar and turbulent flow, Interphase mass transfer, Film theory, Penetration theory, surface-renewal theories, analogy between mass, heat and momentum transfer. relative volatility, ideal solutions, azeotropes, enthalpy concentration diagrams, flash vaporization, partial condensation, differential distillation steam distillation, azeotropic and extractive distillation. Continuous distillation

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books 1:.McCabe, Smith and Harriot, Unit Operations of Chemical Engineering
2.Foust et al, Principles of Unit Operations.

Ref. Books 1: Badger and Banchero. Introduction to Chemical Engineering.
2:Foust, Wenzel, Clump, Maus and Andersen, Principles of Unit Operations.

CO-PO & PSO Mapping															
COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	-	2	1	-	-	-	-	-	-	-			
CO2	1	-	2	3	-	-	-	-	-	-	-	-			
CO3	-	2			3	-	-	-	-	-	-	-	1		
CO4	3	-	3	2	1	-	-	-	-	-	-	2			
Avg.	2.0	1.5	2.5	2.33	1.66							2.0	1.0		

Subject Code	Course Title	L	T	P	C	
BPCBT4110	**Molecular Biology Lab**	**0**	**0**	**2**	**1**	

Course Educational Objective

In this laboratory, students will have the opportunity to isolate the nucleic acids from various organisms.

CO1	Isolatethe nucleic acid from different organisms.
CO2	Learn the separation of macromolecule using electrophoresis.
CO3	Know the quantification of biomolecules.
CO4	Understand the restriction digestion and molecular mapping.

LIST OF EXPERIMENTS

1. Isolation, purification of DNA from plant sample and its yield estimation.
2. Isolation, purification of DNA from blood sample and its quantification using UV spectrophotometer.
3. Isolation, purification of DNA from bacterial sample and its quality assessment.
4. Isolation of plasmid DNA from bacteria and estimation its size using agarose gel electrophoresis.
5. Effect of gel concentration on solidification and migration of DNA sample
6. Restriction digestion of supplied DNA sample and estimate the molecular weight of the fragments resulted.
7. Elution of the DNA from the supplied gel and assess the integrity of the fragments.
8. Isolation and purification of RNA from plant/yeast sample and its quantification using UV spectrophotometer..
9. Isolation and purification of protein from the supplied sample and its quantification using UV spectrophotometer.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	2	3	-	1	-	-	-	-	-	-	-			
CO2	3		-	-	2	-	-	-	-	-		2			
CO3	1	2	2	1	-	-	-	-	-	-	-	-	1		
CO4	2	1	1		1	-	-	-	-	-	-	-			1
Avg.	1.75	1.66	2.0	1.0	1.33							2.0	1.0		1.0

Subject Code	Course Title	L	T	P	C	QP
BPCBT4120	**Biostatistics Lab**	**0**	**0**	**2**	**1**	**A**

Course Educational Objective

In this laboratory, students will to study the important of Biostatistics in various biotechnological experiments

Student can analysis and decision making in biological experiment.

Course outcomes: At the end of the course, the student will be able to:

CO1	Understand the importance and application of biostatistics.
CO2	learn how to represent the biological data for analysis
CO3	Know the comparison of data and application of null hypothesis.
CO4	Gain the practical knowledge on ANOVA and correlation of coefficient.

LIST OF EXPERIMENTS

1. Introduction to biostatistics and measurement.
2. Construct and interpret graphical displays such as histograms, bar charts, ogive etc.
3. Collection of sample data and opening sample data sets.
4. Measures of central tendency
5. Measures of dispersion.
6. Hypothesis testing; Students t-test and interpreting confidence level.
7. Hypothesis testing; Chi-square test and interpreting confidence level.
8. Analysis of variance (ANOVA)
9. analysis of biological data with correlation coefficient

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	2	2	-	-	-	-	-	-	-	-	-			
CO2	2	3	2	-	-	-	-	-	-	-	-	-			
CO3	2	2	1	1	-	-	-	-	-	-	-	2	1	1	
CO4	1	1	1	-	-	-	-	-	-	-	-	-			
Avg.	1.5	2.0	1.5	1.0								2.0	1.0	1.0	

Subject Code	Course Title	L	T	P	C	QP
BPCBT4130	**Bio-analytical Techniques Lab**	**0**	**0**	**2**	**1**	

Pre -Requisite: Mechanics of Solid

Course Educational Objective

In this laboratory, students will have the opportunity to study the various bioinstruments.

Separation and quantification of biom olecules using various biophysical m ods

Course outcomes: At the end of the course, the student will be able to:

CO1	study the spectrophotometric analysis of DNA and protein
CO2	learn the denaturation of protein and nucleic acid and their estimation.
CO3	understand the techniques of electrophoresis.
CO4	have basic idea on operation of HPLC, GC, DSC, FTIR and Electron microscopy (SEM/TEM).

LIST OF EXPERIMENT

1. UV-Visible spectroscopy: UV – spectrophotometric analysis of DNA and protein samples/
2. Determine λmax of DNA, protein, bromophenol blue solutions by wavelengthscan
3. Denaturation of proteins and nucleic acids.
4. chromatographic analysis of chlorophyll
5. 2D-TLC analysis of amino acids
6. Use of viscometer in protein analysis
7. Comparison of Coomassie brilliant blue and silver staining methods for visualizing protein bands in SDS-PAGE
8. Comparison of ethidium bromide and silver staining methods for visualisation of small DNA fragments analyzed by native PAGE
9. Fluorescence spectroscopy (demonstration)
10. GC & HPLC (demonstration)

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	-	-	-	-	-	-	-	-	-			
CO2	2		2	-	-	-	-	-	-	-	-	-			
CO3	2	1		1	2	-	-	-	-	-	-	-			1
CO4	2	2	2	-	-	-	-	-	-	-	-	2	1		
Avg.	2.25	1.66	1.66	1.0	2.0							2.0	1.0		1.0

Subject Code	**Course Title**	L	T	P	C	QP
BBTPC5130	**Upstream Process Engineering Lab**	**0**	**0**	**2**	**1**	

Course Educational Objective
In this laboratory, students will have the opportunity to know the techniques of upstream processing.
The machines and equipment used to determine experimental data include closed conduit using Venturimeter, Orifice meter, Rotameter.

Course outcomes: At the end of the course, the student will be able to:	
CO1	understand the flow regime and construction of friction factor.
CO2	know the Pressure drop for flow by various theories.
CO3	Determine the various heat and mass transfer coefficient.
CO4	understand the operation of various reactors.

LIST OF EXPERIMENT (Minimum 8 experiments)

1. Experiments on Reynold's Apparatus-Determination of flow regime and construction of friction factor against NRe.
2. Experiments on flow measuring devices - in closed conduit using (a) Venturimeter, (b) Orifice meter (c) Rotameter.
3. Study and verification of conservation of energy of a flowing liquid in a Bernoulli's apparatus.
4. Determination of Pressure drop for flow through packed bed & verification of Ergun Equation, Kozeny-Karman equation, Blake-Plummer Equation.
5. To Determine the Overall heat transfer coefficient of a concentric pipe heat exchanger based on the inside diameter of the tube.
6. To calculate the heat loss in a lagged pipe made of various insulating materials.
7. Determination of volumetric mass transfer coefficient (Kla) of gas-liquid system.
8. Determination of mixing time in stirred tank reactor.
9. To determine the coefficient of absorption/adsorption in packed bed columns.
10. To separate the solute from one phase to another (aqueous to solvent) phase by liquid-liquidextraction.
11. Double Pipe Heat Exchanger.
12. Shell and Tube Heat Exchanger.

CO-PO & PSO Mapping															
COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	3	-	-	-	-	-	-	-	-	-			
CO2	3	3	1	-	-	-	-	-	-	-	-	-			
CO3	2	2		-	-	-	-	-	-	-	-	-	1		
CO4	3	3	2	-	-	-	-	-	-	-	-	1			1
Avg.	2.25	2.25	2.0									1.0	1.0		1.0

Subject Code		L	T	P	C	QP
BHSBT4060	**Engineering Economics & Costing**	**2**	**0**	**0**	**2**	**A**

Course Educational Objective

CEO1: to understand the significance of the economic aspects of engineering and to become proficient in the evaluation of engineering proposals in terms of worth and cost

CEO2: to help students to grasp various economics concepts and theories towards making economic decision.

Course outcomes: At the end of the course, the student will be able to:

CO1	Understanding the fundamentals of economic theory in general- concept of demand & supply, theories of production-Laws of returns
CO2	Overview of cost and revenueconcepts: Understood the nature and behavior of cost, cost sheet, Break-even analysis- linear approach and understanding of depreciation with its measurement.
CO3	Acquainted with evaluation of engineering proposals(Private and public) by learning the concept of Time-value of Money, Determination of economic life of an asset, Replacement of existing asset with a new asset etc.
CO4	Familiar with Indianfinancial system and banking structure, idea about concept of national income –its measurement and inflation.

UNIT:1 **10 Hours**

Engineering Economics –Meaning,Nature, Scope, Basic problems of an economy, Micro economics and Macro Economics.Demand and Supply Analysis -Meaning of demand, Demand function, Law of Demand and its exceptions, Determinants of demand, Elasticity of demand &its measurement (Simple numerical problems to be solved) Meaning of supply, Law of supply and its exception, Determinants of supply, Elasticity of supply, Determination of market equilibrium (Simple numerical problems to be solved).Theory of Production - Production function, Laws of returns: Law of variable proportion, Law of returns to scale

UNIT:2 **10 Hours**

Cost and revenue concepts, Elements of costs, Preparation of cost sheet, Segregation of costs into Fixed and variable costs. Basic understanding of different market structures, Price and output Determination under perfect competition (Simple numerical problems to be solved), Break Even Analysis - Linear approach (Simple numerical problems to be solved). Depreciation- Causes of depreciation, Methods of calculating depreciation (Straight line method, Declining balance method)

UNIT: 3 **12 Hours**

Time value of money -Interest Analysis - Simple and compound, nominal and effective rate of interest, Cash flow diagrams, Principles of economic equivalence.Evaluation of engineering projects-

Present worth method, Future worth method, Annual worth method, Internal rate of return method, Cost benefit analysis for public projects. Replacement Analysis- Determination of economic life of an asset, Replacement of existing asset with a new asset.

UNIT:4 **8 Hours**

Overview of Indian financial system. Commercial bank, Functions of commercial bank, Central bank, Functions of Central Bank. Inflation- Meaning of inflation, types, causes, measures to control inflation. National Income - Definition, Concepts of national income, Method of measuring national income.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books 1. Riggs, Bedworth and Randhwa, "Engineering Economics", McGraw Hill Education India

Principles of Economics, DevigaVengedasalam; KarunagaranMadhavan , Oxford University Press.

Ref. Books 1. Engineering Economy by William G.Sullivan, ElinM.Wicks, C. PatricKoelling, Pearson R.PaneerSeelvan, " Engineering Economics", PHI

Ahuja,H.L., "Principles of Micro Economics" , S.Chand& Company Ltd

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1							2							
CO2		1				2									
CO3							2					2	1		
CO4	1	2				2					2			1	1
Avg.	1.0	1.5				2.0	2.0	2.0			2.0	2.0	1.0	1.0	1.0

Subject Code	Title of the subject	L	T	P	C	QP
BPCBT4180	**Minor Project-I**	0	0	4	1	

Course Educational Objectives

CEO1	To encourage students to identify, plan, and execute a small-scale project that integrates theoretical knowledge with practical applications in their domain of study.
CEO2	To develop research aptitude, technical writing, problem-solving skills, and teamwork through guided project development and documentation.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Identify a relevant problem in the domain of study and formulate clear project objectives through literature review and problem analysis.
CO2	Apply appropriate engineering principles, tools, and techniques to design and develop a feasible solution or prototype.
CO3	Work effectively as an individual or in a team to manage project tasks, timelines, and resources.
CO4	Document and present the project outcomes with clarity, demonstrating technical writing, presentation, and communication skills.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			1												
CO2	1							1							1
CO3	1	1		1	1				2				1	1	
CO4		1													
Avg.	1.0	1.0	1.0	1.0	1.0			1.0	2.0				1.0	1.0	1.0

V Semester

Subject Code	Title of the subject	L	T	P	C	QP
BHSBS5080	**Human Values and Professional Ethics**	2	0	0	2	A

Course Educational Objectives	
CEO1	To develop an understanding of human values and the moral framework that guides personal and professional behavior.
CEO2	To install ethical decision-making skills and a sense of social responsibility essential for professional engineering practice.
Course Outcomes: ***Upon successful completion of this course, students should be able to:***	
CO1	Understand the significance of human values and apply them to individual and professional life.
CO2	Identify and analyze ethical dilemmas in engineering and formulate responsible solutions.
CO3	Demonstrate commitment to professional ethics, sustainability, and societal well-being.
CO4	Communicate effectively and work ethically in multidisciplinary teams and diverse environments.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1								3							
CO2						1		2							
CO3								2				2			
CO4						1		3					1	1	1
Avg.						1.0		2.5				2.0	1.0	1.0	1.0

1. BASIC CONCEPTS

Introduction, Terminology, Moral and Morality, Ethics, Values, Spirituality, Stakeholders, Government Edicts, Religious Edicts, Social Edicts, Constitutional Edicts, Universality, Contextual Aspects, Context, Changing Scenario, Personal Ethics, Professional Ethics, Ethical Dilemmas, Life Skills, Life Skills (WHO), Emotional Intelligence, Ability – based Model (Salovey

- Mayer, Model), Emotional Competencies (Goleman's Model), Thoughts on Ethics, Indian Thoughts, Global Thoughts on Ethics, Value Education, Current Scenario, Objectives of value Education, Importance of value Education, Acquiring Values,Dimensions of Ethics, Setting Goals in Life.

2. PROFESSION AND PROFESSIONALISM

Introduction, Profession, Professional, Professionalism, Criteria, Characteristics, Responsibilities, Competencies, Expectations, Support, Professional Associations, Roles of a Professional, Professional Risks, Professional Accountability, Professional Success, Ambition and Satisfaction, Ethics and Profession, Image of a Profession

3. ETHICAL THEORIES

Introduction, Basic Ethical, Principles, Moral Development Theories, Piaget's Theory, Elliot Turiel's Domain Theory, Comparison of Moral Development Theories, Learning Moral Values, Classification of Ethical Theories, History, Classification, Some Basic Theories, Deontology, Utilitarianism, Virtue Theory, Rights Theory, Casuist Theory, Moral Absolutism, Moral Relativism, Ethical Egoism, Feminist Consequentialism, Comparison of Ethical Theories, Moral Issues, Variety of Moral Issues, Examples, Moral Dilemmas, Examples, Resolving Moral Dilemmas, Moral Autonomy, Religion and Ethics, Influence of

Religion, Conflict with Ethics, Types of Enquiry, Descriptive or Factual Enquiry, Conceptual Enquiry, Normative Enquiry, Uses of Ethical Theories.

4. ETHICS IN ENGINEERING PROFESSION

Introduction, Engineering Profession, Technology and Society, Engineering as Social, Experimentation, Similarities between Engineering and Other Scientific Experiments, Differences, Engineering Professionals, Training, Skill Set, Life Skills, Innovation and Creativity, Professional Organizations, Professional Categories, Engineering Failures, Issues in Engineering Ethics, Ethical Obligations of Engineering Professional, Concept of safe Exit, Roles of Engineers, Engineers as Managers, Other Roles Played by Engineers, Balanced Outlook on Law.

5. ENGINEER'S RESPONSBILITY FOR SAFETY

Introduction, Safety and Risk, Concept of Safety, Assessment of Risk, Risk Assessment Technique, Safety in Engineering Products, Risk and Cost, Engineer's Responsibility for Safety, Product Safety, Mandatory Product Standards, (Australia), Designing for Safety, Product Costs, Probability of Safety and Risk, Risk- Benefit Analysis, Risk Cost and Management, Principles of Risk Management, Context Establishment, Identification, Severity and Probability of Risk, Strategies for Risk Management, Case Studies ,

Space Shuttle Challenger, Tamil Nadu Floods (2015), Bhopal Gas Tragedy, Other Tragedies, Classification of Disasters, Disaster Management Cycle, Disaster Management in India, Providing for Safe Exit, Major Ethical Issues.

6. **RESPONSIBILITIES AND RIGHTS OF PROFESSIONALS**

Introduction, Rights and Responsibility as Citizens, Responsibilities, Rights, Professional Responsibilities, Collegiality, Loyalty, Confidentiality, Respect for Authority, Accountability, Pride of Profession, Pride of Employer, Conflict of Interest, Gifts and Bribes, Collective Bargaining, Occupational Crimes, Professional Rights, Rights of an Employee, Rights of a Professional, Whistle- blowing, Discrimination, Vishakha Guidelines and Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal)Act 2013

7. GLOBAL ISSUES

Introduction, Current Scenario, Technology Revolution, Globalization and MNCS, Impact of Automation, International Trade, World Summits, Disaster Management (in 2015), Issues, Business Ethics, Corporate Governance, Finance and Accounting, Corporate Social Responsibility, Definitions, Concept, ISO and CSR, Scenario, CSR Rules in India, Case Studies, Kellogg's, Infosys Foundation, Tata Group of Companies, Environment Ethics,

Environment, Challenge of Environmental Ethics, Anthropocentrism, Sustainable Development, Ecosystem, Energy Concerns, Ozone Depletion, Pollution, Ethical Issues, Computer Ethics, Manufacturing and Marketing of Computers, Software, Cybercrimes, Date Stealing, Embezzlement, Hacking, Media Ethics, Roles of Media, Positive Aspects of Media, Negative Aspects of Media, Classification of Media, Support to Media, Accountability of Media, Regulation of Media, Factors in Media Ethics, Advertising Ethics, War Ethics, Weapons Development, Terrorism, Ethical Issues, Bioethics, Abortion, Euthanasia, Surrogacy, Cloning, Genetics, Research Ethics, Intellectual Property Rights, Why Intellectual Property Rights?, Purpose and Advantages on IPR, Domains of IPR, Professionals and Ethics.

8. ETHICAL CODES

Introduction, Need for Ethical Codes, Sample Codes, Institution of Electrical and Electronics Engineers, National Society for Professional Engineers (USA), Board of Ethical Review, American Society of Civil Engineers, American Society for Mechanical Engineers. Computer Society of India, Codes from Other Professions, Medical Council of India, Observations, Advertising Standards Council of India, Corporate Codes, Tata Group of Companies, Development of Codes, Implementationof Codes, Limitation of Codes.

9. ETHICS AUDIT

Introduction, Need of Ethics Audit, Ethics Profile of Organizations, Consideration for Ethics Audit, Manufacturing Unit, Educational Institution, Ethics Standards and Benchmarking, Objectives of Ethics Audit, Setting Ethics Standards, Ethics Assurance, Audit Brief, Ethics Auditors, Procedure for ethics Audit, Ethics Audit Report, Examples, Drug Manufacturing Unit, Educational Institution, Ethics Indices, Ethisphere Institute, FTSE4Good Index, Dow Jones Sustainability Index, Good Corporation Standard, Starting an Ethics Audit Programme.

10. HUMAN VALUES AND ATTITUDES

Introduction, Terminology, Domains of Learning, Affective Domain Taxonomy, Human Values, Classification of Values, Values and Ethics, University of Values, Value System, Degeneration of Values, Importance of Values, Acquiring Values, Attitudes, Components of Attitude, Types of Attitude, Attitude Formation, Attitude Change, Importance of Correct Attitude, Values, Attitude, and Professionals.

11. ETHICAL LIVING

Introduction, Needs of Life, Maslow's Hierarchy of Needs, Mc Celland's Theory, some Thoughts on Life, Four Orders of Nature, Anthrosophical View, Indian Philosophical Thoughts, Harmony in Life, Harmony with the self, Harmony with the Family, Harmony with Society, Harmony with Nature, Ethical Living, Why Ethical Living, Setting Goals in Life, Areas, Achieving Goals, Ethical Living for Professionals, Appendix Practical Tasks, Index,

About the Author.

RECOMMENDED BOOKS FOR REFERENCE:

1. R. Subramanian, "Professional Ethics", Oxford University Press, New Delhi, 2013
2. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, NewDelhi, 2013
3. Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics –Concepts and Cases", Thompson Learning, 2003.
4. Daniel Albuquerque, "Business Ethics", Oxford University Press, New Delhi, 2013
5. Edmund G. Seebauer and Robert L. Barry, "Fundamentals of Ethics", Oxford University Press New Delhi, 2012

Subject Code		L	T	P	C	QP
BPCBT5010	**Genetic Engineering and r-DNA Technology**	**3**	**0**	**0**	**3**	**-**

Course Educational Objective

CEO1: To introduce the basic of Genetic Engineering and its application

CEO2: To understand the functions gene transfer to organisms

Course outcomes: At the end of the course, the student will be able to:

CO1	obtain knowledge in digestion of DNA, vector system for cloning and expression.
CO2	understand the cloning strategies and expression of recombinant molecules
CO3	aware of gene, genome sequencing and DNA finger printing techniques.
CO4	acquire knowledge in molecular markers, genome mapping and apply genetic engineering principles for biotechnological and biomedical applications.

UNIT:1 **15 Hours**

Basic principle of DNA isolation and purification; Restriction endonuclease, Ligase and other modifying enzymes; DNA& RNA Markers, Linker, Adapter and MCS; Gene cloning vectors-Plasmid, bacteriophage, cosmid, BAC, YAC; Expression vectors: basic concept, bacteria and yeast based expression vector.

UNIT:2 **13 Hours**

Basic concept of gene cloning;Gene library- genomic and c-DNA, contig library; Polymerase Chainreaction, Cloning of interacting gene: two hybrid and three hybrid assay;Cloning of differentially expressed gene; DNA micro arrays and Chips - principle andManufacturing process.

UNIT:3 **12 Hours**

DNA finger printing and DNA foot printing; DNA Sequencing; Site-directed mutagenesis; Expression of heterologous gene; In vitro transcription and translation; Gene knock out strategies; RNA interference: Antisense RNA, si RNA and mi RNA; RibozymeTechnology.

UNIT:4 **15 Hours**

Molecular markers- Types (RFLP, RAPD, AFLP, SCAR, SSR, SNP, EST), Principle and methodology; Application of molecular markers: in diagnostics, gene tagging, gene mapping, Physical mapping of the genome. Genome analysis using 16S rRNA typing/ sequencing, Genome. Projects: Human, Rice; Gene therapy and its applications; DNA vaccines and rDNAproducts;Genetic engineering regulations and safety guidelines.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books 1. Principles of Mol. Biology - OS Prim Rose
2. Genetic Engineering by B D Singh, Rastogi Publication

Ref. Books Molecular Biology. By Turner. 2.Molecular “Biology of Gene” – Watson

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	-	-			-	-	-	-	-	-	-			
CO2	-	1	2		3	-	-	-	-	-	-	-			
CO3	2	-	1	2	1	-	-	1	-	-	-	-	2		
CO4	2	2	-	1	-	-	-	-	-	-	-	2			2
Avg.	1.66	1.5	1.5	1.5	2.0			1.0				2.0	2.0		2.0

Title of the Course						
Subject Code	**PROCESS INSTRUMENTATION**	L	T	P	C	QP
BOEEI5060		**3**	**0**	**0**	**3**	

Pre -Requisite: Instruments and spectroscopy.

Course Educational Objective

CEO1: Troubleshoot electronics and instrumentation systems using current equipment and systems.

CEO2: Analyze and solve problems in electronics and instrumentation systems dealing with meters and instruments.

CEO3: To Conduct, analyze, and interpret experimental results to improve process.

Course Outcome

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

CO1	State and summarize the different flow, level, temperature and pressure measuring devices used in instrumentation.
CO2	Describe the process of measuring different environmental factors.
CO3	Test the outcomes of measurement and minimize the possible error by various techniques.
CO4	Design the various meters with their specification, working and applications.

CO-PO & PSO Mapping

Cos	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	1										2	3	
CO2	3	2	2										3	3	3
CO3	2	2	2										3	3	1
CO4	2	1	2										3	3	
Avg.	2.4	2.4	1.5										2.83	2.33	0.83

UNIT I **[8 Hours]**

BASIC CONCEPTS AND QUALITIES OF MEASUREMENT: Introduction; Measurement and its Aim; The Functional Elements of an Instrument; Performance Characteristics; Statistical Analysis.

UNIT II **[15 Hours]**

LEVEL MEASUREMENT: Methods of Liquid Level Measurement, Direct Methods – Hook-type Level Indicator, Sight Glass, Float-type Level Indicator; Displacer Level Detectors; Indirect Methods – Hydrostatic Pressure Type, and Electrical Methods.

FLOW MEASUREMENT: Methods of Flow Measurement; Inferential Flow Measurement; Quantity Flow meters; Mass Flowmeters; Calibration of Flowmeters; Selection of Flowmeters.

UNIT III **[15 Hours]**

PRESSURE MEASUREMENT: Pressure; Methods of Pressure Measurement; Manometers; Elastic Pressure Transducers; Measurement of Vacuum; Force-Balance Pressure Gauges; Electrical Pressure Transducers; Pressure Switches; Calibration of Pressure Measuring Instruments; Maintenance ansd Repair of Pressure Measuring Instruments; Troubleshooting.

UNIT IV **[8 Hours]** **METHODS OF COMPOSITION ANALYSIS:** Spectroscopic Analysis; Absorption Spectroscopy; Emission Spectroscopy; Mass Spectroscopy.
UNIT:V **[10 Hours]** **TEMPERATURE MEASUREMENT:** Temperature; Temperature Scales; Methods of Temperature Measurement; Expansion Thermometers; Filled-System Thermometers; Electrical Temperature Instruments; Pyrometers.
Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS
Text Books: *1.* Industrial Instrumentation and Control, 3rd ed. by S K Singh, McGraw-Hill. ***2.*** Industrial Instrumentation by D P Eckman, CBS.
Reference Books: 1. Principles of Measurement Systems, 3rd ed. by J P Bentley, PHI. *2.* Instrumentation: Devices and Systems, 2nd ed. by C Rangan, G Sarma, and V S V Mani, *McGraw-Hill.*

Title of the subject						
Subject Code		L	T	P	C	QP
BPCBT5050	**Industrial Microbiology and Enzyme Technology**	**3**	**0**	**0**	**3**	A

Course Educational Objective

CEO1:To study about fermentation process and to study the culturing of micro organisms and maintenance of cultures.

CEO2:To study about the preparation of alcohol using yeast cells and sugars by fermentation process.

Course outcomes: At the end of the course, the student will be able to:

CO1	Obtain knowledge in microbial growth, design of fermenter and types of fermentation technology.
CO2	Able to demonstrate a knowledge and understanding of different types of commercially important products by using fermentation technology.
CO3	Acquire the knowledge about formulation and selection of media and application of molecular products with its biosafety.
CO4	Obtain knowledge in strain development and improvement of possible process modifications for improved control over microorganisms for microbial product synthesis.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	1	1	-	-	-	-	-	-	-	3	1	-
CO2	2	1	2	3	3	-	-	-	-	-	-	-	2	3	2
CO3	1	2	3	2	2	-	-	-	-	-	-	-	2	2	-
CO4	2	1	1	3	2	-	2	-	-	-	-	2	3	3	-
Avg.	1.6	1.5	2	2	1.8	-	-	-	-	-	0.16	0.3	2.0	1.83	0.33

UNIT:1 **[10 Hours]**

Microbial Processes and fermentation technology: Design and components of basic fermentor, Types of fermentation processes-Solid-state, Semi solid-state and liquid-state fermentations; batch, fed-batch and continuous fermentations, Different separation techniques and application of fermentation in waste treatment.

UNIT:2 **[10 Hours]**

A brief outline of microbial processes for the production of some commercially important Organic acids (e.g. citric acid); Amino acid (Glutamic acid); and Alcohol (ethanol) Antibiotics(penicillin),enzymes(Proteases),polysaccharides(cellulose**)**; lipids(Triglycerides) recombinant protein (Insulin), production of vaccines (Hepatitis-B).

UNIT:3 **[10Hours]**

Commercial media and strain development: Media selection and development for industrial production, Isolation, selection, characterization of microorganisms, Molecular products from microbes,Recombinant microbial strain of bio-safety for agricultural and industrial engineering

[10Hours]

UNIT-4

stock culture, development of inoculum, strain improvement: induced mutation, over producing decontrolled mutants, genetically engineered strain,Economics of a fermentation process, Microbiology technology for environmental nourishment.

UNIT:5 **[10 Hours]**

Stability of enzyme: Enzyme immobilization, Enzyme stabilization by selection and genetic engineering, Biotechnological applications of enzymes in industry, analytical purpose and medical therapy, Group transfer redox, Elimination, isomarization and rearrengement, C-C bond cleavage.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS
Text Books 1. Principle of Fermentation Technology , P.F. Stanbury, A. Whitaker and S.J. Hall, Elsevier 2. Industrial Microbilogy, Prescot and Dunn,
Ref. Books 1. Biochemical Engineering and Biotechnology Handbook, Atkinson, B and Marituna, F., The Nature Press, Macmillan Publ. Ltd. 2. Biochemical Engineering Fundamentals, Bailey &Olis. MGH.

Subject code	Title of the subject	L	T	P	C	QP
BPCBT5030	**Bio-chemical REACTION ENGINEERING**	3	0	0	3	

Course Educational Objective

CEO1:To enhance skills in the areas of biochemical processes, to provide the fundamental background of biological systems, bio

CEO2:To provide the fundamental background of biological systems, bio-chemical engineering, environmental engineering, advanced bioprocess engineering, biologically mediated processes and waste treatment.

Pre-Requisites (If any)-Chemical Engg Process caluculation, Matchmatics, Chemical Engg. Reaction Engg

Course Outcome: Upon successful completion of this course, students should be able to:

CO1	Describe the bioprocess monitoring/control.
CO2	Design of ideal reactors for single and complex reactions and non-isothermal reactors.
CO3	Illustrate operation and choice of bioreactor.
CO4	Explain heat & mass transfer and scale up of bioprocesses.

Unit:1 **10hrs**

Material Balance & Energy Balances: Mathematical requisites – use of log-log and semi-log graph paper, triangular diagram, graphical differentiation and graphical integration, material balance without chemical reaction, material balance with chemical reaction, energy balance; enthalpy changes, heat of reaction and its temperature dependence, heats of solution and mixing, adiabatic flame temperature, use of psychometric charts.

Unit:2 **10hrs**

Kinetics of homogeneous reactions: classification of reactions, reaction rate, speed of reaction, rate equation, concentration-dependent term of rate equation, rate constant, order and molecularity, representation of elementary and nonelementary reactions, kinetic models for nonelementary reactions, temperature-dependent term of a rate equation, activation energy and temperature dependency.

Unit:3 **13hrs**

Kinetic analysis of batch reactor data: Integral and differential methods for analyzing kinetic data, interpretation of constant volume batch reactor, data for zero, first, second and third order reactions, half life period, irreversible reaction in parallel and series, auto catalytic reaction. Kinetic interpretation of batch reactor data for single reactions: interpretation of variable volume batch reaction data for zero, first and second order reactions, Ideal batch reactor, steady state CSTR and plug flow reactors and their use for kinetic interpretation. Design for single reaction: size comparison of single reactors, plug flow reaction in series and/or parallel, equal and different size of mixed reactor in series, finding the best system for given conversion, recycle reactor, Design of multiple reactions in batch, CSTR and PFR.

Unit:4 **12hrs**

Biochemical reaction systems: Cell and enzyme fermentation, Monod's model of growth kinetics. Kinetics of Enzyme catalyzed reactions for free and immobilized enzymes. – derivation of Michaelis-Menten equation, Briggs-haldane relationship, the determination and significance of kinetic constants, Lineweaver-burk and Eadie-Hofstee plot, principles of enzyme inhibition – Competitive, noncompetitive and uncompetitiveMichaelish-Menten kinetics, inhibition by foreign substances,

kinetics of competitive and noncompetitive inhibitions, microbial fermentation, batch fermentor and mixed flow fermentor, kinetic expressions of fermentation.
Teaching Mentod (s):Chalk& Board/PPT/Video Lecture
Text Books 1:Chemical process Principles (Part I & II), Houge, Watson & Ragatz, Asian Student Edition Asia Publishing House 2.Basic Principles and Calculations in Chemical Engineering, Himmelbalu, Prentice Hall (l) 6th Ed.
Ref. Books 1: Levenspiel, O., Chemical Reaction Engineering, Wiley Eastern Ltd. 2:Smith& Vanes, Thermodynamics for Chemical Engineers, MGH.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	0	0	-	-	-	-	-	-	-	-			
CO2	1	3	2	0	1	-	-	-	-	-	-	-			
CO3	2	1	1	0	-	-	-	-	-	-	-	1	1		
CO4	0	1	0	1	-	-	-	-	-	-	-	-			1
Avg.	2.0	1.5	1.5	1.0	1.0							1.0	1.0		1.0

Subject Code	**Course Title**	L	T	P	C	QP
BPCBT5110	Genetic Engineering and r-DNA Technology Lab	**0**	**0**	**2**	**1**	

Course Educational Objective
In this laboratory, students will have the opportunity to study the techniques of gene cloning
Understand the basic principle and techniques of PCR and hybridization of DNA and Protein

Course outcomes: At the end of the course, the student will be able to:	
CO1	know the isolation of plasmid DNA and its importance in gene cloning.
CO2	do the various ligation methods and transformation techniques.
CO3	learn the screening techniques of recombinant cells.
CO4	know the basic principle of PCR and hybridization techniques.

CO-PO & PSO Mapping															
COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	2	3	-	1	-	-	-	-	-	-	-			
CO2	3	3	2	-	-	-	-	-	-	-	-	-			
CO3	1	2		1	-	-	-	-	-	-	--	2			
CO4	2	1	1	-	2	-	-	-	-	-	-	-	1		1
Avg.	1.75	2.0	2.0	1.0	1.5							2.0	1.0		1.0

LIST OF EXPERIMENT

1. Isolation and Restriction enzyme digestion of bacterial genomic DNA
2. Isolation and Purification of plasmid DNA
3. Purification of digested DNA-column purification
4. Preparation of target DNA by linker/adapters/alkaline phosphatase treatment for cloning
5. Ligation of DNA fragment with cloning vector
6. Preparation of competent cells
7. Transformation in *E.coli* with recombinant vector
8. Isolation of recombinants and confirmation of insert DNA in vector
9. Preparation of DNA probe by nick translation /PCR
10. Amplification of DNA sample by PCR
11. Southern Hybridisation
12. Western Hybridisation
13. DNA profiling by RAPD

Title of the subject						
Subject Code		L	T	P	C	QP
BPCBT5040	**Bioreactor Design and Analysis**	**3**	**0**	**0**	**3**	A

Pre -Requisite:

Course Educational Objective

CEO1:To understand the importance of bioprocess engineering and the role of bioprocess engineer and the importance of regulatory constraints.

CEO2:To understand the instrumentation and control of bioreactors their scale up aspects etc.

Course outcomes: At the end of the course, the student will be able to

CO1	learn the principle and operation of different types of bioreactors.
CO2	understand the conditions for both ideal and non-ideal bioreactors.
CO3	know about mass transfer in biochemical processes carried out in different bioreactors.
CO4	acquire basic concept in bioreactor design and modeling and simulation of fermentation process.

UNIT:1 **[12 Hours]**

Principles and concepts: Recapitulation of the principles of Kinetics for chemical and Bio-chemical Reactions. Fundamentals of homogeneous reactions for batch / semi-batch, plug low reactor (PFR), continuous stirred rank reactors (CSTR), fluidized bed reactor, bubble column, air lift fermenteretc, stirred tank/mixed reactors, adiabatic and programmed reactors. Unconventional bioreactors: Hollow fiber reactor, membrane reactor, perfusion reactor for animal and plantcell culture

UNIT:2 **[12 Hours]**

Bioreactor Analysis: Analysis of ideal bioreactors: Fed-Batch reactors, Enzyme catalyzed reactions in CSTRs, CSTR reactors with Recycle and wall growth, Ideal Plug-Flow Tubular reactor. Analysis of Non-ideal Reactor. Concept of ideal and non-ideal reactor; residence time distribution;models of non-ideal reactors – plug flow reactor for microbial processes.

UNIT:3 **[11 Hours]**

Mass transfer in biochemical processes; Multiphase bioreactors – packed bed with immobilized enzymes or microbial cells; three – phase fluidized bed trickling bed reactor; Design and analysis of the above reactor systems; Gas liquid reactors, Reactor stability.

UNIT:4 **[12 Hours]**

Bioreactor Design: Design considerations: oxygen transfer, heat transfer, rheology, mixing. Scale up and scale down concepts. Bioprocess control and computer coupled bioreactors; Growth and product formation by recombinant cells. Mechanical fittings in a bioreactor: vessel, agitation system materials, piping and valves for biotechnology. Instrumentation and control of bioprocesses: Bioreactor sensor, online sensors for cell properties, off-line analytical methods; Biosensors. Bioreactor design calculation.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books

1. Bailey and Ollis, “Biochemical Engineering Fundamentals”, McGraw Hill (2nd Ed.). 1986. Press.
2. Scragg.A.H “Bioreactors in Biotechnology”- A Practical approach

Ref. Books

1. Bailey &Olis, Biochemical Engg. Fudamentals, MGH.,1990
3. Levenspiel, O., Chemical Reaction Engineering, Wiley Eastern Ltd.
4. Lydersen, D’Elia, Nelson, Bioprocess engineering: Systems and equipment.

CO-PO & PSO Mapping															
COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	1												
CO2	2	2		1											
CO3	2		2		2										
CO4	2	2			1							2	1		1
Avg.	2.25	1.66	1.5	1.0	1.5							2.0	1.0		1.0

Subject Code	Title of the subject	L	T	P	C	QP
BPCBT5140	**Bioreactor Design and Analysis Lab**	0	0	2	1	

Course Educational Objectives

CEO1	To provide hands-on experience in the operation, monitoring, and analysis of different types of bioreactors used in industrial bioprocessing.
CEO2	To develop experimental skills related to microbial growth, mass transfer, and bioreactor performance analysis for research and industrial applications.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Operate and demonstrate the working principles of various laboratory-scale bioreactors.
CO2	Analyze microbial growth kinetics and calculate key parameters such as specific growth rate, yield coefficients, and productivity.
CO3	Evaluate the influence of operating parameters (pH, temperature, agitation, aeration) on bioreactor performance.
CO4	Perform scale-up calculations and interpret data to optimize bioprocess efficiency.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	2	3	-	1	-	-	-	-	-	-	-			
CO2	3	3	2	-	-	-	-	-	-	-	-	-			
CO3	2	1		1	-	-	-	-	-	-	--	2			
CO4	2	1	1	-	2	-	-	-	-	-	-	-	1		1
Avg.	2.0	1.75	2.0	1.0	1.5							2.0	1.0		1.0

Subject Code	Title of the subject	L	T	P	C	QP
BPCBT5180	**Minor Project-II**	0	0	4	2	

Course Educational Objectives

CEO1	To deepen students' ability to design, implement, and evaluate engineering solutions by applying advanced knowledge and technical skills in a focused project.
CEO2	To enhance students' project management, analytical thinking, and professional communication through independent or team-based research and development activities.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Formulate and refine a project problem statement with clear objectives based on thorough literature review and feasibility analysis.
CO2	Design and develop a working solution or prototype by integrating advanced engineering concepts and tools.
CO3	Demonstrate effective project planning, execution, and teamwork skills in achieving defined project milestones.
CO4	Prepare detailed technical documentation and deliver professional presentations to communicate project outcomes and future scope.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			1												
CO2	1							1							1
CO3	1	1		1	1				2				1	1	
CO4		1													
Avg.	1.0	1.0	1.0	1.0	1.0			1.0	2.0				1.0	1.0	1.0

Subject Code	Title of the subject	L	T	P	C	QP
BPCTP5190	**Summer Internship-II**	0	0	0	1	

Course Educational Objectives	
CEO1	To provide extended industry exposure for students to apply advanced domain knowledge and technical skills in solving real-world industrial or research problems.
CEO2	To strengthen students' professional competencies, including communication, teamwork, and ethical practices, through immersive learning in a structured industrial or research environment.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***	
CO1	Apply advanced technical and theoretical knowledge to address practical challenges in an industrial or research setting.
CO2	Analyze and interpret data or processes relevant to the assigned tasks using industry-standard tools or methodologies.
CO3	Demonstrate professional behavior, including time management, communication, and adherence to workplace ethics and safety norms.
CO4	Prepare a detailed internship report and effectively present the outcomes, reflecting on learning experiences and potential improvements.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1															
CO2	1					2									
CO3					2										
CO4		1				2	1						1		
Avg.	1.0	1.0			2.0	2.0	1.0						1.0		

Subject Code		L	T	P	C	QP
BPCBT5020	**Immunology &Immuno technology**	**3**	**0**	**0**	**3**	**-**

Course Educational Objective

CEO1: To study about the process of immunity and organs and cells of lymphoid system.

CEO2: To study about complement system, major histocompatibility Hybridoma technology and various immune responses.

Course outcomes: At the end of the course, the student will be able to:

CO1	Obtain knowledge in immunology, the structure and function of lymphoid organs and cells.
CO2	Have knowledge in Major histocompatibility, antibody diversityand complement response in the blood.
CO3	understand immune response,hypersensitive reactions, and organ transplantations and also obtain knowledge in various auto immune diseases.
CO4	Know in the development of vaccines and immunological techniques.

UNIT:1 **11 Hours**

Basic concepts of immunology: Immunity, types of immunity, humoral and cell mediated immunity, Cells of immune system and Haematopoiesis, Lymphoid organs, Primary and secondary lymphoid organs, antigen-properties of antigen,antigenity,immunogencity, immunoglobulin and antibodies.

UNIT:2 **13 Hours**

Major Histocompatibility Complex (MHC), Antigen processing and presentation, synthesis and secretion of antibody, Molecular basis of antibody diversity, polyclonal, monoclonal antibody and Hybridoma Technology, complement system, antigen-antibody reaction.

UNIT:3 **11 Hours**

Immuneresponseand tolerance: Regulation of immune response, immune tolerance, Hypersensitivity, autoimmunity,Transplantationimmunology,Immuno- deficiency and immuno- proliferate diseases. Dysfunctions of immune system and their modulation, Approaches for correcting immune dysfunction, Vaccinology.

UNIT:4 **10 Hours**

Immunobiotechnology: Vaccines, viral, bacterial peptides, genetically engineered production of lymphokines, second generation generation antibodies. Immunological techniques: immunodiffusion, immunoprecipitation, agglutination and ELISA

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books 1 Immunology: Lydyard, P.M., Whelan, A., Fanger, M.W., 1st Ed., Viva Books.

2. Essential Immunology: Roitt, I.M., 9th Ed.(1997) Blackwell Scientific, Oxford, UK.

Ref. Books 1 Immunology: Kuby, J. 3rd Ed. (1997) Freeman W. H., oxford.

4. Immunotechnology by A Khan, Pearson Publication

CO-PO & PSO Mapping															
COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	-	-	2	1	-	-	-	-	-	-	-			
CO2	-	2	1	1	-		-	-	-	-	-	-			
CO3	2	-	1		1		-	1	-	-	-	-	1		
CO4	-	1	-		1		-	-	-	-	-	2		1	1
Avg.	1.5	1.5	1.0	1.5	1.0			1.0				2.0	1.0	1.0	1.0

Subject Code	Course Title	L	T	P	C	QP
BPCBT5120	**Immunology &Immunotechnology Lab**	**0**	**0**	**2**	**1**	

Course Educational Objective
In this laboratory, students will have the opportunity to learn the various techniques of Immunology
Various kinds of immunoprotein present in blood and their interactions with relate to disease analysis.

Course outcomes: At the end of the course, the student will be able to:	
CO1	study the morphology and structure of nucleus of various blood cells.
CO2	Antigen and antibody reaction study by diffusion techniques
CO3	Blotting of blood proteins
CO4	understand the technique and mechanism of identification of blood group.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	2	3	-	-	-	-	-	-	-	-	-			
CO2	3	2	1	-	-	-	-	-	-	-	-	2.0			
CO3	2	2	3	-	-	-	-	-	-	-	-	-	1.0	1.0	
CO4	3	1	2	-	-	-	-	-	-	-	-	-			
Avg.	2.25	1.75	2.25										1.0	1.0	

LIST OF EXPERIMENTS

1. Preparation of blood film and identification of different leucocytes
2. Ouchterlony double diffusion technology
3. Radial immunodiffusion technology
4. Rocket immuno-electrophoresis
5. Immunoelectrophoresis
6. Dot ELISA and Sandwich ELISA
7. Immunoblotting
8. Purification of immunoglobulin from blood serum by column chromatography
9. Determination of blood group by agglutination
10. Localization of specific antigen by immunocytochemistry

VI SEMESTER

Subject Code		L	T	P	C	QP
BPCBT6020	**Bioinformatics**	**3**	**0**	**0**	**3**	A

Course Educational Objective

CEO1: Providing fundamental knowledge of different computational tools to find sequential analysis using various software.

CEO2: To familiar with different Bio-informatics algorithms for prediction of structure of protein and DNA..

CEO3: Providing knowledge on use of different biological database.

CEO4: Creating the computational programming for data analysis.

Course outcomes: At the end of the course, the student will be able to

CO1	Understand and analyze the concept of use of various biological databases.
CO2	Analysis ofvarious algorithms for structural study of DNA & protein.
CO3	Design different molecular modeling using software.
CO4	Develop of different computational program for drug design.

UNIT:1 15 Hours

Sequence data banks- Introduction to sequence data banks- protein sequence data bank. NBFR-PIR, SWISSPORT, Signal peptide data bank, Nucleic acid sequence data bank –Gen bank, EMBL nucleotide sequence data bank, AIDS Virus sequence data bank. RRNA data bank, structural data banks- protein Data bank (PDB), The Cambridge Structural Database (CSD) : Genome data bank – Metabolic pathway data : Microbial and Cellular Data Banks.

UNIT:2 **12 Hours**

systems of microbes, Hybridoma data Bank Structure, Virus Information System, Cell line Information system; other important Data Banks in the area of Biotechnology/life sciences/biodiversity.

Sequence Analysis : Analysis Tools for Sequence Data Banks: Pair wise alignment-NEEDLEMAN AND Wunsch algorithm, Smith Waterman, BLAST, FASTA algorithms to analyze sequence data: Sequence patterns motifs and profiles

UNIT:3 **13 Hours**

Secondary Structure Predictions prediction algorithms, Chao-Fasman algorithm, Hidden-Markov model, Neural Networking.

Tertiary Structure predictions: prediction algorithms, Chao-Fasman algorithm, Hidden-Markov model, Neural Networking.

UNIT:4 **10 Hours**

Protein classifications, Fold libraries, Protein structure prediction; Fold recognition (threading), Protein structure predictions: Comparative Modeling (Homology, Advanced topics: Protein folding, Protein-ligand interactions, Molecular Modeling & Dynamics, Drug Designing.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books 1. Bryan Bergeron, Bioinformatics computing, Prentice Hall Inc.
2. Baxevanis AS and Ouellette BF, Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, Wiley International Science.

Ref. Books
1. Tao Jiang, Ying Xu, Michael Q. Zhang, Current Topics in Computational Molecular Biology, MIT press.
2. Thomas lengauer,Bioinformatics from genome to drug .WILLEY-VCH press.
3. Mount DW, Bioinformatics: Sequence and Genome Analysis, Spring Harbor Press.

CO-PO & PSO Mapping															
COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	2	-	2	-	-	-	-	-	-	-			
CO2	2	2	-		-	-	-	-	-	-	-	2			
CO3	-	-		2	1	-	-	-	-	-	-	-			
CO4	-	2	2	1	3	-	-	-	-	-	-	-	1		1
Avg.	2.0	1.75	2.0	1.5	2.0							2.0	1.0		1.0

Subject Code	Title of the subject	L	T	P	C	QP
BPCBT6030	**Downstream processing Engineering**	3	-	-	3	

Course Educational Objective

CEO1:. Learn the fundaments of downstream processing

CEO2: Understand the principle, working and application of major unit operations in Bioprocessing of industrially important products.

Course outcomes: At the end of the course, the student will be able to

CO1	understand the principles of major downstream operations used in a bioprocess industry such as filtration, centrifugation, extraction and chromatography.
CO2	design and optimize the cost effective biosepation techniques.
CO3	understand techniques such as precipitation, coagulation and flocculation in downstream processing.
CO4	learn product recovery and product polishing methods.

UNIT:1 **12 Hours**

Introduction; An overview of bioseparation. Role and importance of Bioseparation process in biotechnological processes. Problems and requirements of bioproduct purification. Cost-cuttingstrategies Characteristics of biological mixtures – Process of Classification of Bioproducts -Biological activity Analysis of purity-Process economics-Capital and operating cost analysis

UNIT:2 **14 Hours**

Separation of cells and other insolubles from fermented broth. Foam separation, Precipitation, Filtration and microfiltration, centrifugation (batch, continuous, basket).Chromatography in bioseparation.

UNIT:3 **10 Hours**

Cell disruption: Physical methods (osmotic shock, grinding with abrasives, solid shear, liquid shear), Chemical methods (alkali, detergents), Enzymatic methods, RO, Ultra-filtration: Semipermeablemembranes, membrane geometry and ultrafiltration module configuration.

UNIT:4 **14 Hours**

Separation of soluble bio-products: Liquid-liquid extraction, Distillation, Absorption, Adsorptionprecipitation,.Other bioseparation techniques like Dialysis, electro-dialysis, LiquidElectrophoresis. Products polishing : Crystallization and drying.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books 1. Roger G. Harrison, Paul W. Todd, Scott R. Rudge, and DemetriPetrides, Bioseparations
Science and Engineering, Oxford University Press, USA (October 31, 2002)
2. Heinemann, Product Recovery in Bioprocess Technology, Butterworth Publication.

Ref. Books 1. Wankat P.C, " Rate controlled separations ", Elsevier, 1990
2. Asenjo J.M., " Separation processes in Biotechnology " Marcel Dekker Inc. 1993.
3. Belter PA and Cussler E, " Bioseparations ", Wiley 1985

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	1	1	1	-	-	-	-	-	-	-			
CO2	-	1				-	-	-	-	-	-	-	1		
CO3	2	-	2	2	3	-	-	-		-	-	-			1
CO4	-	2	2	3	-	2	-	-	-	-	-	1			
Avg.	2.0	1.75	1.75	2.0	2.0	2.0						1.0	1.0		1.0

Subject Code		L	T	P	C	QP
BPCBT6040	**Environment Biotechnology**	3	-	-	3	A

Pre -Requisite:

Course Educational Objective

CEO1: To introduce the environmental biotechnology and its importance

CEO2: To have knowledge on biodegradation processes

Course outcomes: At the end of the course, the student will be able to

CO1	acquire the basic knowledge in environmental pollution and source of pollution.
CO2	learn on biological treatment of waste water.
CO3	understand the types of Xenobiotic compounds and their adverse effect on environment.
CO4	learn about the pollution control mechanisms by the application of Biotechnology.

UNIT:110 Hours

Introduction to environmental biotechnology, Environmental monitoring bioreporter, biomarker.Bioprospecting, Biomicroelectronics and biosensor technology; Introduction to environmental pollutants: Water, Soil and Air: their sources and effects. Removal ofSpecific Pollutants: Sources of Heavy Metal Pollution, Microbial Systems for Heavy Metal accumulation, Biosorption& detoxification mechanisms.

UNIT:2 **12 Hours**

Microbiology and biochemistry of wastewater treatment: Biological Treatment of anaerobic and aerobic; methanogenesis, methanogenic,acetogenic, and fermentative bacteria- technical process and conditions; Use of GeneticallyEngineered Organisms. emerging biotechnological processes in waste - water treatment; Applications include treatment of municipal and industrial wastewaters.

UNIT:3 **14 Hours**

Biodegradation of xenobiotic compounds: Xenobiotic compounds: Aliphatic, Aromatics, Polyaromatic Hydrocarbons, Polycyclic aromatic compounds, Pesticides, Surfactants and microbialtreatment of oil pollution. Biotransformation and biocatalysts: Basic organic reaction mechanism, Common prejudices against Enzymes. Advantages & Disadvantages of Biocatalysts, Isolated enzymes versus whole cell systems. Mechanistic Aspects and Enzyme Sources. BiocatalyticApplication, Catalytic Antibodies; Stoichiometry, kinetics, and thermodynamics of microbialprocesses for the transformation of environmental contaminants

UNIT:4 **12 Hours**

Bio-oxidation& microbial leaching: Biooxidation – Direct and Indirect Mechanisms, Recovery ofmetals from solutions; Microbes in petroleum extraction; Microbial desulfurization of coal.Clean technologies: Composting Technology and Organic farming, biofertilizers, biopesticides,microbial polymer production and bio plastic technology. Biotechnology of fossil fuels:Desulfurization of coal, oil shales, microbial enhanced oil recovery (MEOR). Biofuels: Biogastechnology, biohydrogen, bioethahnol production. Biotechnology of mineral processing. Ethicalissues in environmental biotechnology and regulatory framework.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books 1 Text book of Environmental Biotechnology byP.K.Mohapatra, I.K.International
2. of Environmental Biotechnology concept and application by Hans Joachim, Jordening, J.winter, Wiley- Vch

Ref. Books 1 Advanced Environmental Biotechnology by S.K. Agarwal, A P H Publishing corporation
2 Environmental Biotechnology by D.K.Markandey and. Rajvaidya A P H Publishing Corporation

CO-PO & PSO Mapping															
COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	-	-	1	-		2	-	-	-	-	-			
CO2	-	1	1	-	-		-	-	-	-	-	-			
CO3	-	-	2		1		1	-	-	-	-	1			
CO4	1	-	2		2		2	1	-	-	-	-	1	1	
Avg.	1.5	1.0	1.75	1.0	1.5		1.75	1.0				1.0	1.0	1.0	

Subject Code		L	T	P	C	QP
BPEBT6050	**Nanobiotechnology**	**3**	**0**	**0**	**3**	A

Pre -Requisite:

Course Educational Objective

CEO1: To provide the knowledge on importance on nano biotechnology and its application.

CEO2: To have an idea about the application of nano biotechnology in industry and allied sciences at the end of course, student will be able.

Course Outcome

CO1	Learn the concept of "nanotechnology" and its interdisciplinary aspects.
CO2	Students will learn various approaches to synthesize characterized their advantages and limitations.
CO3	To understand the importance of engineered nonmaterial's for biomedical, therapeutic and environmental applications.
CO4	To evaluate the potential toxic effects of nanotechnology on living organisms and the environment.

UNIT:1 (10 Hours)

Basic Concepts of Nanoscience: Importance of "Nano" dimension, size matters: bulk vs nanomaterials, nanotechnology exists in nature, brief history of nanotechnology, applications of nanotechnology, challenges and future prospects, effect of 'nano' scale on material properties (electrical, thermal, mechanical, optical, chemical), quantum structures, quantum confinement, classification of nanostructured materials, surface effects of nanomaterials

UNIT:2 (10 Hours)

Synthesis and Characterization of Nanomaterials: Bottom-up and bottom-down approaches: milling, arc discharge, laser ablation, spray pyrolysis, chemical vapor deposition, physical vapor deposition, wet chemical synthesis of nanoparticles, self-assembled monolayer, Characterization of nanostructures, Spectroscopy: UV-Vis, FTIR; Electron microscopy: Scanning electron microscopy, EDX, Transmission electron microscopy, Atomic force microscopy.

UNIT:3 (10 Hours)

Engineered Nanomaterials for Biological Applications: Current status of nanobiotechnology, biogenic synthesis of nanoparticles: microbial and plant mediated, surface functionalization of nanomaterials, biological applications of functionalized nanomaterials, Biological nanomachines: ribosomes, photosynthesis systems, Bionanomotors, Nano-antimicrobials, Immobilized nanoparticles for water disinfection and biopesticides delivery applications.

UNIT:4 (12 Hours)

Biomedical Applications and Nanotoxicity: Biopolymers, Polymeric biomaterials, lipid nanoparticles for drug delivery applications, magnetic nanoparticles based hyperthermia treatment of cancer, DNA nanotechnology, Nano-biosensors: fabrication, functionalization, applications, Cytotoxic and genotoxic effects of nanomaterials, toxic effects on environment, impact of nanotechnology on society and industry.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books

1. Gabor L. Hornyak., H.F. Tibbals, Joydeep Dutta, John J. Moore, Introduction to Nanoscience and Nanotechnology, CRC Press, 2008.
2. "Nanostructures and Nanomaterials: Synthesis, Properties and Applications", G. Cao, Imperial College Press (2004)
3. Nanobiotechnology; Concepts, Applications and Perspectives", C. M. Niemeyer, C. A. Mirkin, Wiley-VCH (2004)

Ref. Books 1. Stuart M. Lindsay, Introduction to Nanoscience, Oxford University Press, 2009.
2. Poole C., and Owens F., Introduction to Nanotechnology, John Wiley, New Jersey, 2003.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	-	-	-	1	-	1	-	-	-	-	-			
CO2	1	-	1	2			-	-	-	-	-	-			
CO3	2	2	2	1	1		-	1	-	-	-	1			
CO4	-	1	2	1	3		-	-	-	-	-	-	1	1	1
Avg.	1.75	1.5	1.75	1.33	1.75		1.0	1.0				1.0	1.0	1.0	1.0

Subject Code	Title of the subject	L	T	P	C	QP
BPCBT 6010	**Plant Biotechnology**	3	0	-	3	A

Course Educational Objectives

CEO1	To provide the practical oriented theory on plant tissue culture
CEO2	To have knowledge on gene transfer to plants

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Acquire knowledge in various types of plant tissue culture techniques and various components of plant tissue culture media, e.g. minerals, growth factors and hormones.
CO2	Understand the importance of Micro propagation and somatic hybridization.
CO3	Learn the technology of plant transformation including vector and vector less gene transfer methods.
CO4	Acquire knowledge in biosynthesis of plant primary and secondary metabolites and their importance.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	-	-	1		-		-	-	-	-	-			
CO2	-	-	1		1	-		-		-	-	-			
CO3	2	1	3		-	-		-	-	-	-	1	1		1
CO4	2	2	2		1	-			-	-	-	-			
Avg.	2.0	1.5	2.0	1.0	1.0							1.0	1.0		1.0

UNIT:1 **10 Hours**

Concept of totipotency and plasticity of plant cell; Tissue culure media- preparation, composition and plant growth regulators; Initiation and establishment of culture: Explants preparation, Callus culture, Single cell culture, Suspension culture, Microspore culture, Embryo rescue.

UNIT:2 **10 Hours**

Micro propagation: Organogenesis, Somatic embryogenesis, Artificial seed; Protoplast technology: Isolation and culture of protoplast, Somatic hybridization, Screening and selection of somatic hybrid.

UNIT:3 **15 Hours**

Concept of genetic transformation: Vector based (*Agrobacterium*, Virus) and Direct transformation (Gene gun, Electroporation, Microinjection, etc.); Application of genetic transformation: promoter tagging, activation tagging, herbicide resistance, insect resistance, disease resistance, terminator seed technology; Products of genetic transformation: Case studies for golden rice, Bt cotton and *Flavr Savr* tomato.

UNIT:4 **12 Hours**

Primary and secondary metabolites in plant. Alkaloids and its importance. Production of secondary metabolites through tissue culture, bioreactor based production and optimization. Biotransformation.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books 1Introduction to Plant Biotechnology by H S Chawal, Science Publisher Inc.
2. Plant Biotechnology by Adrian Slater, Oxford press

Ref. Books 1Introduction to Plant Biotechnology by M.K.Razdan, Science Publisher Inc.
2 Plant Biotechnology by Agnes Ricroch ,S.Chopra, S.J.Fleisher, Springer

Title of the subject						
Subject Code		L	T	P	C	QP
BOEBT6060	**Optimization in Engineering**	**3**	**0**	**0**	**3**	A

Course Educational Objective

CEO1: To provide basics of optimization in engineering.

CEO2: To introduce linear and non linear programming

Course outcomes: At the end of the course, the student will be able to

CO1	make use of the concepts of operations research modelling approaches
CO2	Formulate and solve engineering and managerial situations as LPP.
CO3	Formulate and solve engineering and managerial situations as Transportation and Assignment problems.
CO4	Determine average queue length and waiting times of queuing models.

UNIT:1 **[10 Hours]**

Introduction: Historical overview of operations research, fundamentals of or Modeling Approach. Linear Programming: Basic assumptions, formulation, graphical method, simplex method, duality theory, primal-dual relationships, sensitivity analysis.

UNIT:2 **[14 Hours]**

Transportation and Assignment Problems: Specific features of transportation problem, streamlined simplex method for solving transportation problems, special features of assignment problems, Hungarian method for solving assignment problems. Integer programming: Special features, binary integer programming models, branch-and-bound technique, cutting-plane method.

UNIT:3 **[14 Hours]**

Dynamic Programming: Characteristics, principle of optimality, solution procedure, deterministic problems. Concepts relating to queuing systems, basic elements of queuing model, role of Poison & exponential distribution, concepts of birth and death process.

UNIT:4 **[14 Hours]**

Non-linear programming: Introduction to non-linear programming. Unconstraint optimization: Fibonacci and Golden Section Search method. Constrained optimization with equality constraint: Lagrange multiplier, Projected gradient method Constrained optimization with inequality constraint: Kuhn-Tucker condition, Quadratic programming Introduction to Genetic Algorithm.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

TBooks

1. Taha H.A., Operations Research 9th Edition, Prentice Hall of India, New Delhi, 2010.
2.Kanti Swarup., Man Mohan., and Gupta, P.K., Introduction to Operations Research 7thEdition, Sultan chand& Sons, New Delhi, 2005

Ref. Books

1. P. K. Gupta, D.S.Hira, “Operations Research”, S.Chand and Company Ltd
2. Hillier, F.S., and Lieberman G.J., Introduction to Operations Research, 7thEdition, TMH, 2009.
3.Kalyanmoy Deb, “Optimization for Engineering Design”, PHI Learning Pvt Ltd

CO-PO & PSO Mapping															
COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	-	-		-			-	-	-	-	-			
CO2	2	1	1	-	-			-	-	-	-	-			
CO3	-	2	2		1			-	-	-	-	1			
CO4	1	-	2		1				-	-	-	-	1	1	
Avg.	1.75	1.5	1.75		1.0							1.0	1.0	1.0	

Subject Code	Course Title	L	T	P	C	QP
BPCBT6110	**Plant Biotechnology Lab**	**0**	**0**	**2**	**1**	

Course Educational Objective

In this laboratory, students will have the opportunity to understand the techniques of plant tissue culture and establishment of plantlet.

The establishment of plant tissue culture laboratory for micro propagation and generation of transgenic plants.

Course outcomes: At the end of the course, the student will be able to:

CO1	Learn about the preparation of various plant tissue culture media and their sterilization.
CO2	Know about the establishment of callus culture.
CO3	Learn about agrobacterium mediated gene transfer technique.
CO4	Acquire the skill for protoplast isolation and somatic hybridization.

LIST OF EXPERIMENTS

1. Media preparation, sterilization technique explant preparation 2 establishment of meristem culture
2. Study of organogenesis
3. multiple shoot generation
4. Somatic embryogenesis in carrot and encapsulation somatic embryo
5. Anther culture of Datura
6. Establishment of suspension culture
7. Agrobacterium mediated transformation (Demonstration)
8. Embryo/Endosperm Culture
9. Isolation of protoplasts

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1												
CO2					1										
CO3	2	1	1												
CO4	2		2				1					1		1	
Avg.	2.33	1.5	1.33		1.0		1.0					1.0		1.0	

Title of the subject						
Subject Code		L	T	P	C	QP
BMCHS6070	**Dietetics and Nutritions**	**2**	**0**	**0**	**2**	**A**

Course Educational Objective

CEO1: Graduates can understand the importance of diet for good health

CEO2: Graduates should know about balance diet, menu planning and critically evaluation of meal

Course outcomes: At the end of the course, the student will be able to:

CO1	Know about importance of health and balance diet
CO2	Understand about composition of human diet and their function
CO3	Acquire knowledge on role of vitamins and minerals in food
CO4	Get an idea about menu planning and critically evaluation of meal

COs	PROGRAMME OUTCOMES(POs)											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	2											
CO2		3										
CO3	1											2
CO4		2										

UNIT:1 **10 Hours**

Basic Aspects

A. Definition of the terms Health, Nutrition and Nutrients

B. Importance of food (Physiological, Psychological and social function of food) in maintaining good health.

C. Classification of nutrients, Balanced diet, food groups

Balanced Diet

- Definition
- Importance of balanced diet

D. RDA for various nutrients- age, gender, physiological state

UNIT:2 **10 Hours**

Macronutrients

Carbohydrates

- Definition
- Classification(Mono, di and polysaccharides)
- Dietary Sources
- Function- Excess

Lipids

- Definition
- Classification
- Dietary Sources
- Functions

Protein

- Definition
- Classification based upon amino acid composition
- Dietary sources
- Functions
- Methods of improving quality of protein in food (special emphasis on soya protein

and whey protein)

Energy

- Definition of Energy and Units of its measurement (Kcal)
- energy contribution from macronutrients(carbohydrates proteins, and fat)
- Factors affecting energy requirements
- Concept of BMR, SDA
- Dietary Sources of energy
- Concept of energy balance and the health hazards associated with Underweight, Overweight

Water

- Definition
- Dietary Sources (visible, invisible)
- Function of water
- Role of water maintaining health (water balance)

UNIT:3 **8 Hours**

Macro nutrients

A. Vitamins

- Definition and classification (water and fat soluble vitamins)
- Food Sources, function and significance of

1. Fat soluble vitamins (Vitamin A, D, E, K)
2. Water soluble vitamins (Vitamin C, Thiamine, Riboflavin, Niacin, Cyanocobalamin and Folic acid)

B. **Minerals**

- Definition and classification (major and minor)
- Food Sources, functions and significance of calcium, Iron, Sodium, Iodine and Fluorine

.

UNIT:4 **6 Hours**

Digestion and Absorption

Mechanical and Chemical breakdown of food

Menu Planning

- Planning of nutritionally balanced meals based upon the three food group system
- Factor affecting food planning
- Critical evaluation of few meals served at the Institutes/ Hotels based on the principle of meal planning
- Calculation of proximate principles and energy of 3 Indian and 3 Conti lunch menus
- Critical evaluation and suggested improvement

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Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books

1. Food Science and nutrition- Sunetra Roday
2. Food hygiene and sanitation -Sohna Roda
3. Nutrition and Dietetics by Shubhangini A. Joshi

.

Ref. Books

1.Food Science- Porter and Hotchkin

2.Advanced Nutrition and Dietetics in Nutrition Support

Editor(s): Mary Hickson PhD RD,, Sara Smith PhD RD,, Kevin Whelan PhD RD FBDA,

Subject Code	Course Title	L	T	P	C	QP
BPCBT6220	**Bioinformatics Lab**	**0**	**0**	**2**	**1**	

Pre –Requisite: mathematics, computer, biology
Course Educational Objective
In this laboratory, students will have the opportunity to understand the biological database used in Bioinformatics for biotechnological analysis.
Study of various bioinformatics tools to designing of genome, protein for biological applications.

Course outcomes: At the end of the course, the student will be able to:	
CO1	understand about the various genome and protein database and its applications in biotechnology.
CO2	learn to design the phylogenetic tree for genome analysis.
CO3	familiar with various bioinformatics software.
CO4	learn the technique of molecular docking, receptor analysis and Molecular Dynamics simulation.

LIST OF EXPERIMENT

1. Retrieving Human genome data, OMIM, SNP databases to understand genetic and metabolic disorders. (At least 2 each)
2. Mining genomic data to identify genomic features: codon usage, repeats, Homologous sequences etc.
3. Making Phylogenetic tree of given sequences by using ClustalW and PHYLIP.
4. Gene and promoter prediction for Prokaryotes and eukaryotes (comparative analysis by using different tools: at least 3)
5. Learning about molecule visualisation software like Rasmol, Pymol etc.
6. Primary Structural databases: pdb, ndb, csd and Derived databases of structures: DSSP, FSSP, CATH & SCOP.
7. Prediction of secondary structures of proteins: at least 3 methods
8. Prediction of Tertiary structure of proteins and Validation of model protein structure: Energy minimization, Procheck, verify 3D, Prosa II, ERRAT etc.
9. Molecule drawing. Conversion of 2D structure to 3D structure.
10. Molecular docking and analysis of receptor with ligand
11. Molecular Dynamics simulation

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3		1	-											
CO2	2	1			2										
CO3		3	2	1								1			
CO4	2	2			2								1		1
Avg.	2.33	2.0	1.5	1.0	2.0							1.0	1.0		1.0

Subject Code	Title of the subject	L	T	P	C	QP
BPCBT6080	**Minor Project-III**	0	0	4	2	

Course Educational Objectives

CEO1	To guide students in applying comprehensive engineering knowledge and research skills toward the development of an innovative or problem-solving project with practical relevance.
CEO2	To prepare students for professional practice or higher studies by fostering independent thinking, critical analysis, project execution, and technical communication.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Identify a complex engineering problem or research question and develop a detailed project plan with clear objectives and methodology.
CO2	Apply multidisciplinary knowledge, tools, and techniques to design, implement, and validate a functional solution or model.
CO3	Analyze results, troubleshoot issues, and optimize performance using systematic and critical thinking approaches.
CO4	Prepare a comprehensive technical report and deliver an effective oral presentation, demonstrating clarity, professionalism, and awareness of ethical and societal impacts.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			1												
CO2	1							1							1
CO3	1	1		1	1				2				1	1	
CO4		1													
Avg.	1.0	1.0	1.0	1.0	1.0			1.0	2.0				1.0	1.0	1.0

VII SEMESTER

Subject Code	Subject	L	T	P	C	QP
BHSMS7040	**Entrepreneurship Development**	2	0	0	2	A

Course Educational Objectives	
CEO1	Explore the entrepreneurial mindset and culture that has been developing in companies of
CEO2	Examine the entrepreneurial process involved in both pursuing an entrepreneurial venture within a large company and the creating and managing a new enterprise for implementation of an entrepreneurial venture.
CEO3	Discuss the dynamics of participating on a business team and the power inherent in a team relative to individual effort
CEO4	Provide the background and tools necessary to understand and participate in the entrepreneurial process within a large company, in a new venture or as an investor

Course Outcomes	
CO1	Understand the concepts of entrepreneurship and skills required to be an entrepreneur
CO2	Indentify the Business Opportunities to and evaluate the feasibilities of the Project;
CO3	Understand the formalities for setting up of a new venture and know the concepts of
CO4	Evaluate different financial institutions supporting small scale industry.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1						3									
CO2						0		3			3				
CO3						0			2		2				
CO4						0					3				
AVG						0.6		0.6	1		1.6				

SYLLABUS

Unit I **[10Hrs]**

Concept of Entrepreneurship, Motivation for Economic Development and Entrepreneurial Achievement, Enterprise and Society Why and how to start Business – Entrepreneurial traits and skills, Mind Vrs Money in Commencing New Ventures, Entrepreneurial success and failures, Environmental dynamics and change. Entrepreneurial Process Step by step approach to entrepreneurial start up Decision for Entrepreneurial start up.

Unit II **[10Hrs]**

Identifying the Business opportunity - Business opportunities in various sectors, formalities for setting up small enterprises in manufacturing and services, Environmental pollution and allied regulatory and non-regulatory clearances for new venture promotion in SME sector. Writing a Business plan, components of a B-Plan, determining Bankability of the project.

Unit III **[10 Hrs]**
Central / State level Institution promoting SME. Financial Management in small business. Marketing Management, problems & strategies Problems of HRM – Relevant Labour – laws. Sickness in Small Enterprises. Causes and symptoms of sickness – cures of sickness. Govt. policies on revival of sickness and remedial measures.
Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Subject Code		L	T	P	C	QP
BPEBT7010	**Food Biotechnology**	**3**	**0**	**0**	**3**	A

Pre -Requisite:

Course Educational Objective

CEO1:To provide knowledge on food production technology

CEO2: To have idea on food preservative technologies

Course outcomes: At the end of the course, the student will be able to

CO1	understand the composition of major food products ,analysis of food quality and food production technology.
CO2	understand the role of beneficial enzymes in food processing and preservation.
CO3	understand the causes of food spoilage and technology used to control or destroy micro organism commonly found in food.
CO4	understand the role of beneficial micro organisms in food processing and preservation.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	-	-	2	1		-	-	-	-	-	-		
CO2	2	1	1	-	2		-	-	-	-	-	-		
CO3	-	-	-	1			-	1	-	-	-	1		
CO4	2	1	2		-		1	-	-	-	-	-	1	
Avg.	1.75	1.0	1.5	1.5	1.5		1.0	1.0				1.0	1.0	

UNIT:1 **10 Hours**

Food quality and Production technology Analysis of food, major ingredients present in different product, Food additives colour, flavour, vitamins, Single cell protein, mushroom, Fermentative production of food, Pickling and alcoholic beverages, Genetically manipulated crop based food, oriental foods, probotics/ prebiotics in food products.

UNIT:2 **10 Hours**

Technology for improved process Enzyme in bakery, fermented cereal products, Enzymes in fat/oil industries, Protease in cheese making, enzymes in beverage production, Utilization of food waste for production of value added products, enzymes in sugar syrup, genetically modified food.

UNIT:3 **14 Hours**

Food spoilage and control Spoilage of food, Microbiology of water, meat, milk, vegetables, Microbial safety of food products, Chemical safety of food products, heavy metal, fungal toxins, pesticide and herbicide contamination, Food preservatives and additives, Post-harvest technology for food preservation. Technology – canning, dehydration, ultrafiltration, sterilization, irradiation etc.

UNIT:4 **15 Hours**

Microbiology of fruits & vegetable and products like jam, jelly, sauce, juice; Microbiology of cereal and cereal products like bread, biscuits, confectionary. Microbiology of milk & milk products like cheese, butter, ice-cream, milk powder; Microbiology of meat, fish, poultry & egg and their products.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books

1. Food Biotechnology by V K. Joshi and R.S. Singh, I K International Publishing House.
2. Food Biotechnology by Rita Singh , Global vision publishing house

Ref. Books

1. Fundamental of food biotechnology by Byong H. Lee, Wiley-BCH.
2. Food biotechnology by S.C. Bhatia, WPI Publishing

Subject Code		L	T	P	C	QP
BOEBT7030	**Animal Biotechnology**	**3**	**0**	**0**	**3**	A

Course Educational Objective

CEO1: To provide a basic knowledge on animal cell culture.

CEO2: To provide the knowledge on application of cell culture for pharmaceutical purposes.

Course outcomes: At the end of the course, the student will be able to

CO1	understand the basics of animal cell culture and culture conditions.
CO2	acquire knowledge in optimization of media, scaling up animal cell culture, characterization and maintenance of cell lines.
CO3	Students will understand the stem cell culture and its applications in tissue engineering and animal cloning.
CO4	Students will learn molecular biology techniques like PCR, hybridization and RFLP.

UNIT:1 (12 Hours)

Animal Biotechnology Equipments and materials for animal cell, culture technology, Brief discussion on the chemical, physical and metabolic functions of different constituents of culture medium, Development of primary culture. Development of cell line by enzymatic disaggregation, Biology and characterization of the cultured cells, measuring parameters of growth

UNIT:2 (15 Hours)

Different type of cell culture media, growth supplements, serum free media, balanced salt solution, other cell culture reagents, culture of different tissues and its application.Behavior of cells in culture, division, their growth pattern, metabolism of estimation of cell number. Measurement of viability and cytotoxicity; Scaling up the cell culture to large scale/industrial level production.Development of cell lines, characterization and maintenance of cell lines, cryopreservation, common cell culture contaminants. Culture of cells for production of various biologicals.

UNIT:3 (10 Hours)

Application of animal cell culture, stem cell cultures, embryonic stem cells and their applications. Hybridoma technology, Organ culture technology, Transfection of animal cells, Future tissue engineering, animal cloning.

UNIT:4 (10 Hours)

Bacterial and viral diseases in animals; monoclonal antibodies and their use in diagnosis; molecular diagnostic techniques like PCR, insitu hybridization; northern and southern blotting; RFLP.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books

1. Animal cell culture by R.I. Freshney
2. Animal Biotechnology by P.Ramadas

Ref. Books

1. In vitro cultivation of Animal cells by Dr.C.K.Leach,Butterworth and Heinnmamm Ltd.1994.
2. Hand book of Animal Husbandry by Gopalakrishnan .
3. A Text Book of Biotechnology R C Dubey, S Chand publication

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	-	1	1	-		-	-	-	-	-	-			
CO2	1	1	2		1	-	-	-	-	-	-	-			
CO3	-	2				-	-	-	-	-	-	2			
CO4	1	-	-		2	-	1	2	-	-	-	-	1		1
Avg.	1.33	1.5	1.5	1.0	1.5		1.0	2.0				2.0	1.0		1.0

Subject Code		L	T	P	C	QP
BPEBT7020	**Medical and Pharmaceutical Biotechnology**	**3**	**0**	**0**	**3**	A

Course Educational Objective

CEO1: To provide knowledge on drug development and new generation antibiotics.

CEO2:To provide theory and practical knowledge on diagnosis technique.

Course outcomes: At the end of the course, the student will be able to

CO1	understand the drug development in pharmaceutical process
CO2	understand the recent disease and diagnosis and their therapy
CO3	learn about the role of proteomics assay in drug development
CO4	know about the control of different pharmaceutical products.

UNIT:1 **13 Hours**

Production of pharmaceuticals by genetically engineered cells (hormones, interferons), Microbial transformation for production of important pharmaceuticals (steroids and semi-synthetic antibiotics), Techniques for development of new generation antibiotics. Protein engineering, drug design, drug targeting.

UNIT:2 **13 Hours**

ELISA and hybridoma technology, Use of enzymes in clinical diagnosis, Use of biosensors for rapid clinical analysis, Diagnostic kit development for microanalysis, Genetic diseases and DNA based diagnoses, DNA vaccine, Gene Therapy, Toxicogenomics

UNIT:3 **11 Hours**

Role of Proteomics in Drug Development, Diagnosis of disease by Proteomics Development of antibody based protein assay for diagnosis.Separation and identification techniques for protein analysis, Development of antibody based protein array for diagnosis

UNIT:4 **8 Hours**

Pharmaceutical products and their control, Therapeutical categories such as laxatives, vitamins, analgesics, non-steroid contraceptives, antibodies and Biologicals Hormones.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books

1. Stanbury.P.F, Whitaker.A and Hall.S.J, "Principles of Fermentation Technology", 2nd Edition, Aditya Books (P) Ltd, 1995.
2. Molecular Diagnosis of Infectious Diseases (Methods in Molecular Medicine) by Jochen Decker, U. Reischl
3. Gary Walsh, "Pharmaceutical Biotechnology-Concepts and Applications," Wiley, 2007

Ref. Books

1. EpenetosA.A.(ed), Monoclonal antibodies: applications in clinical oncology, Chapman and Hall Medical, London
2. Text book of industrial pharmacy by S R Hiremath, Orient Black Swan publication.
3. Leon and Lachman et al- Theory and Practice of Industrial pharmacy.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	-	2	1	-	-	-	-	-	-	-	-			
CO2	-	-			1		1	-	-	-	-	-			
CO3	2	1		-	2		-	-	-	-	-	2	1		
CO4	-	-	1	2	-			1	-	-	-	-			1
Avg.	2.0	1.0	1.5	1.5	1.5		1.0	1.0				2.0	1.0		1.0

Subject Code	Title of the subject	L	T	P	C	QP
BPCBT7180	**Project Work-I**	0	0	4	4	

Course Educational Objectives	
CEO1	To prepare students to independently identify, analyze, and solve real-world engineering problems through structured project-based learning.
CEO2	To foster innovation, research aptitude, and collaborative skills by encouraging students to design, develop, and document solutions using appropriate engineering tools and methodologies.
Course Outcomes: ***Upon successful completion of this course, students should be able to:***	
CO1	Identify and define a complex engineering problem through literature review, gap analysis, and formulation of clear objectives.
CO2	Develop a comprehensive project plan including methodology, resources, and timeline for systematic execution.
CO3	Apply appropriate engineering concepts, tools, and technologies to initiate design and development of the proposed solution.
CO4	Demonstrate effective technical communication and documentation through interim reports, reviews, and presentations.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2		2												
CO2	2							2							2
CO3	2	2		2	2				2				2	2	
CO4		2													
Avg.	2.0	2.0	2.0	2.0	2.0			2.0	2.0				2.0	2.0	2.0

Subject Code	Title of the subject	L	T	P	C	QP
BPCBT7170	**Summer Internship-III**	0	0	2	1	

Course Educational Objectives

CEO1	To provide students with advanced industrial or research exposure that aligns with their specialization, fostering the application of domain-specific knowledge in solving complex, real-world problems.
CEO2	To develop students' professional skills, including leadership, critical thinking, project management, and effective communication, through active engagement in industry or research-based projects.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Apply advanced technical and analytical skills to independently handle complex tasks or projects in an industrial or research environment.
CO2	Integrate academic knowledge with industry/research practices to propose or implement innovative solutions.
CO3	Demonstrate professionalism, leadership, teamwork, and ethical responsibility in real-world workplace scenarios.
CO4	Prepare and present a well-structured internship report and deliver an oral presentation that reflects critical thinking, learning outcomes, and future scope.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1															
CO2	1					2									
CO3					2										
CO4		2				2	1						1	1	
Avg.	1.0	2.0			2.0	2.0	1.0						1.0	1.0	

VIII SEMESTER

Subject Code		L	T	P	C	QP
BPEBT8010	**IPR, Bioethics and Bio safety**	**3**	**0**	**0**	**3**	

Pre -Requisite:

Course Educational Objective

CEO1: To provide the knowledge on importance on IPR in Biotechnology.

CEO2:To introduce biosafety regulations and its application in biotechnology

Course outcomes: At the end of the course, the student will be able to

CO1	Student will understand the basics of intellectual property rights and its importance
CO2	Students will obtain knowledge in patent requirements; patent writing and patenting procedure.
CO3	Students will understand the professional responsibilities for biosafety, biosafety levels, international agreements and protocols for Biosafety.
CO4	Students will understand the social and ethical issues related to plant, animal and modern biotechnology.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		-				-	-	-	-		-	-			
CO2		1				-	-	2	-	-	-	-			
CO3	-	1				-	1	-	-	-	-	-			
CO4	-	-			-	-	2	3	-	-	-	2	1		1
Avg.		1.0					1.5	2.5				2.0	1.0		1.0

UNIT:1 (12 Hours)

Concept of property, rights, duties and their correlation; Intellectual property rights and its types- Patents, Trademarks, Copyright & Related Rights, Industrial Design, Traditional Knowledge, Geographical Indications, Protection of new GMOs; Process patent vs product patent; International framework for the protection of IP; IP as a factor in R&D; IPs of relevance to Biotechnology and few Case Studies; Introduction to History of GATT, WTO, WIPO and TRIPS.

UNIT:2 (14 Hours)

Basic requirement of a patentable invention- novelty, inventive step, Prior art and Stae of art; Patent databases; Searching International Databases; Analysis and report formation; Indian Patent Act 1970 and Recent Amendments; Filing of a patent application; Precautions before patenting- disclosure/non-disclosure; WIPO Treaties; Budapest Treaty; PCT and Implications; Role of a Country Patent Office; Procedure for filing a patent, International patenting-requirement, Patent infringement- meaning, scope, litigation,
remedies; Case studies and examples-Rice, Neem etc.

UNIT:3 (12 Hours)

Introduction to Biosafety regulations; Primary Containment for Biohazards and Biosafety Levels; Biosafety Levels of Specific Microorganisms; Recommended Biosafety Levels for Infectious Agents and Infected Animals; Biosafety guidelines - Government of India. Definition of GMOs & LMOs; Roles of Institutional Biosafety Committee, RCGM, GEAC etc.
for GMO applications in food and agriculture; Environmental release of GMOs.

UNIT:4 (10 Hours)
Overview of National Regulations and relevant International Agreements including Cartagena Protocol. Concept of Bioethics, Public concerns on Human genome research and transgenics-Genetic testing and screening, Ethics in clinical trials and GCP, ELSI & Human genome projects; Ethics in human cloning-a case study.
Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS
Text Books 1. Stanley SA, Bioethics, Wisdom educational services 3. Sateesh MK, Bioethics and Biosafety, IK International Pvt. Ltd.

Subject Code	**BIOMEDICAL INSTRUMENTATION**	L	T	P	C	QP
BEEBT 8010		**3**	**0**	**0**	**3**	**A**

Pre -Requisite: Biomedical equipments, tissues, cells and electrodes.

Course Educational Objective

CEO1: With widespread use and requirements of medical instruments, this course gives knowledge of the principle of operation and design of biomedical instruments.

CEO2: It attempts to render a broad and modern account of biomedical instruments.

CEO3: It gives the introductory idea about human physiology system which is very important with respect to design consideration.

Course Outcome

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

CO1	Define and recognize several signals which are drawn out from the human body.
CO2	Describe divergent physical inabilities in living body by biomedical electrodes.
CO3	Examine & interpret the simulated and experimental data.
CO4	Summarize the various recorders and blood flowmeters

UNIT: I **12 Hours**

FUNDAMENTALS OF MEDICAL INSTRUMENTATION: Sources of Biomedical Signals; Basic Medical Instrumentation System; Performance Requirements of Medical Instrumentation Systems; Intelligent Medical Instrumentation Systems - Use of Microprocessors in Medical Instruments, PC Based Medical Instruments; General Constraints in Design of Medical Instrumentation Systems; Regulation of Medical Devices.

BIOELECTRIC SIGNALS AND ELECTRODES: Origin of Bioelectric Signals; Electrocardiogram (ECG), Electroencephalogram (EEG), Electromyogram (EMG), Recording Electrodes - Electrode-Tissue Interface, Polarization, Skin Contact Impedance, Motion Artefacts; Silver-Silver Chloride Electrodes; Electrodes for ECG, EEG, EMG; Microelectrodes.

UNIT: II **16 Hours**

PHYSIOLOGICAL TRANSDUCERS: Introduction; Classification of Transducers; Performance Characteristics of Transducers; Displacement, Position and Motion Transducers; Pressure Transducers; Transducers for Body Temperature Measurement; Photoelectric Transducers; Biosensors; Smart Sensors.

RECORDING SYSTEMS: Basic Recording System; General Considerations for Signal Conditioners; Preamplifiers - Differential Amplifier, Isolation Amplifier; Sources of Noise in Low Level Measurements - Electrostatic and Electromagnetic Coupling to AC Signals, Proper Grounding (Common Impedance Coupling); Biomedical Signal Analysis Techniques; Signal Processing Techniques; Writing Systems: Direct Writing Recorders, The Ink Jet Recorder, Potentiometric Recorder, Digital Recorders.

BIOMEDICAL RECORDERS: Electrocardiograph (ECG); Phonocardiograph (PCG); Electroencephalograph (EEG); Electromayograph (EMG).

UNIT: III **10 Hours**

PATIENT MONITORING SYSTEMS: System Concepts; Measurement of Heart Rate; Blood Pressure Measurement; Measurement of Respiration Rate.

BLOOD FLOWMETERS: Electromagnetic Blood Flowmeters; Ultrasonic Blood Flowmeters; NMR Blood Flowmeter; Laser-Doppler Blood Flowmeter.

UNIT: IV **4 Hours**

PATIENT SAFETY: Electric Shock Hazards; Leakage Currents; Safety Codes for Electro medical Equipment.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:

Hand Book of Biomedical Instrumentation, 2nd Edition by R S Khandpur, Tata McGraw Hill 2003 (Chapters 1, 2, 3, 4, 5, 6, 11, 18)

Biomedical Instrumentation and Measurements, 2nd Edition by Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, PHI Pvt. Ltd.

Reference Books:

Introduction to Biomedical Equipment Technology, 4th Edition by Joseph J. Carr, John M. Brown, Pearson Education 2007.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	-		-	-	-	-	-	-	-	-	1		-
CO2	2	1			-	-	-	-	-	-	-	-	-		-
CO3	1	-	-		2	-		-	-	-	-	-	1		-
CO4	2	2	-			-	-	1	-	-	-	1	-	-	1
Avg.	1.5	1.33	-		2.0	-	-	1.0	-	-	-	1.0	1.0		1.0

Subject Code		L	T	P	C	QP
BOEBT8010	**Protein Engineering**	**3**	**0**	**0**	**3**	A

Course Educational Objective

CEO1:To provide importance and application of protein engineering.

CEO2: To have an idea about industrial important enzymes.

Course outcomes: At the end of the course, the student will be able to

CO1	Gain the knowledge about different forces acting on protein structure interactions and proeinenginnering applications.
CO2	Know thermodynamic and chemical principle of proteins
CO3	Have the knowledge in the features, design principles and approaches of protein engineering with stabilization.
CO4	Be understand the biophysical techniques used in protein characterization.

UNIT:1 **(12 Hours)**

Overview of protein structure and its hierarchical architecture; Protein engineering – definition,applications; Forces stabilizing proteins – Van der waals, electrostatic, hydrogen bonding andweakly polar interactions, hydrophobic effects. Structural features of protein, Ramachandranmap, Protein-protein, Protein-DNA, protein-ligand interactions. Protein structure-functionrelationship.

UNIT:2 **(10 Hours)**

Stability of Protein Structure: Laws of thermodynamics, heat, energy and work, chemical equilibrium flexibility, reversible folding and unfolding, pH titration, chemical denaturation, thermal denaturation, solvent perturbation and chemical modification.

UNIT:3 **(11 Hours)**

Features or characteristics of proteins that can be engineered- affinity and specificity; Experimental methods of protein engineering: Rational designing, Directed evolution like site directed mutagenesis, Module shuffling, Guided protein recombination, etc.; Computational Approaches to protein engineering. Mechanism of stabilization of proteins from psychrophilesand thermophiles vis-à-vis those from mesophiles; Protein and enzyme engineering case studies For its stability, specifity and affinity- Protease, Lipase and Lysozyme. Role of solvent.

UNIT:4 **(10 Hours)**

Characterization of proteins: NMR spectroscopy, crystallography, spectroscopic (UV-Vis, CD, IR,Florescence), calorimetric methods, Viscometry, Molecular sieve chromatography, Electrophoresis, EPR in protein structure and function analysis with example.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books 1. Edited by T E Creighton, Protein function. A practical approach, 2nd Edition, Oxforduniversity press.

2. Cleland and Craik, Protein Engineering, Principles and Practice, Vol 7, Springer Netherlands.
2. Mueller and Arndt., Protein engineering protocols, 1st Edition, Humana Press.
3. L. Alberghina, Protein Engineering for industrial biotechnology, Harwood Academic Publisher

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	-		1	2	-	-	-	-		-	-			
CO2	2	1	2		-	-	-	-	-	-	-	-			
CO3	-	2	1	2	2	-	-	-	-	-	-	-			
CO4	-	-	2	1	1	-	-	-	-	-	-	1	1	1	
Avg.	1.5	1.5	1.75	1.75	1.75							1.0	1.0	1.0	

Subject Code	Title of the subject	L	T	P	C	QP
BPCBT8180	**Major Project**	0	0	6	3	A

Course Educational Objectives	
CEO1	To enable students to undertake a comprehensive, innovative, and solution-oriented project that demonstrates the integration of knowledge, technical skills, and design thinking in their area of specialization.
CEO2	To develop professional competencies including project management, teamwork, research aptitude, ethical responsibility, and effective communication through independent or collaborative project execution.
Course Outcomes: ***Upon successful completion of this course, students should be able to:***	
CO1	Identify, define, and analyze a complex engineering or research problem with clear objectives, scope, and significance.
CO2	Design and develop an effective solution or prototype using appropriate methodologies, tools, and interdisciplinary knowledge.
CO3	Demonstrate project management skills, teamwork, ethical practices, and adaptability in addressing challenges during the project lifecycle.
CO4	Prepare comprehensive documentation and deliver impactful presentations that effectively communicate the project outcomes, innovations, and societal relevance.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2		2												
CO2	2							2							2
CO3	2	2		2	2				2				2	2	
CO4		2													
Avg.	2.0	2.0	2.0	2.0	2.0			2.0	2.0				2.0	2.0	2.0