RV Educational Institutions ®
RV College of Engineering ®

Autonomous Institution Affiliated to Visvesvaraya Technological University, Belagavi

Approved by AICTE, New Delhi

Go, change the world

Scheme and Syllabus of

III & IV Semester of Bachelor of Engineering (B.E.)

(2021 Scheme)

(AS PER NEP-2020 GUIDELINES)

BIOTECHNOLOGY

ACADEMIC YEAR 2022-2023

VISION

Leadership in Quality Technical Education, Interdisciplinary Research & Innovation, with a Focus on Sustainable and Inclusive Technology

MISSION

1. To deliver outcome based Quality education, emphasizing on experiential learning with the state of the art infrastructure.
2. To create a conducive environment for interdisciplinary research and innovation.
3. To develop professionals through holistic education focusing on individual growth, discipline, integrity, ethics and social sensitivity.
4. To nurture industry-institution collaboration leading to competency enhancement and entrepreneurship.
5. To focus on technologies that are sustainable and inclusive, benefiting all sections of the society.

QUALITY POLICY

Achieving Excellence in Technical Education, Research and Consulting through an Outcome Based Curriculum focusing on Continuous Improvement and Innovation by Benchmarking against the global Best Practices.

CORE VALUES

Professionalism, Commitment, Integrity, Team Work, Innovation

RV COLLEGE OF ENGINEERING®

(Autonomous Institution Affiliated to VTU, Belagavi)

R.V. Vidyaniketan Post, Mysore Road

Bengaluru – 560 059

Bachelor of Engineering (B.E.)
Scheme and Syllabus of III & IV Semesters

2021 SCHEME

BIOTECHNOLOGY

DEPARTMENT VISION

A Premier Department in Biotechnology Education, Research and Innovation with a Focus on Sustainable Technologies for the Benefit of Society and Environment.

DEPARTMENT MISSION

- Create state-of-the-art infrastructure for research and training in Biotechnology
- Develop graduates who are ethically and socially concerned
- Promoting collaboration with academia, industries and research organizations at national and international level
- Contribute to socioeconomic development through sustainable and inclusive technologies

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Have a strong foundation in scientific and engineering principles, develop oral and written communication skills and team work that prepare them for a successful career in Biotechnology and allied industries.
PEO2: Function at a technically competent level in formulating and solving problems in Biotechnology and to develop an outlook for higher education and lifelong learning.
PEO3: Organize and utilize the knowledge to develop biological processes and products, exhibit professionalism, ethical attitude to become an entrepreneur.

PROGRAM SPECIFIC OUTCOMES (PSOS)

PSO	Description
PSO1	Gain knowledge in Basic sciences, Mathematics and Biology to understand the Engineering problems related to Biotechnology and Bioinformatics.
PSO2	Develop the skills in the area of Biotechnology, Chemical Engineering and Informatics to solve complex Biological problems.
PSO3	Acquire technical knowledge to design, analyse, optimize and scale up Bio processes to develop value added products.
PSO4	Develop intellectual, personal and professional abilities through experiential learning and interdisciplinary projects.

Lead Society: American Society of Agricultural and Biological Engineers

ABBREVIATIONS

Sl. No.	Abbreviation	Meaning
1.	VTU	Visvesvaraya Technological University
2.	BS	Basic Sciences
3.	CIE	Continuous Internal Evaluation
4.	SEE	Semester End Examination
5.	PE	Professional Core Elective
6.	GE	Global Elective
7.	HSS	Humanities and Social Sciences
8.	PY	Physics
9.	CY	Chemistry
10.	MA	Mathematics
11.	AS	Aerospace Engineering
12.	AI & ML	Artificial Intelligence & Machine Learning
13.	BT	Biotechnology
14.	CH	Chemical Engineering
15.	CS	Computer Science & Engineering
16.	CV	Civil Engineering
17.	EC	Electronics & Communication Engineering
18.	EE	Electrical & Electronics Engineering
19.	EI	Electronics & Instrumentation Engineering
20.	ET	Electronics & Telecommunication Engineering
21.	IM	Industrial Engineering & Management
22.	IS	Information Science & Engineering
23.	ME	Mechanical Engineering

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Bachelor of Engineering in
BIOTECHNOLOGY

III SEMESTER

Sl. No.	Course Code	Course Title	Credit Allocation				BoS	Category	CIE Duration (H)	Max Marks CIE		SEE Duration (H)	Max Marks SEE	
			L	T	P	Total				Theory	Lab		Theory	Lab
1	21MA31C	Integral Transforms and Advanced Numerical Methods *	3	1	0	**4**	MA	Theory	1.5	**100**	****	**3**	**100**	****
2	21BT32B	Bioinspired Engineering **	2	0	0	**2**	BT	Theory	1	**50**	****	**2**	**50**	****
3	21BT33	Cell and Molecular Biology	3	0	1	**4**	BT	Theory+Lab	1.5	**100**	**50**	**3**	**100**	**50**
4	21BT34	Biochemistry	3	0	1	**4**	BT	Theory+Lab	1.5	**100**	**50**	**3**	**100**	**50**
5	21BT35	Bioprocess Calculations	3	1	0	**4**	BT	Theory	1.5	**100**	****	**3**	**100**	****
6	21BT36	Biochemical Thermodynamics	2	0	0	**2**	BT	Theory	1	**50**	****	**2**	**50**	****
7	21DCS37***	Bridge Course: Mathematics ***	2(A)	0	0	**AUDIT**	MA	Theory	1.5	**50**	****	****	****	****
8	21BT39	Design thinking Lab	0	0	2	**2**	BT	Lab	1	****	**50**	**2**	****	**50**
9	21BT310	Summer Internship I	0	0	1	**1**	BT	Internship	1	****	**50**	**2**	****	**50**
						23								

* Summer Internship-1 will be done after the II sem for 03 Weeks

Bachelor of Engineering in BIOTECHNOLOGY

IV SEMESTER

Sl. No.	Course Code	Course Title	Credit Allocation				BoS	Category	CIE Duration (H)	Max Marks CIE		SEE Duration (H)	Max Marks SEE	
			L	T	P	Total				Theory	Lab		Theory	Lab
1	21BT41	Biostatistics	2	1	0	**3**	BT	Theory	1.5	**100**	****	**3**	**100**	****
2	21BT42A	Environmental Technology **	2	0	0	**2**	BT	Theory	1	**50**	****	**2**	**50**	****
3	21BT43	Unit Operations	2	1	1	**4**	BT	Theory + Lab	1.5	**100**	**50**	**3**	**100**	**50**
4	21BT44	Programming for ComputationalBiology	2	1	1	**4**	BT	Theory + Lab	1.5	**100**	**50**	**3**	**100**	**50**
5	21BT45	Biophysics	3	0	1	**4**	BT	Theory	1.5	**100**	**50**	**3**	**100**	**50**
6	21BT4AX	Professional Elective – Group A MOOC Courses	2	0	0	**2**	BT	MOOC	1.5	**50**	****	**2**	**50**	****
7	21HS46A/ 21HS46V	Kannada Course: AADALITHA KANNADA (18HS38A)VYAVAHARIKA KANNADA (18HS38V)	1	0	0	**1**	HSS	Theory	1	**50**	****	**2**	**50**	****
	21HSA46A /B/C/D/E ***	Ability Enhancement course	0	0	1	**1**	HSS	Lab	1	****	**50**	**2**	****	**50**
8	21DCS47	Bridge Course: C Programming	2 (A)	1	0	**AUDIT**	CS	Theory	1.5	**50**	****	****	****	****
9	21HSU48	Universal Human Values and Professional Ethics	2	0	0	**2**	HSS	Theory	1	**50**	****	**2**	**50**	****
						23								

* Summer Internship-II will be done after the IV sem for 04 Weeks

*ENGINEERING MATHEMATICS – III		
COURSE TITLE	**COURSE CODE**	**BRANCHES**
Linear algebra, Integral transforms and Number theory for CS & IS	21MA31A	CS and IS
Linear algebra, Integral transforms and Fourier series for AS, EC, EE, EI & ET	21MA31B	AS, EC, EE, EI, ET
Integral transforms, Optimization and Numerical Techniques for BT, CH, CV, IM & ME	21MA31C	BT, CH, CV, IM, ME
Mathematics for AI & ML	21MA31D	AI and ML

** MANDATORY COURSES			
Sl.No	**COURSE TITLE**	**COURSE CODE**	**BRANCHES**
1	Environmental Technology	21BT32A	All circuit Branches
2	Biology for Engineers	21BT32B	BT & AS
3	Engineering Materials	21ME32	ME, CH & AS

*** **Bridge Course: Audit course for lateral entry diploma students (**Only CIE and NO SEE**)**			
Sl.No	**COURSE TITLE**	**COURSE CODE**	**BRANCHES**
1	Bridge Course Mathematics	21DMA37	AS,BT,CH,CV,EC,EE,EI, IM,ME&TE
2	Bridge Course C Programming	21DCS37	CS,IS & AI

Ability enhancement courses ***		
Sl.No	**Course code**	**Courses**
1	21HSAE39A	National Service Scheme (NSS)
2	21HSAE39B	National Cadet Corps (NCC)
3	21HSAE39C	Physical Education
4	21HSAE39D1/2/3	Music/Dance/Theatre
5	21HSAE39E1/2	Art work/ Photography & Film making

*ENGINEERING MATHEMATICS – IV			
Sl.No	**COURSE TITLE**	**COURSE CODE**	**BRANCHES**
1	Statistics and probability for Data Science	21MA41	CS, IS &AI
**** MANDATORY COURSES**			
Sl.No	**COURSE TITLE**	**COURSE CODE**	**BRANCHES**
1	Materials for Electronics Engineering (Common with EC/EE/ EI/ET).	21EC42	EC,EE,EI,TE
2	Environmental technology for AS, CH, IM & ME Programs	21ME42	AS,BT,CH,IM &ME
3	Environmental Technology	21BT42A	
4	Civil Engineering Materials for CV Program	21CV42	CV
5	Bio inspired Engineering	21BT42	AI,CS & IS
**** Bridge Course: Audit course for lateral entry diploma students**			
Sl.No	**COURSE TITLE**	**COURSE CODE**	**BRANCHES**
1	Bridge Course Mathematics	21DMA48	CS,IS & AI
2	Bridge Course C Programming	21DCS48	AS,BT,CH,CV,EC,EE,EI,IM,ME & TE

ELECTIVE: GROUP A (MOOC COURSES)			
SL. NO.	**Course Code**	**Course Title**	**No of Weeks**
1	21BT4A1	Computer Aided Drug Design	8 Weeks
2	21BT4A2	Organ Printing	8 Weeks
3	21BT4A3	Big data computing	8 Weeks
4	21BT4A4	Cellular biophysics, its framework and quantitative biology	8 Weeks
5	21BT4A5	Introduction to Mechanobiology	8 Weeks

Semester: III						
INTEGRAL TRANSFORMS, OPTIMIZATION AND NUMERICAL TECHNIQUES (Theory) (Common to BT, CH, CV, IM, ME)						
Course Code	**:**	**21MA31C**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:1:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L+15T**		**SEE Duration**	**:**	**3.00 Hours**

Unit-I	**09 Hrs**
Laplace Transform: Existence and uniqueness of Laplace Transform (LT), transform of elementary functions, region of convergence. Properties - Linearity, scaling, s-domain shift, differentiation in the s-domain, division by t, differentiation and integration in the time domain. Transform of unit impulse function and periodic functions (square wave, saw-tooth wave, triangular wave, full and half wave rectifier).	
Unit – II	**09 Hrs**
Inverse Laplace Transform and solution to differential equations: Inverse Laplace transforms – properties, evaluation using different methods. Convolution theorem (without proof), problems. Applications to solve ordinary linear differential equations.	
Unit –III	**09 Hrs**
Fourier Series: Periodic function, even and odd functions. Dirichlet's conditions, Euler's formulae for Fourier series, problems on time periodic signals (square wave, half wave rectifier, saw-tooth wave and triangular wave), Fourier sine series, Fourier cosine series.	
Unit –IV	**09 Hrs**
Linear Programming: Mathematical formulation of Linear Programming Problem (LPP). Solving LPP using Graphical, Simplex and Big M methods.	
Unit –V	**09 Hrs**
Numerical Methods: Numerical solutions to partial differential equations – Finite difference approximation to derivatives, solution of Laplace equation in two dimension, heat and wave equations in one dimension (explicit methods).	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Illustrate the fundamental concepts of Laplace and inverse Laplace transforms, Fourier series, linear programming and numerical methods.
CO2:	Apply the acquired knowledge of Laplace and inverse Laplace transforms, Fourier series, linear programming and numerical methods to solve the problems of engineering applications.
CO3:	Analyze the solution of the problems using appropriate techniques of Laplace and inverse Laplace transforms, Fourier series, linear programming and numerical methods to the real world problems arising in many practical situations.
CO4:	Interpret the overall knowledge of integral transforms Fourier series, linear programming and numerical methods gained to engage in life-long learning.

Reference Books	
1	Higher Engineering Mathematics, B.S. Grewal, 44th Edition, 2015, Khanna Publishers, ISBN: 978-81-933284-9-1.
2	Higher Engineering Mathematics, B.V. Ramana, 11th Edition, 2010, Tata McGraw-Hill, ISBN: 13-978-07-063419-0; ISBN: 10-0-07-063419-X.
3	Advanced Engineering Mathematics, E. Kreyszig, 10th Edition (Reprint), 2016. John Wiley & Sons, ISBN: 978-0470458365.
4	Numerical Methods for Engineers, Steven C Chapra and Raymond P Canale, McGraw Hill Publishing Co., 8th edition, 2021, ISBN: 978-9-35-460136-1.

<table>
<tr><th colspan="3">ASSESSMENT AND EVALUATION PATTERN</th></tr>
<tr><th></th><th>CIE</th><th>SEE</th></tr>
<tr><td>WEIGHTAGE</td><td>50%</td><td>50%</td></tr>
<tr><td colspan="2">QUIZZES</td><td></td></tr>
<tr><td>Quiz-I</td><td rowspan="2">Each quiz is evaluated for 10 marks adding up to 20 MARKS</td><td rowspan="2"></td></tr>
<tr><td>Quiz-II</td></tr>
<tr><td colspan="2">THEORY COURSE
(Bloom’s Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating)</td><td></td></tr>
<tr><td>Test – I</td><td rowspan="2">Each test will be conducted for 50 Marks adding upto 100 marks. Final test marks will be reduced to 40 MARKS</td><td rowspan="2"></td></tr>
<tr><td>Test – II</td></tr>
<tr><td>EXPERIENTIAL LEARNING</td><td>40</td><td></td></tr>
<tr><td>MATLAB</td><td>20</td><td rowspan="2"></td></tr>
<tr><td>Model presentation/ case study/ video preparation</td><td>20</td></tr>
<tr><td>MAXIMUM MARKS FOR THE THEORY</td><td>100 MARKS</td><td>100 MARKS</td></tr>
</table>

Semester III/IV						
BIOINSPIRED ENGINEERING (Theory) (Common to AI,BT,CS&IS)						
Course Code	**:**	**21BT32B/42B**		**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	**2:0:0**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**25L**		**SEE Duration**	**:**	**2.00 Hours**

Unit-I	**08 Hrs**
Introduction to Bio-inspired Engineering : Stem cells; types and applications. Synthetic Biology. Synthetic/ artificial life. Biological Clock, Biological and synthetic materials. Biopolymers; Bio-steel, Bio-composites, multi-functional biological materials.Inimitable properties of biomaterials: Antireflection and photo-thermal, Microfluidics in Biology.	
Unit – II	**09 Hrs**
Lesson from Nature-Bioinspired Materials and mechanism Firefly-Bioluminescence, Cockleburs –Velcro, Lotus leaf - Self-cleaning materials, Gecko - Gecko tape, Whale fins - Turbine blades, Box Fish / Bone - Bionic car, Shark skin - Friction reducing swim suits, Kingfisher beak - Bullet train, Coral - Calera cement, Forest floor / Ecosystem functioning - Flooring tiles, Morpho butterfly- Photonics and Iridescence, Namib beetle- Water collection, Termite/ ant hill-passive cooling, Birds/Insects- flights/ aerodynamics, Mosquito inspired micro needle.	
Unit –III	**09 Hrs**
Biomedical Inspiration-Concept and applications Organ system- Circulatory- artificial blood, artificial heart, pacemaker. Respiratory- artificial lungs.Excretory- Artificial kidney. Artificial Support and replacement of human organs: Artificial Skin, artificial liver and pancreas. Total joint replacements- artificial limbs. Visual prosthesis -bionic eye.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Elucidate the concepts and phenomenon of natural processes
CO2:	Apply the basic principles for design and development of bioinspired structures
CO3:	Analyse and append the concept of bio-mimetics for diverse applications
CO4:	Designing technical solutions by utilization of bio-inspiration modules.

Reference Books	
1.	Yoseph Bar-Cohen. Biomimetics: Biologically Inspired Technologies D. Floreano and C. Mattiussi, "Bio-Inspired Artificial Intelligence", CRC Press, 2018. ISBN: 1420037714, 9781420037715.
2.	Guang Yang, Lin Xiao, and Lallepak Lamboni. Bioinspired Materials Science and Engineering. John Wiley, 2018. ISBN: 978-1-119-390336.
3.	M.A. Meyers and P.Y. Chen. Biological Materials, Bioinspired Materials, and Biomaterials Cambridge University Press, 2014 ISBN 978-1-107-01045.
4.	Tao Deng. Bioinspired Engineering of Thermal Materials. Wiley-VCH Press, 2018. ISBN: 978-3-527-33834-4.

ASSESSMENT AND EVALUATION PATTERN		
	CIE	**SEE**
WEIGHTAGE	**50%**	**50%**
QUIZES		
Quiz-I	Each quiz is evaluated for 10 marks and the total marks obtained from two quizzes will be reduced to **10 MARKS.**	
Quiz-II		
THEORY COURSE (Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and		

Creating)		
Test – I	Each test will be conducted for 25 Marks adding upto 50 marks. Final test marks will be reduced to **30 MARKS**	
Test – II		
EXPERIENTIAL LEARNING	**10**	
Photosynthesis and Photovoltaic cells, Bionic/Artificial leaf. 3D-Bioprinting. Biosensors: e-tongue and e-nose. Echolocation. Insect foot adaptations for adhesion. Thermal insulation and storage materials. Bees and Honeycomb Structure. Artificial Intelligence-Travelling Salesman Problem (TSP), Artificial Neural Networking and bio-robotics.	**05**	
Video based seminar (4-5 minutes per student)	**05**	
MAXIMUM MARKS FOR THE THEORY	**50 MARKS**	**50 MARKS**
TOTAL MARKS FOR THE COURSE	**50**	**50**

III Semester						
CELL AND MOLECULAR BIOLOGY (Theory and Practice)						
Course Code	**:**	**21BT33**		**CIE**	**:**	**150 Marks**
Credits: L:T:P	**:**	**3:0:1**		**SEE**	**:**	**150 Marks**
Total Hours	**:**	**42L+30P**		**SEE Duration**	**:**	**03 Hrs**

Unit-I	**08Hrs**
Cell: Structure of Prokaryotic and Eukaryotic cell. DNA as the Genetic material: Griffith, Hershey-Chase experiments. Cell cycle and its regulation, Cell signalling: Reception, transduction and response.Programmed cell death. Structure and functions of Chloroplast and Mitochondria.	
Unit – II	**09Hrs**
Central Dogma of Molecular Biology: Replication of DNA in Prokaryotic cell and Eukaryotic cell. Mechanism of action of telomerase, DNA damage, and repair: Base excision repair, mismatch excision repair, photo-reactivation, nucleotide excision, and SoS repair. Transcription in the prokaryotic and eukaryotic cell: Initiation, elongation, and termination. Processing of mRNA. Translation in the prokaryotic and eukaryotic cell: Initiation, elongation, and termination. Post-translational modification of proteins. Protein targeting.	
Unit –III	**08Hrs**
Gene Regulation: Regulation of gene expression in prokaryotes (lac-operon and trp-operon). Positive and negative gene regulation, riboswitches. Regulation of gene expression in eukaryotes: Transcriptional control, RNA processing control, Translational control, and Post-translational level control. Hormonal (steroid hormone, auxin, and gibberellic acid) control of gene expression in eukaryotes. Gene silencing: antisense technique, RNA interference, Ribozymes. Genome editing systems (CRISPR/Cas9, Zinc finger nucleases and TALENs).	
Unit –IV	**09Hrs**
Microbiology: Structure of Blue green algae (*Spirulina*), Fungi (*Saccharomyces cerevisiae*), Protozoa, (Amoeba), Bacteria (*Escherichia coli*) and Viruses (Coronavirus). Horizontal gene transfer in bacteria: Conjugation, Transformation and Transduction. Culture of microorganisms: Nutrient media preparation, Sterilization of media, Isolation of microorganisms from soil sample, Growth and Measurement of bacteria, replica plating technique. Simple and Differential (Gram) staining techniques. Beneficial microflora for Humans, agriculture, environment, and industry. Human diseases caused by fungi, protozoa, bacteria and viruses.	
Unit –V	**08Hrs**
Immunology: Immune system, Innate and adaptive immune response, Human antibody: Structure, types, and functions. Vaccines: Inactivated, attenuated, viral vector, protein subunit, DNA, and RNA vaccines. Cancer: Oncogenes, tumour suppressor genes, signalling pathways in tumorigenesis. Techniques: Immunofluorescence, rocket immunoelectrophoresis (RIEP), Radio-immuno-assay, and ELISA.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Comprehend various molecular mechanisms/processes of the cell.
CO2:	Compare and contrast various molecular mechanisms of the cell.
CO3:	Apply various techniques required for isolation, culture and manipulation of cells, and detection of antigens/antibodies in the sample.
CO4:	Analyse and articulating the biological information, designing experiment and interpret the results.

Reference books	
1	Molecular Cell Biology, Lodish H, Berk A, Kaiser CA, Krieger M, Bretscher A, Ploegh H, Martin KC, Yaffe M, Amon A, 9th edn, 2021, MacMillan, ISBN-978-1319426736, ISBN-978-1319365042.
2	Karp's Cell and Molecular Biology, 9th edn, 2020, John Wiley & Sons Inc, ISBN-10:1119598249, ISBN-13: 978-1119598244
3	Kuby Immunology Punt J, Stranford S, Jones P, Owen JA, 8th edn, 2018, W.H. Freeman Publication, ISBN-10: 1319114709, ISBN-13: 978-1319114701.
4	Prescots Microbioogy, 10th edn, 2017, McGraw Hill, ISBN: 9813151269, ISBN-13: 978-9813151260

Lab Experiments

1. Isolation of microorganisms from soil sample by serial dilution technique: spread plate, streakplate, and pour plate technique.
2. Culture of microorganisms: study of bacterial growth curve
3. Staining of microorganisms: Simple (Fungi) and Differential (Gram) staining.
4. Isolation of cellulase/pectinase/amylase producing microorganisms.
5. Antibiotic sensitivity testing of bacteria.
6. Isolation of genomic DNA from bacteria.
7. Isolation of chloroplast from plant cells.
8. Study of divisional stages of mitosis and meiosis in plants (Onion)
9. Agglutination technique: Blood group identification
10. Rocket immunoelectrophoresis (RIEP)
11. Enzyme linked Immunosorbent Assay (ELISA)

Experiential learning

Innovative Projects:

1. Isolation of industrially important microbes.
2. Production of useful compounds from microbes.
3. Plant-microbe interaction.
4. Formulation of bio pesticides.
5. Formulation of biofertilizers.
6. Detection of microbial contamination in water and food.
7. Isolation of genomic DNA from bacteria/plant/animal cells.
8. Extraction of total proteins from plant seeds.
9. Early detection of diseases in plants/humans.

Students can pick up any one project as part of experiential learning

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Final test marks will be reduced to 40 MARKS</td><td rowspan="2">*****</td></tr>
<tr><td>Test – II</td></tr>
<tr><td colspan="2">EXPERIENTIAL LEARNING (Maximum of 40 Marks)</td><td>*****</td></tr>
<tr><td>Case Study-based Teaching-Learning</td><td>10</td><td rowspan="2">*****</td></tr>
<tr><td>Innovative experiments/projects</td><td>30</td></tr>
<tr><td>MAXIMUM MARKS FOR THE THEORY</td><td>100 MARKS</td><td>100 MARKS</td></tr>
<tr><td>PRACTICALS</td><td>50</td><td>50</td></tr>
<tr><td>TOTAL MARKS FOR THE COURSE</td><td>150</td><td>150</td></tr>
</table>

Semester: III						
BIOCHEMISTRY (Theory and Practice)						
Course Code	**:**	**21BT34**		**CIE**	**:**	**150 Marks**
Credits: L:T:P	**:**	**3:0:1**		**SEE**	**:**	**150 Marks**
Total Hours	**:**	**42L+30P**		**SEE Duration**	**:**	**3Hours + 3Hours**

Unit-I	**09 Hrs**
Foundations of Biochemistry Influence of hydrogen Bonds and other weak interactions in biomolecules, behavior of hydrophilic and hydrophobic substances in water, thermodynamics of transferring a nonpolar molecule from an aqueous solution to a nonpolar solvent, types of solutions (hypertonic, isotonic and hypotonic), osmosis and diffusion. Ionization of water, pH, Henderson Hasselbalch equation and its significance, influence of acids and bases in altering the pH, types of buffers and preparation of buffers. The blood buffering system.	
Unit – II	**08 Hrs**
Carbohydrates and Lipids Carbohydrates: Structure and properties of monosaccharide, disaccharide and polysaccharide (structural polysaccharides and storage polysaccharides). Carbohydrate metabolism: Aerobic and anaerobic glycolysis, tricarboxylic acid cycle and gluconeogenesis. Lipid metabolism: Biosynthesis and biodegradation of fatty acids. Biochemical functions of fatty acids, triacylglycerols, phospholipids, glycolipids, lipoproteins and steroids.	
Unit –III	**09 Hrs**
Proteins and Nucleic acids Amino Acids: Classification, structure and properties of amino acids. Proteins: primary, secondary, tertiary and quaternary structures of proteins. Biodegradation of amino acids- deamination, transamination and urea cycle. Nucleic acids- Nucleotides, bases, sugars, structure, types, properties and functions of DNA and RNA. Summary of nucleotide metabolism and regulation of nucleotide metabolism.	
Unit –IV	**08 Hrs**
Enzymes Enzyme classification, factors affecting enzyme activity, Enzyme specificity, Purification of enzymes, Enzyme assays and factors affecting enzyme activity, Michaelis–Menten Equation, enzyme inhibition (competitive, uncompetitive and non-competitive).	
Unit –V	**08 Hrs**
Hormones and vitamins The major endocrine systems and their target tissues, Hormonal Regulation of Metabolism. Common endocrine disorders: Diabetes Mellitus, Hypothyroidism, hyper thyroidism, Graves disease, Hashimoto's disease. Vitamins: Types and associated deficiency diseases.	

Course Outcomes: After completing the course, the students will be able to:-	
CO 1	Remember and explain the fundamentals of biochemistry such as structures, functions and interactions of biologically important molecules and their functions.
CO 2	Understand the complex biochemical pathways, reaction mechanisms within living cells and the associated metabolic disorders
CO 3	Comprehend biochemical principles and apply them to biological systems/samples
CO 4	Design basic biochemical experiments, analysis, interpret and present the data.

Reference Books	
1.	Lehninger Principles of Biochemistry, David L. Nelson, Michael M. Cox, 67h Edition, 2017, W.H.Freeman, ISBN-10: 9781464126116, ISBN-13: 978-1464126116
2.	Principles of Biochemistry, Donald Voet, Judith G. Voet, Charlotte W. Pratt, 4th Edition, 2012, John Wiley & Sons, ISBN-10: 1 9781464126116, ISBN-13: 978-1464126116
3.	Biochemistry, U Satyanarayana, 5th Edition, 2017, Books & Allied Ltd, ASIN: B073Y7XGH4
4.	Biochemistry, Denise Ferrier, Lippincott, 2017, Williams & Wilkins, ISBN: 149636354X, 9781496363541

Laboratory Component
1. Qualitative tests for amino acids 2. Qualitative tests for carbohydrates 3. Estimation of reducing sugars 4. Estimation of total sugars. 5. Estimation of total proteins 6. Assay of enzyme activity **Open ended experiments:** 1. Extraction of bromelain 2. Estimation of beta carotene 3. Estimation of ascorbic acid 4. Determination of dietary fiber 5. Enzyme extraction and determination of enzyme activity. 6. Calculation of Km &Vmax for an enzyme catalysed reaction 7. Effect of temperature on enzyme activity 8. Effect of pH on enzyme activity Experiments 1-6 are performed by all students. Students should pick any2 open ended experiments from the above list of open ended experiments and perform during the semester.
PART B **Innovative Experiments (IE)** 1. Extraction and Purification of enzymes 2. Purification of industrially important compounds 3. Characterization of bioactive compounds, 4. Extraction and purification of valuable compounds from waste. Students can pick up any one project as part of experiential learning

ASSESSMENT AND EVALUATION PATTERN		
	CIE	**SEE**
WEIGHTAGE	**50%**	**50%**
QUIZZES		
Quiz-I	Each quiz is evaluated for 10 marks adding up to **20 MARKS.**	*****
Quiz-II		
THEORY COURSE (Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating)		*****
Test – I	Each test will be conducted for 50	

Test – II	Marks adding upto 100 marks. Final test marks will be reduced to **40 MARKS**	*****
EXPERIENTIAL LEARNING (Maximum of 40 Marks)		*****
Case Study-based Teaching-Learning	**20**	*****
Innovative experiments/projects	20	
MAXIMUM MARKS FOR THE THEORY	**100 MARKS**	**100 MARKS**
PRACTICALS	**50**	**50**
TOTAL MARKS FOR THE COURSE	**150**	**150**

Semester III				
BIOPROCESS CALCULATIONS (Theory)				
Course Code:	**21BT35**		**CIE Marks:**	**100**
Credits: L:T:P	**3:1:0**		**SEE Marks:**	**100**
Hours:	**42 L +15T**		**SEE Duration:**	**3 Hrs**

UNIT-I	**08 Hrs**
Basic Concepts of Units and Conversion **Introduction**: Dimensions and System of Units, Fundamental and derived units, Mole Concept, Concept of mole. Expressions for composition of mixtures of solids, liquids and gases, percentage by weight, mole and volume. Composition of mixtures and solutions.	
UNIT II	**08 Hrs**
Material balance for various Separation Processes **Material balance without reaction**: Distillation, Extraction, crystallization, evaporation, drying, leaching. Continuous filtration, batch mixing, Continuous fermentation, Material balance of unsteady state operation, simple numerical examples.	
UNIT III	**09 Hrs**
Material balance for various Bioprocesses **Material balance Involving Chemical reactions:** Principles of Stoichiometry, Concept of limiting and excess reactants; fractional conversion, percentage of conversion, percentage yield. Material balance involving reactions with reference to penicillin, lactic acid, and ethanol production.	
UNIT IV	**09 Hrs**
Material balance for Recycle, Bypass and Purging Operation **Recycle by-pass and Purge**: Material balances with and without reactions involving recycle; by-pass; and purge streams, Uses of recycle and purge streams, Problems involving recycle and purge streams. Simple numerical examples.	
UNIT V	**08 Hrs**
Stoichiometry for Microbial Process **Microbial stoichiometry –** Stoichiometry of microbial growth and product formation, Growth Stoichiometry and electron balances, Bio mass yield, Product stoichiometry, Theoretical Oxygen demand, Oxygen consumption in aerobic microbial cultures, Maximum possible yield in bioprocess.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Apply the concept of dimension and unit conversion to check dimensional consistency of balanced equation and understand the specific terms used in process calculation
CO2:	Perform material balance problems without chemical reactions.
CO3:	Develop material balance equations for biochemical processes with reactions.
CO4:	Formulate growth medium based on stoichiometry and elemental balances.

Reference Books	
1.	Bioprocess Engineering principles, Pauline M Doran., Second Edition, 2013, Academic press, Elsevier, UK, ISBN: 9780122208515
2.	Basic Principles and Calculations in Chemical Engineering, Himmelblau D.M., Sixth Edition, 2007, Prentice Hall of India, New Delhi, ISBN-81-203-1145-0
3.	Bioprocess Engineering Basic Concepts, Shuler M.L., and Kargi F., Second Edition, 2002, Prentice Hall of India, New Delhi, ISBN-0130819085
4.	Stoichiometry, Bhatt B. I., Vora S. M., Fourth Edition,2004, Tata McGraw Hill Publishing Ltd., New Delhi , ISBN 0-07-462039-8

Experiential learning topics	
Process calculations involved for the production of 1kg of following compounds.	
1	Instant coffee powder
2	Molasses from fermentation
3	Mango and orange squash
4	Asafoetida
5	Yeast
6	Milk powder
7	Grape wine

Experiments to be performed	
1	Determination of normality
2	Determination of molarity and molality
3	Determination of specific gravity and ppm
4	Determination of moles and mole fraction
5	Determination of API gravity

ASSESSMENT AND EVALUATION PATTERN		
	CIE	**SEE**
WEIGHTAGE	**50%**	**50%**
QUIZZES		
Quiz-I	Each quiz is evaluated for 10 marks adding up to 2**0 MARKS.**	*****
Quiz-II		
THEORY COURSE (Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating)		*****
Test – I	Each test will be conducted for 25 Marks adding upto 50 marks. Final test marks will be reduced to 4**0 MARKS**	*****
Test – II		
EXPERIENTIAL LEARNING (Maximum of 40 Marks)		*****
Case Study-based Teaching-Learning	**20**	*****
Experiments performed	**20**	
MAXIMUM MARKS FOR THE THEORY	**100 MARKS**	**100 MARKS**
TOTAL MARKS FOR THE COURSE	**100**	**100**

Semester III				
BIOCHEMICAL THERMODYNAMICS (Theory)				
Course Code:	**21BT36**		**CIE Marks:**	**50 Marks**
Credits: L:T:P	**2:0:0**		**SEE Marks:**	**50 Marks**
Hours:	**26 L**		**SEE Duration:**	**90 Mins**

UNIT-I	**09 Hrs**

Laws of Thermodynamics

First Law of Thermodynamics: Systems and surroundings, work and heat measurement, Internal energy, flow process and non-flow process. Standard enthalpy of formation, standard enthalpy of reaction, enthalpy of formation in computational chemistry.

Second Law: Concept of Entropy, Second law of TD, Heat Pump and Heat Engine, Entropy changes for Ideal gas (Constant volume, pressure, temperature, adiabatic) 3rd law of thermodynamics.

Numericals related to the above topics.

UNIT II	**07 Hrs**

Solution Thermodynamics

Solution properties: Ideal solutions partial molar properties, Gibbs Duhem equation, Phase equilibrium criteria. Non ideal solutions, residual and excess properties, fugacity, fugacity co efficient, Numericals.

UNIT III	**10 Hrs**

Thermodynamics Equilibrium

Chemical Reaction Equilibrium: Variation of Gibbs free energy with composition, temperature and pressure, application of equilibrium to biochemical reactions. (Gibbs energy to the catalyst, stability for nucleic acid and proteins etc.,)

Phase Equilibrium: Liquid phase properties from VLE data, consistency test for VLE data, Gibbs free energy, models for excess Gibbs free energy, Numericals related to the above topics.

Course Outcomes: After completing the course, the students will be able to	
CO1:	Apply the laws of thermodynamics on closed and open systems.
CO2:	Evaluate the thermodynamic properties of ideal and real gases.
CO3:	Verify the consistency of vapour liquid equilibrium data
CO4:	Predict equilibrium composition of mixtures under phase and chemical-reaction equilibria.

Reference Books	
1.	A text book of chemical Engineering thermodynamics, Narayan K V, Second Edition, 2013, Prentice Hall Publication, ISBN9788120347472
2	Physical chemistry for life sciences, Atkins P and D Paula, WH Freeman and company, New York 2nd, 2011, Prentice Hall of India, New Delhi, ISBN-81-203-1145-0
3.	Introduction to Chemical Engineering Thermodynamics, J M Smith and D C Vanes, Eight Edition, 2018, Mcgraw Hill, ISBN-1259696529
4.	Chemical Engineering Thermodynamics Y.V.C. Rao, 2nd Edition 4th Reprint 2009, New Age International Publication, Nagpur, ISBN. 9788173714610

Experiential Learning: Energy transfer involved during fermentation processes,

Experiential learning topics	
Energy transfer involved during fermentation processes Process calculations involved for the production of 1kg of following compounds.	
1	Beer production
2	Drying of Instant coffee
3	Drying of milk powder
4	Production of yeast
5	Production of grape wine

ASSESSMENT AND EVALUATION PATTERN		
	CIE	**SEE**
WEIGHTAGE	**50%**	**50%**
QUIZZES		
Quiz-I	Each quiz is evaluated for 5 marks adding up to 1**0 MARKS**	*****
Quiz-II		
THEORY COURSE (Bloom's Taxonomy Levels: Remembering, Understanding, Applying,Analyzing, Evaluating, and Creating)		*****
Test – I	Each test will be conducted for 25 Marks adding upto 50 marks.Final test marks will be reduced to 2**0 MARKS**	*****
Test – II		
EXPERIENTIAL LEARNING (Maximum of 20 Marks)		*****
Case Study-based Teaching-Learning	**10**	*****
Experiments performed	**10**	
MAXIMUM MARKS FOR THE THEORY	**50 MARKS**	**50 MARKS**
TOTAL MARKS FOR THE COURSE	**50**	**50**

Semester: III						
Bridge Course: MATHEMATICS (Common to all branches)						
Course Code	**:**	**21DMA37**		**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	**2:0:0**		**SEE**	**:**	**50 Marks**
Audit Course				**SEE Duration**	**:**	**2.00 Hours**

Unit-I	**05 Hrs**
Differential Calculus: Partial derivatives –Introduction, simple problems. Total derivative, composite functions. Jacobians –simple problems.	
Unit – II	**05 Hrs**
Vector Differentiation: Introduction, simple problems in terms of velocity and acceleration. Concepts of gradient, divergence –solenoidal vector function, curl – irrotational vector function and Laplacian, simple problems.	
Unit –III	**06 Hrs**
Differential Equations: Higher order linear differential equations with constant coefficients, solution of homogeneous equations-Complementary functions. Non-homogeneous equations –Inverse differential operator method of finding particular integral based on input function (force function).	
Unit –IV	**05 Hrs**
Numerical Methods: Solution of algebraic and transcendental equations – Intermediate value property, Newton-Raphson method. Solution of first order ordinary differential equations – Taylor series and 4th order Runge-Kutta methods. Numerical integration – Simpson's 1/3rd, 3/8th and Weddle's rules. (All methods without proof)**.**	
Unit –V	**05 Hrs**
Multiple Integrals: Evaluation of double integrals, change of order of integration. Evaluation of triple integrals.Applications – Area, volume and mass – simple problems.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Illustrate the fundamental concepts of partial differentiation, double integrals, vector differentiation, solutions of higher order linear differential equations and numerical methods.
CO2:	Derive the solution by applying the acquired knowledge of total derivatives of implicit functions, Jacobians, homogeneous linear differential equations, velocity and acceleration vectors to the problems of engineering applications.
CO3:	Evaluate the solution of the problems using appropriate techniques of differential and integral calculus, vector differentiation, differential equations and numerical methods to the real-world problems arising in many practical situations.
CO4:	Compile the overall knowledge of differential and integral calculus, vector differentiation, differential equations and numerical methods gained to engage in life – long learning.

Reference Books	
1	B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2015, ISBN: 978-81-933284-9-1.
2	Higher Engineering Mathematics, B.V. Ramana, 11th Edition, 2010, Tata McGraw-Hill, ISBN: 978-0-07-063419-0.
3	N.P. Bali & Manish Goyal, A Text Book of Engineering Mathematics, Lakshmi Publications, 7th Edition, 2010, ISBN: 978-81-31808320.
4	Advanced Engineering Mathematics, E. Kreyszig, 10th Edition (Reprint), 2016. John Wiley & Sons, ISBN: 978-0470458365.

Continuous Internal Evaluation (CIE); Theory (50 Marks)
CIE is executed by way of quizzes (Q) and tests (T**)**. A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. The two tests are conducted for 30 marks each and the sum of the marks scored from two tests is reduced to 30. **Total CIE is 20(Q) +30(T)=50 Marks.**

Semester End Evaluation (SEE); Theory (50 Marks)
SEE for 50 marks is executed by means of an examination. The Question paper for the course consists of five main questions, one from each unit for 10 marks adding up to 50 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Semester IV							
Course Title: DESIGN THINKING LAB (Practice)							
Course Code	**:**	**21ME46**			**CIE Marks**	**:**	**50 Marks**
Credits: L:T:P	**:**	**0:0:2**			**SEE Marks**	**:**	**50 Marks**
Total Hours	**:**	**39 Hrs**			**SEE Duration**	**:**	**3 Hours**

Unit - I	**10 Hrs**
Understanding Design thinking: Design Thinking Methodology: The 5 Stages of the Design Thinking Process-Empathise, Define (the problem), Ideate, Prototype, and Test. Shared model in team-based design – Theory and practice in Design thinking – Explore presentation signers across globe – Multivarible product or Prototyping, Real-Time design interaction capture and analysis – Enabling efficient collaboration in digital space – Empathy for design – Collaboration in distributed Design	
Unit - II	**15 Hrs**
DT For strategic innovations Growth: Story telling representation – Strategic Foresight - Change – Sense Making - Maintenance Relevance – Value redefinition - Extreme Competition – experience design - Standardization – Humanization - Creative Culture – Rapid prototyping, Strategy and Organization – Business Model design.	
Unit - III	**14 Hrs**
Design Thinking Workshop: The Design Challenge: Define the Design Challenge, Prototyping & Iteration- Feasibility Study, Testing- Documentation and the Pitching: 10 hours design thinking workshop from the expect and then presentation by the students on the learning from the workshop,	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understanding various design process procedure
CO2:	Explore reverse engineering to understand products
CO3:	Develop technical drawing/prototype for design ideas
CO4:	Create design ideas through different techniques

References Books:	
1	Kilion Langenfeld, Design Thinking for Beginners, Personal Growth Hackers, ISBN: 13-9783967160628
2	Andrew Pressman, Design Thinking: A Guide to Creative Problem Solving for Everyone, Routeldge Taylor & Francis Grovel, 1st Edition, 2018, ISBN: 13-978-1-315-56193-6
3	Walter Brenner, Falk Uebernickel, Design Thinking for Innovation Research and Practice, Springer, 1st Edition, 2016, ISBN: 13-9783319260983
4	Emrah Yayici, Design Thinking Methodology Book, ArtBiz Tech Publishers, 1st Edition, 2016, ISBN:10- 6058603757, 13-9786058603752

ASSESSMENT AND EVALUATION PATTERN		
	CIE	**SEE**
WEIGHTAGE	**50%**	**50%**
PRACTICALS	**50**	**50**
TOTAL MARKS FOR THE COURSE	**50**	**50**

Semester IV							
Course Title: SUMMER INTERNSHIP-I (Practice)							
Course Code	**:**	**21XXI310**			**CIE Marks**	**:**	**50 Marks**
Credits: L:T:P	**:**	**0:0:2**			**SEE Marks**	**:**	**50 Marks**
Total Hours	**:**	**3 Weeks**			**SEE Duration**	**:**	**1 Hours**

Guidelines	**3 Weeks**

1. **A minimum of 1 credit of internship after I year may be counted towards B.E. degree program.**
2. **During II semester to III semester transition, Three weeks of internship is mandatory**.
3. **Internship report and certificate need to be submitted at the end of the internship tothe concerned department for the evaluation.**
4. **Internship evaluation will be done during III semester for 1 credit in two phases.**
5. **Students can opt the internship with the below options:**

A. **Within the respective department at RVCE (Inhouse) Departments** may offer internship opportunities to the students through the available tools so that the students come out with the solutions to the relevant societal problems that could be completed within THREE WEEKS.

B. At RVCE Center of Excellence/Competence

RVCE hosts around 16 CENTER OP EIXCELLENCE in various domains and around 05 CENTER OP COMPETENCE. The details of these could be obtained by visiting the website https:/ /rvce.edu.in / rvce-center-excellence. Each center would be providing the students relevant training/internship that could be completed in three weeks.

C. At Intern Shala

Intern Shala is India's no.1 internship and training platform with 40000+ paid internships in Engineering. Students can opt any internship for the duration of three weeks by enrolling on to the platform through https: / /internsha1a.com

D. At Engineering Colleges nearby their hometown

Students, who are residing out of Bangalore, should take permission from the nearing Engineering College of their hometown to do the internship. The nearby college should agree to give the certificate and the letter/email stating the name of the student along with the title of the internship held with the duration of the internship in their official letter head.

E. At Industry or Research Organizations

Students can opt for interning at the industry or research organizations like BEL, DRDO, ISRO, BHEL, etc.. through personal contacts. However, the institute/industry should providethe letter of acceptance through hard copy/email with clear mention of the title of the work assigned along with the duration and the name of the student.

Procedures for the Internship:

1. **Request letter/Email from the office of respective departments should go** to Places where internships are intended to be carried out with a clear mention of the duration of Three Weeks. Colleges/Industry/ CoEs/CoCs will confirm the training slots and the number of seats allotted for the internship via confirmation letter/ Email.
2. Students should submit a synopsis of the proposed work to be done during internship program. Internship synopsis should be assessed or evaluated by the concerned Colleges/Industry/CoEs/CoC. Students on joining internship at the concerned Colleges/Industry/ CoEs/CoCs submit the Daily log of student's dairy from the joining date.
3. Students will submit the digital poster of the training module/project after completion of internship.
4. Training certificate to be obtained from industry.

Course Outcomes: After completing the course, the students will be able to	
CO1:	Develop communication, interpersonal, critical skills, work habits and attitudes necessary for employment.
CO2:	Assess interests, abilities in their field of study, integrate theory and practice and explore career opportunities prior to graduation.
CO3:	Explore and use state of art modern engineering tools to solve societal problems with affinity towards the environment and involve in professional ethical practice.
CO4:	Compile, document and communicate effectively on the internship activities with the engineering community.

ASSESSMENT AND EVALUATION PATTERN		
	CIE	**SEE**
Phase – I	**20**	**50**
Phase- II	**30**	
TOTAL MARKS FOR THE COURSE	**50**	

SEMESTER – IV				
BIOSTATISTICS (Theory)				
Course Code:	**21BT41**		**CIE Marks:**	**100**
Credits: L:T:P	**2:1:0**		**SEE Marks:**	**100**
Hours:	**28 L + 13 T**		**SEE Duration:**	**3 Hrs**

UNIT-I	**6 hrs**

Introduction and Data presentation:
Basic concepts, definitions, formulae, common terms in statistics. Tools and application of Biostatistics. Types of numerical data - Nominal data, Ordinal data, Ranked data, Discrete data and Continuous data. Tables - Frequency distribution and Relative frequency, Graphical representation, Sampling Theory – Simple Random Sampling, Systematic Sampling, Stratified Sampling, Cluster Sampling.

UNIT II	**5 hrs**

Measures of central tendency and dispersion:
Central Limit Theorem, Graphical representation of data in central tendency, Mean, Median andMode. Frequency data. Measures of variation- Dispersion, Range, Mean deviation and Standard deviation.

UNIT III	**5 hrs**

Probability and distributions:
Theorems of probability, Bayes' theorem. Probability distributions- Discrete distribution(Binomial distribution, Poisson distribution) testing of hypothesis (Chi square test, t test and z test).

UNIT IV	**6 hrs**

Correlation and Regression:
Introduction, Types of correlation, Correlation coefficient - Pearson's correlation coefficient, Spearman's Rank correlation coefficient and their applications. Regression concepts, Types of regression - Simple Linear Regression, Multiple Regression, Logistic regression, regression validation, Goodness of fit.

UNIT V	**6 hrs**

Mathematical modelling in Biotechnology:
Lotka-Volterra Model of Predation, Mutation, Selection, Matrix Model of Base Substitution, mathematical model for Inheritance such as Genetic Inbreeding Model and Mendalian Model ofGenetics. Growth equations of microbial populations.

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand and explain the fundamental concepts of statistics in Biostatistics
CO2	Organize Data, communicate essential features of data both numerically and graphically
CO3	Provide interpretations/conclusions of statistical problems as mathematical modelling.
CO4	Identify research questions that may be answered using statistical methods and to translate the questions into the appropriate analysis procedure.

Reference Books	
1.	Khan and Khanum, Fundamentals of Biostatistics, Ukaaz publications, 2020, ISBN: 9788190044103
2.	Dr. K S. Chandrashekar, Engineering Mathematics-IV, Sudha publications, 2017, ISBN: 8193001087
3.	Pranab Kumar Banerjee, Introduction to Biostatistics, S. Chand & Co. Ltd, 2011, ISBN:9788121923293

4.	Marcello Pagano and Kimberlee Gauvreau, Principle of Biostatistics, Thomson Asia Pvt., Ltd., 2nd ed. 2018, ISBN: 9781138593145

Experiential learning topics	
1	Frequency distribution and Relative frequency
2	Simple Random Sampling, Systematic Sampling, Stratified Sampling, Cluster Sampling.
3	Central tendency and Measures of variation
4	Bayes' theorem. Binomial distribution and Poisson distribution
5	Correlation coefficient – Pearson's correlation coefficient, Spearman's Rank correlation coefficient
6	Simple Linear Regression, Multiple Regression
7	Mathematical modelling in Biotechnology

ASSESSMENT AND EVALUATION PATTERN		
	CIE	**SEE**
WEIGHTAGE	**50%**	**50%**
QUIZZES		
Quiz-I	Each quiz is evaluated for 10 marks adding up to 2**0 MARKS.**	*****
Quiz-II		
THEORY COURSE (Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing,Evaluating, and Creating)		*****
Test – I	Each test will be conducted for 50 Marks adding upto 100 marks Finaltest marks will be reduced to 4**0 MARKS**	*****
Test – II		
EXPERIENTIAL LEARNING (Maximum of 40 Marks)		*****
Case Study-based Teaching-Learning	**20**	*****
Video based seminar (4-5 minutes per student)	**20**	
MAXIMUM MARKS FOR THE THEORY	**50 MARKS**	**50 MARKS**
TOTAL MARKS FOR THE COURSE	**50**	**100**

Semester IV						
ENVIRONMENTAL TECHNOLOGY (Theory) (Common to all branches)						
Course Code	**:**	**21BT32A/21BT42A**		**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	**2:0:0**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**26 L**		**SEE Duration**	**:**	**90 min**

Course Learning Objectives: The students will be able to	
1	Explain the various components of environment and the significance of the sustainability of healthy environment.
2	Identify the implications of different types of the wastes produced by natural and anthropogenic activity.
3	Develop critical thinking for shaping strategies (scientific, social, economic and legal) for environmental protection and conservation of biodiversity, social equity and sustainable development
4	Design the models that help mitigate or prevent the negative impact of proposed activity on the environment in line with Sustainable Developmental Goals.

Unit I	08 hrs
Introduction: Climate action – Paris convention, Sustainable Developmental Goals in relation to environment, Components of environment, Ecosystem. Environmental education, Environmental acts & regulations, role of non-governmental organizations (NGOs), EMS: ISO 14000, Environmental Impact Assessment. Environmental auditing.	
Unit II	09 hrs
Pollution and its remedies: Air pollution – point and non-point sources of air pollution and their controlling measures (particulate and gaseous contaminants). Noise pollution, Land pollution (sources, impacts and remedial measures), **Water management:** Advanced water treatment techniques, water conservation methods. **Waste management:** Solid waste, e-waste & biomedical waste – sources, characteristics & disposal methods. Concepts of Reduce, Reuse and Recycling of the wastes. **Waste to Energy:** Different types of Energy, Conventional sources & Non-conventional sources of energy: Solar, Hydro Electric, Wind, Nuclear, Biomass & Biogas Fossil Fuels and Hydrogen.	
Unit III	09 hrs
Environmental design: Green buildings, green materials, Leadership in Energy and Environmental Design (LEED), Hydroponics, Organic Farming, Biofuels, IC engine to E mobility transition and its impacts, Carbon Credits, Carbon Foot Prints, Opportunities for Green Technology Markets, Carbon Sequestration. **Resource recovery system:** Processing techniques, Materials recovery systems, Biological conversion (composting and anaerobic digestion). Thermal conversion products (Combustion, Incineration, Gasification, Pyrolysis, use of Refuse Derived Fuels). Case studies.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Identify the components of environment and exemplify the detrimental impact of anthropogenic activities on the environment.
CO2:	Differentiate the various types of wastes and suggest appropriate safe technological methods to manage the waste.
CO3:	Apply different renewable energy resources for sustainable development of clean energy.
CO4:	Adopt the appropriate recovering methods to recover the essential resources from the wastes for reuse or recycling.

Reference Books	
1.	Shashi Chawla, A Textbook of Environmental Studies, McGraw Hill Education, 2017, ISBN: 1259006387,
2.	Richard A Schneider and Jerry A Nathanson, Basic Environmental Technology, Pearson, 6th Edition, 2022. ISBN: 9789332575134,
3.	G. Tyler Miller (Author), Scott Spoolman (Author), (2020) Environmental Science – 15th edition, Publisher: Brooks Cole, ISBN-13: 978-1305090446 ISBN-10: 130509044
4.	Howard S. Peavy, Donald R. Rowe and George Tchobanoglous. 2000. Environmental Engineering, McGraw Hill Education, First edition (1 July 2017). ISBN-10**:** 9351340260, ISBN-13**:** 978-9351340263

Experiential learning topics	
Assessment of the environment of certain big campuses/areas/industries etc, a case study	
1	Development of data sheet
2	Survey and its record
3	Identifying the problems associated
4	Provide a solution for the identified problem

Experiments to be performed	
1	Data development
2	Working model (in silico or demo model)
3	Preparing a report
4	Brainstorming of the work carried out.

Experiential learning evaluation will be evaluated based on the experiments and the preparation, presentation of the topics, equal weightage is given for experiments and theory.

ASSESSMENT AND EVALUATION PATTERN		
	CIE	**SEE**
WEIGHTAGE	**50%**	**50%**
QUIZZES		
Quiz-I	Each quiz is evaluated for 5 marks adding up to 1**0 MARKS.**	*****
Quiz-II		
THEORY COURSE (Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating)		*****
Test – I	Each test will be conducted for 25 Marks adding upto 50 marks. Final test marks will be reduced to 2**0 MARKS**	*****
Test – II		
EXPERIENTIAL LEARNING (Maximum of 20 Marks)		*****
Case Study-based Teaching-Learning	**10**	*****
Experiments performed	**10**	
MAXIMUM MARKS FOR THE THEORY	**50 MARKS**	**50 MARKS**
TOTAL MARKS FOR THE COURSE	**50**	**100**

Semester: IV						
UNIT OPERATIONS (Theory and Practice)						
Course Code	**:**	**21BT43**		**CIE**	**:**	**100+50 Marks**
Credits: L:T:P	**:**	**2:1:1**		**SEE**	**:**	**100+50 Marks**
Total Hours	**:**	**28L+15T+30P**		**SEE Duration**	**:**	**3Hours + 3Hours**

UNIT-I	**06 Hrs**
Momentum transfer **Introduction to Fluid Mechanics:** Fluid: Definition, Fluid Statics-Hydrostatic equilibrium, Pressure measurements- Manometers-U tube. Fluid dynamics - Shear stress, Shear strain, Newton's law of viscosity, Newtonian and Non Newtonian fluids. Fluid flow**:** Continuity equation, Bernoulli's equation. Simple numerical. Applications of Bernoulli's equation- Venturimeter, Orifice meter, Rotameter.	
UNIT II	**06 Hrs**
Heat Transfer **Introduction to Heat transfer:** Modes of heat transfer. Steady state conductions through single-layer, composite-layer, slabs, cylinders, spheres with constant thermal conductivity. Simple problems. Convection, Film co- efficient, overall Heat transfer co-efficient. Log mean temperature difference (LMTD), simple problems **Heat Exchange Equipment**: Construction and elementary design of double pipe heat exchanger shell and tube heat exchanger. Simple numerical to calculate heat transfer area in heat exchangers.	
UNIT III	**06 Hrs**
Mechanical Operation **Particle Size Analysis**: Size reduction- Laws of Size reduction, Ball mill and drop weight crusher. **Settling**: Drag, drag coefficient free and hindered settling. Terminal settling velocity, equation for one dimensional motion of particle through a fluid in gravitational field. Motion of particles in Stoke's, Newton's and intermediate.	
UNIT IV	**05 Hrs**
Separation Techniques **Filtration:** Introduction, Classification of filtration, types, Kozeny-Carman equation. Characteristics of filter media and filter aids, Industrial filters- rotary drum filter, leaf filter and plate and frame filter press. **Adsorption:** Batch and continuous adsorption, mathematical models for batch adsorption (Freundlich and langmiur equation).	
UNIT V	**05 Hrs**
Separation Techniques **Distillation:** Types of distillation: simple, flash, steam distillation Azeotropic and extractive distillation. Distillation with and without reflux, types of feed line. McCabe Thiele Method to find number of plates. **Extraction:** Single stage and multi stage extraction, co current and counter current multistage extraction.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Apply the principles of unit operations to analyse fluid flow problems.
CO2:	Assess the performance of heat exchangers and evaporators by numerical problems.
CO3:	Develop terminal settling velocity for gravity settling processes for variousapplications.
CO4:	Design of binary component distillation and extraction using graphical methods

Reference Books	
1.	W. L. McCabe, J. C. Smith and P. Harriott, Unit Operations in Chemical Engineering, McGraw-Hill, New York, 7th Edition, 2005,ISBN 2005978-0071247108.
2.	R.K. Bansal, Fluid Mechanics and Hydraulics of Machines, Laxmi Publications, NewDelhi, 9th Edition. 2010. ISBN: 978-81-318-0815-3.
3.	J.M.CoulsonandJ.F.Richardson:ChemicalEngineeringVoI1.Fluidflow,Heat Transfer and Mass Transfer. Butterworth
4.	Heinemann, an imprint of Elservier, 6th Edition, Indian Reprint, 2006. ISBN: 13:978-0387-25116-5.

Experiential Learning:

1. Continuous adsorption of biological particles.
2. Determination of alcohol contents in fruit juices.
3. Extraction of phytochemicals from medicinal plants and spices.
4. Preparation of perfumes from Steam distillation and vaccum distillation.
5. Determination of average size of macro sized biological compounds using screen analysis
6. Estimation of energy consumed for reduction of biological compounds
7. Estimation of diffusion co efficient of biological compounds
8. Estimation of Emissivity of sphere and cylinder
9. Development of langmiur adsorption mathematical ,

LAB
EXPERIMENTS

1. Determine the discharge co-efficient (Cd) of Orificemeter.
2. Determine the discharge co-efficient (Cd) of Venturimeter.
3. Determination of the friction factor for the flow of water through a packed bed using Ergun's equation.
4. Determination of specific cake resistance 'α 'and filter medium resistance 'Rm' using a leaf filter.
5. Verification of Rayleigh's equation for simple distillation.
6. Determination of the effectiveness factor of screens
7. Determine the isotherms of Freundlich equation for adsorption of bio particles
8. Determine the friction factor for the flow of water in the pipes
9. Determine the heat transfer coefficient in shell and tube heat exchanger
10. Determine the heat transfer coefficient in double pipe heat exchanger

Note: Each student has to perform 10 experiments in semester.10 Experiments are guided experiments, 02 experiments are involving experiential learning.

ASSESSMENT AND EVALUATION PATTERN		
	CIE	**SEE**
WEIGHTAGE	**50%**	**50%**
QUIZZES		
Quiz-I	Each quiz is evaluated for 10 marks adding up to 2**0 MARKS.**	*****
Quiz-II		
THEORY COURSE (Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating)		*****
Test – I	Each test will be conducted for50 Marks adding upto 100 marks. Final test marks will be reduced to 4**0 MARKS**	*****
Test – II		
EXPERIENTIAL LEARNING (Maximum of 40 Marks)		*****
Case Study-based Teaching-Learning	**20**	*****
Experiments performed	**20**	
MAXIMUM MARKS FOR THE THEORY	**100 MARKS**	**100 MARKS**
TOTAL MARKS FOR THE COURSE	**150**	**150**

Semester: IV						
Programming for Computational Biology (Theory and Practice)						
Course Code	**:**	**21BT44**		**CIE**	**:**	**150 Marks**
Credits: L:T:P	**:**	**2:1:1**		**SEE**	**:**	**150 Marks**
Total Hours	**:**	**28L+15T+30P**		**SEE Duration**	**:**	**3 Hours + 3 Hours**

Unit-I	**05 Hrs**
Objected Oriented Programming Introduction to Object Oriented Programming. Objects and Classes, Constructors and Destructor, functions – virtual functions, friend's functions. Encapsulation, Polymorphism and Inheritance.Introduction to Templates and Generic types, Class Templates, and Function Templates.	
Unit – II	**06 Hrs**
Exception handling and working with Database connectivity Exception Handling, Types of exceptions, mechanism of Exception Handing. Exception Throwing and Catching Mechanism. Re-throwing an Exception, Specifying Exceptions. Introduction to ODBC. Connecting front end to Back end database, querying and accessing the result set and closing the connection.	
Unit –III	**06 Hrs**
Fundamentals of Python Introduction to Python. Writing, editing and saving the python scripts. Operator, Data types and operations – Dictionaries, Maps, Hash Tables, lists, tuple, and strings, Records, Sets and Multisets. Statements – I/O, Looping statements, conditional and loop control statements. Functions - Creating and calling functions.	
Unit –IV	**05 Hrs**
Modules and Regular expression basics Modules – Creating and using modules, Installing and testing modules. Regular Expressions – operators, met-characters and modifiers in regular expressions. Working with files and directories – creating/reading files/directories, reading/ writing text and numbers to/from files.	
Unit –V	**06 Hrs**
Problem solving techniques in sequence analysis Overview of Programming in Life sciences. Applications. Basic problem solving techniques forsequence analysis – Smith and Waterman, Needleman and Wunch, and Exon chaining. Clustering algorithms - Neighbour Joining and UPGMA.	

Course Outcomes: After completing the course, the students will be able to:-	
CO 1	Understand basic Object Oriented Programming in C++ and Python, regular expressions alongwith Data types and operations in Python.
CO 2	Explore programming applications of C++ and Python along with the software resources to mine biological databases including Biological databases available online.
CO 3	Apply the programming applications of Object Oriented Programming to solve the problems related to process modelling, simulation and process engineering in Life Sciences
CO 4	Use C++ and Python Programming skills to solve Numerical methods, Differential equations,and mind crunching algorithms such as Dynamic programming in the field of Biotechnology and chemical engineering.

Reference Books	
1.	Beginning C++ Programming, Richard Grimes, Packt Publishing, 2017, ISBN: 9781787129283.
2.	Object Oriented C++ for Science and Engineering, Okon H. Akpan, Createspace Independent Pub,2014, ISBN: 9781500474409.
3.	Introduction to Computation and Programming Using Python -With Application to Understanding Data, John Guttag, MIT Press, 2nd Edition, 2016, ISBN: 9780262529624.
4.	Bioinformatics Algorithms Design and Implementation in Python, Miguel Rocha, Pedro G. Ferreira, Elsevier Science, 2018, ISBN 9780128125212.

Laboratory Component

1. Design, Write and Execute C++ program to parse fasta ids and the sequences from the BLAST output.
2. Design, Write and Execute Python program to parse atomic and hetero-atomic sections of PDB file and estimate the atomic frequencies.
3. Design, Write and Execute a C++ program to find total and average marks of each student using the concept of friend class. Create a student base class with USN, Name, Biochem, Bioinfo, Microbio, MolBio, and BCA as its private members. Use friend class that access private members of student class through friend class and calculate total, average marks and print the result.
4. Design, Write and Execute a Python program to find the most frequent words in a text read from a file
5. Design, Write and Execute a Python program to Simulate bouncing ball using Pygame
6. Design and implement a class to represent a Bank account, and show the usage of the class in the main body of the program.
7. Write a template function to sort an array. Illustrate how you sort integer, character as well as double arrays using the same template function.
8. Throw multiple exceptions and define multiple catch statements to handle negative number and out of memory exception. Negative number exception thrown if given number is negative value and out of memory exception is thrown if the given number is greater than 20.
9. Design, Write and Implement a C++ class to demonstrate hybrid Inheritance.
10. Design, Write and Execute a Python program to connect to database Protein DB stored at local database server using ODBC, and perform various queries on the backend database.
11. Write a C++ program to implement Needleman and Wunch Algorithm for sequence alignment.
12. Design, Write and Execute a C++ program to implement UPGMA Algorithm to perform sequential clustering of data given in the Distance matrix.

PART B - Innovative Experiments (IE)

1. Genome assembly.
2. Variant calling.
3. Detection of genome wide promoter binding sites.
4. Differential Gene Expression assay.
5. Gene Distribution among Chromosomes.
6. Crop management - Controlling watering crop through wireless sensor networks to optimize agriculture via smartphone and web application.
7. Detection of humidity, temperature, moisture precipitation and dew detection.
8. Robotics in smart farming.
9. Workflow automation for screening of compound library for the given target.
10. Machine learning in Python for Gene prediction.

<table>
<tr><th colspan="3">ASSESSMENT AND EVALUATION PATTERN</th></tr>
<tr><td></td><td>CIE</td><td>SEE</td></tr>
<tr><td>WEIGHTAGE</td><td>50%</td><td>50%</td></tr>
<tr><td colspan="2">QUIZZES</td><td></td></tr>
<tr><td>Quiz-I</td><td rowspan="2">Each quiz is evaluated for 10 marks adding up to 20 MARKS.</td><td rowspan="2">*****</td></tr>
<tr><td>Quiz-II</td></tr>
<tr><td colspan="2">THEORY COURSE
(Bloom’s Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating)</td><td>*****</td></tr>
<tr><td>Test – I</td><td rowspan="2">Each test will be conducted for50 Marks adding upto 100 marks. Final test marks will be reduced to 40 MARKS</td><td rowspan="2">*****</td></tr>
<tr><td>Test – II</td></tr>
<tr><td colspan="2">EXPERIENTIAL LEARNING (Maximum of 40 Marks)</td><td>*****</td></tr>
<tr><td>Case Study-based Teaching-Learning</td><td>10</td><td rowspan="3">*****</td></tr>
<tr><td>Programming and IoT Applications in Biotechnology</td><td>20</td></tr>
<tr><td>Video based seminar (4-5 minutes per student)</td><td>10</td></tr>
<tr><td>MAXIMUM MARKS FOR THE THEORY</td><td>100 MARKS</td><td>100 MARKS</td></tr>
<tr><td>PRACTICALS</td><td>50</td><td>50</td></tr>
<tr><td>TOTAL MARKS FOR THE COURSE</td><td>150</td><td>150</td></tr>
</table>

Semester: IV						
BIOPHYSICS (Theory and Practice)						
Course Code	**:**	**21BT45**		**CIE**	**:**	**150 Marks**
Credits: L:T:P	**:**	**3:0:1**		**SEE**	**:**	**150 Marks**
Total Hours	**:**	**42L+30P**		**SEE Duration**	**:**	**3Hours + 3Hours**

Unit-I	**08 Hrs**
Nucleic acids: Different conformations of DNA. Limited Flexibility of DNA. Forces stabilizing nucleic acid structures - Principles of base-stacking, base pairing and Ribose puckering. DNA melting Curve-DNA denaturation and renaturation. Highly variable RNA structures.	
Unit – II	**08 Hrs**
Proteins: Structural organization- Primary, secondary (planar peptide group and its effect on limited polypeptide conformation, alpha helix, beta sheets, Ramachandran plot, Tertiary (protein structural determination- X-ray/NMR, side chains, polarity) and quaternary structures. Protein cooperativity and Hill constant.. Globular and fibrous proteins.	
Unit –III	**08 Hrs**
Chromatography techniques: Chromatography - Principle, instrumentation and biological applications of thin layer, gel permeation, ion exchange, affinity, and high performance liquid chromatography.	
Unit –IV	**09 Hrs**
Centrifugation and Electrophoresis: Centrifugation – Principle, types and applications of preparative, analytical and ultracentrifugation. Electrophoresis - Principle, types and applications of agarose gel electrophoresis, native and sodium dodecyl sulphate polyacrylamide gel electrophoresis and 2D gel electrophoresis. Determination of molecular weight and subunit composition of proteins.	
Unit –V	**09 Hrs**
Spectroscopic Analytical Techniques: Basic concepts and principles of spectroscopy, Absorption spectroscopy: UV-Visible, infrared and atomic absorption spectroscopy. Emission spectroscopy: fluorescence and luminescence. Scattering spectroscopy: Raman, nephelometry and turbidometry.	

Course Outcomes: After completing the course, the students will be able to:-	
CO 1	Remember the molecular organization, structures and functions of biomolecules such as proteins, lipids carbohydrates and nucleic acids.
CO 2	Understand the interactions between the DNA, RNA & protein and the tools required to monitor/detect them
CO 3	Apply the biophysical principles to solve biological problems and to analyze biological systems/samples
CO 4	Design simple experiments to isolate and characterize biomolecules

Reference Books	
1.	Principles and Techniques of Biochemistry and Molecular Biology, Keith M. Wilson, John M. Walker., 8th Edition, 2018, Cambridge University Press. ISBN-13: 978-110716227
2.	Biophysics- An introduction, Rodney Cotterill, Wiley (2014), ISBN-10: 8126551607, ISBN-13: 978-8126551606
3.	Principles of Biochemistry, Donald Voet, Judith G. Voet, Charlotte W. Pratt, 4th Edition,2012, John Wiley & Sons, ISBN-10: 1118092449, ISBN-13: 978-1118092446
4.	Essentials of Biophysics, Narayanan P, 2nd Edition, 2010, Anshan Publishers, ISBN-10: 1848290349, ISBN-13: 978-1848290341

Laboratory Component	
1.	Estimation of nucleic acids by absorbance at 260 nm and hypochromic effect.
2.	Estimation of protein concentration in a given sample using visible spectrophotometer
3.	Estimation of sulphate in a given sample using Turbidometer.
4.	Determination of absorbance maxima of biologically important samples: Pigments / DNA/Protein
5.	Analysis of biologically important metals using Atomic Absorption Spectrometer
6.	Separation of ionic compounds by Ion Exchange Chromatography
7.	Separation of Amino Acids/Organic Acids by Thin Layer Chromatography
8.	Gel Filtration Chromatography
9.	Centrifugation technique
PART B	
Students will perform purification and characterization of biomolecules using chromatographic techniques/any other techniques as an open ended experiment.	

ASSESSMENT AND EVALUATION PATTERN		
	CIE	**SEE**
WEIGHTAGE	**50%**	**50%**
QUIZZES		
Quiz-I	Each quiz is evaluated for 10 marks adding up to **20 MARKS.**	*****
Quiz-II		
THEORY COURSE (Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing,Evaluating, and Creating)		*****
Test – I	Each test will be conducted for 50 Marks adding upto 100 marks. Final test marks will be reduced to **40 MARKS**	*****
Test – II		
EXPERIENTIAL LEARNING (Maximum of 40 Marks)		*****
Literature review and analysis	**20**	*****
Innovative experiments/projects	**20**	
MAXIMUM MARKS FOR THE THEORY	**100 MARKS**	**100 MARKS**
PRACTICALS	**50**	**50**
TOTAL MARKS FOR THE COURSE	**150**	**150**

SEMESTER – IV				
Computer aided drug design (Theory)				
Course Code:	**21BT4A1**		**CIE Marks:**	**100**
Credits: L:T:P	**2:1:0**		**SEE Marks:**	**100**
Hours:	**38 L**		**SEE Duration:**	**3 Hrs**

Course learning objectives

CLO1	Demonstrate the knowledge of physical and chemical properties of pharmacological compounds
CLO2	Apply the drug designing methods for screening and inventing the new targets and drugs
CLO3	Estimate the relevant drug capabilities of known and unknown compounds.
CLO4	Equip with the drug design skills and patenting ability and spread awareness about the compounds

UNIT-I	**6 hrs**

Computer - Assisted Drug Discovery: Drug Discovery and Development process. Compound searching, Target Identification, Target characterisation, Study of molecular interactions between target and compound.

Understanding the primary, secondary and tertiary structure of proteins. Properties of amino acids. Changes in amino acids protonation state due to changes in pH.

UNIT II	**5 hrs**

Understanding the Physicochemical Properties, Lipophilicity, Water Solubility, Pharmacokinetics, Druglikeness and Medicinal Chemistry. Introduction to Molecular mechanics, Force fields for drug design. Study of protein folding: Algorithms, Conformation analysis. Quantum Mechanics algorithms in Drug design.

UNIT III	**5 hrs**

Structure Visualization. Homology modeling - Constructing an initial model, Refining the model, Manipulating the model, Navigation of the model. Model evaluation – Model evaluation techniques, Concept of energy minimization and Energy minimization techniques. Conformation generation, Deriving bioactive conformations, Molecular superposition and alignment.

UNIT IV	**6 hrs**

QSAR: Conventional QSAR vs 3D-QSAR, QSAR Process, Molecular descriptors, Automated QSAR Programs. 3D-QSAR – 3D-QSAR Process. Building the Pharmacophore Models: Components of Pharmacophore model, Creating a Pharmacophore model from active compounds, Creating Pharmacophore model from Active site and Searching compound databases.

UNIT V	**5 hrs**

Docking: Introduction, Search algorithms, Scoring functions. Docking Process – Protein Preparation, Building the ligand, Setting the bounding box, Running the docking calculations.

Role of pharmacokinetics and pharmacodynamics, PK and PD studies in drug development, Drug administration routes and Pharmacodynamic studies

Course Outcomes: After completing the course, the students will be able to

CO1	Understand and explain the fundamental concepts of statistics in Biostatistics
CO2	Organize Data, communicate essential features of data both numerically and graphically
CO3	Provide interpretations/conclusions of statistical problems as mathematical modelling.
CO4	Identify research questions that may be answered using statistical methods and to translate the questions into the appropriate analysis procedure.

Reference Books	
1.	Cancer Drug Design and Discovery, Stephen Neidle, Academic Press Publisher,2008.ISBN 0123694485, 9780123694485
2.	Bioinformatics Technologies, Yi-Ping Phoebe Chen, Springer Science & Business Media, 2005. ISBN 354026888X, 9783540268888
3.	Textbook of drug design and discovery, Kristian Stromgaard, PovlKrogsgaard-Larsen, Ulf Madsen, 5th edition. Published by CRC Press, LLC, 2016. ISBN1498702783, 9781498702782
4.	Computational Drug Design: A Guide for Computational and Medicinal Chemists,David. C. Young, Wiley-Interscience, 2009. ISBN: 978-0-470-12685-1

ASSESSMENT AND EVALUATION PATTERN		
	CIE	**SEE**
WEIGHTAGE	**50%**	**50%**
QUIZZES		
Quiz-I	Each quiz is evaluated for 10 marks adding up to 2**0 MARKS.**	*****
Quiz-II		
THEORY COURSE (Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing,Evaluating, and Creating)		*****
Test – I	Each test will be conducted for 50 Marks adding upto 100 marks Finaltest marks will be reduced to 4**0 MARKS**	*****
Test – II		
EXPERIENTIAL LEARNING (Maximum of 40 Marks)		*****
Case Study-based Teaching-Learning	**20**	*****
Video based seminar (4-5 minutes per student)	**20**	
MAXIMUM MARKS FOR THE THEORY	**50 MARKS**	**50 MARKS**
TOTAL MARKS FOR THE COURSE	**50**	**100**

SEMESTER – IV				
Organ printing				
Course Code:	**21BT4A2**		**CIE Marks:**	**100**
Credits: L:T:P	**2:0:0**		**SEE Marks:**	**100**
Hours:	**27 L**		**SEE Duration:**	**3 Hrs**

Course learning objectives

CLO1	Understand the organ printing and their mechanism of actions
CLO2	Gain knowledge on organ printing and its kinetics
CLO3	Interpret the various principles and biotransformation processes
CLO4	Articulate the knowledge of organ printing to industrial, environmental, and diagnostic applications

UNIT-I	**5 hrs**
Introduction to Organ Printing course and Content Discussion, Introduction to 3D Bioprinting, Introduction to Inkjet 3D Bioprinting, Introduction to Extrusion Bioprinting, Introduction to Laser-assisted Bioprinting	
UNIT II	**6 hrs**
Comparison of Different Bioprinting Techniques - Part 1, Comparison of Different Bioprinting Techniques - Part 2, 3D Bioprinting in Support Bath, Introduction to Bioinks, Important material requirement for Bioink development, Crosslinking of Hydrogels for Bioprinting, Single-Material and Multimaterial Bioink Systems	
UNIT III	**5 hrs**
Printability for Extrusion Bioprinting, Level of complexity in Tissues/Organs for Bioprinting, Design approaches in Bioprinting, Bioprinting of Vasculature, Direct printing of vasculature, Indirect printing of vasculature	
UNIT IV	**5 hrs**
Design of Cornea Tissue-Specific Bioink and 3D Bioprinting of Cornea, Bioprinting of Heart, Bioprinting of Liver, Bioprinting of Kidney, Bioprinting of Lung	
UNIT V	**6 hrs**
4D Bioprinting - Part 1, 4D Bioprinting - Part 2, 4D Bioprinting - Part 3, In Situ Bioprinting, Medical Modeling for Organ Printing, Next Step in Bioprinting, Ethical Issues related to Organ Printing	

Course Outcomes: After completing the course, the students will be able to

CO1	Understand the importance of organ printing and its applications
CO2	Apply the principles and properties involved in organ printing
CO3	Interpret the large-scale industrial applications of organ printing
CO4	Design and develop organ printing for diagnostic applications

Reference Books

1. Bradley R. Ringeisen, Barry J. Spargo and Peter K. Wu. Cell and Organ Printing. 2014. Springer. 978-9401785174
2. Klaus Buchholz, Uwe Theo Bornscheuer, and Volker Kasche, Biocatalysts and Enzyme Technology, second edition,Wiley, 2012,ISBN: 978-3-527-32989-2
3. Prasad Nooralabettu Krishna,Enzyme Technology: Pace maker of Biotechnology,PHI Learning Pvt.2011,ISBN:9788120342392
4. Mohammed Kuddus, Cristobal AguilarValue-Addition in Food Products and Processing Through Enzyme Technology,1st Edition, Elsevier,2021, ISBN:9780323899291

<table>
<tr><th colspan="3">ASSESSMENT AND EVALUATION PATTERN</th></tr>
<tr><td></td><td>CIE</td><td>SEE</td></tr>
<tr><td>WEIGHTAGE</td><td>50%</td><td>50%</td></tr>
<tr><td colspan="2">QUIZZES</td><td></td></tr>
<tr><td>Quiz-I</td><td rowspan="2">Each quiz is evaluated for 10 marks adding up to 20 MARKS.</td><td rowspan="2">*****</td></tr>
<tr><td>Quiz-II</td></tr>
<tr><td colspan="2">THEORY COURSE
(Bloom’s Taxonomy Levels: Remembering, Understanding, Applying, Analyzing,Evaluating, and Creating)</td><td>*****</td></tr>
<tr><td>Test – I</td><td rowspan="2">Each test will be conducted for 50 Marks adding upto 100 marks Finaltest marks will be reduced to 40 MARKS</td><td rowspan="2">*****</td></tr>
<tr><td>Test – II</td></tr>
<tr><td colspan="2">EXPERIENTIAL LEARNING (Maximum of 40 Marks)</td><td>*****</td></tr>
<tr><td>Case Study-based Teaching-Learning</td><td>20</td><td rowspan="2">*****</td></tr>
<tr><td>Video based seminar (4-5 minutes per student)</td><td>20</td></tr>
<tr><td>MAXIMUM MARKS FOR THE THEORY</td><td>50 MARKS</td><td>50 MARKS</td></tr>
<tr><td>TOTAL MARKS FOR THE COURSE</td><td>50</td><td>100</td></tr>
</table>

SEMESTER – IV				
Big data computing (Theory)				
Course Code:	**21BT4A3**		**CIE Marks:**	**100**
Credits: L:T:P	**2:1:0**		**SEE Marks:**	**100**
Hours:	**27 L**		**SEE Duration:**	**3 Hrs**

Course learning objectives

CLO1	Impart the basic concepts of Big data computing in applied bioinformatics.
CLO2	Understand and explain the role of Big data driven operations.
CLO3	Understand the tools and techniques for computing Big data analysis
CLO4	Application of bigdata techniques to real time data.

UNIT-I	**6 hrs**
Introduction to Big Data: Big Data Enabling Technologies, Hadoop Stack for Big Data, Hadoop Distributed File System (HDFS), Hadoop MapReduce 1.0, Hadoop MapReduce 2.0 (Part-I), Hadoop MapReduce 2.0 (Part-II), MapReduce Examples	
UNIT II	**5 hrs**
Parallel Programming with Spark, Introduction to Spark, Spark Built-in Libraries, Design of Key-Value Stores, Data Placement Strategies, CAP Theorem, Consistency Solutions, Design of Zookeeper, CQL (Cassandra Query Language)	
UNIT III	**5 hrs**
Design of HBase, Spark Streaming and Sliding Window Analytics (Part-I), Spark Streaming and Sliding Window Analytics (Part-II), Sliding Window Analytics, Introduction to Kafka	
UNIT IV	**6 hrs**
Big Data Machine Learning (Part-I), Big Data Machine Learning (Part-II), Machine Learning Algorithm K-means using Map Reduce for Big Data Analytics, Parallel K-means using Map Reduce on Big Data Cluster Analysis, Decision Trees for Big Data Analytics, Big Data Predictive Analytics (Part-I), Big Data Predictive Analytics (Part-II)	
UNIT V	**5 hrs**
Parameter Servers, PageRank Algorithm in Big Data, Spark GraphX & Graph Analytics (Part-I), Spark GraphX & Graph Analytics (Part-II), Case Study: Flight Data Analysis using Spark GraphX	

Course Outcomes: After completing the course, the students will be able to

CO1	Understand and explain the fundamental concepts of Biostatistics
CO2	Design the experiments for biological tests
CO3	Derive the interpretation and standardise the experiments
CO4	Identify research topics using statistical methods and develop the project models.

Reference Books	
1.	Rajkumar Buyya et al., Big data principles and paradigms. Morgan Kaufmann, 2016. 978-0-12-805394-2
2.	David, D., B. Heller and B. Yang. Data Science and Big Data Analytics, 2015. Wiley, ISBN: 978-1-118-87613-8 ISBN: 978-1-118-87622-0 (ebk)
3.	Naiara Rodríguez-Ezpeleta, Michael Hackenberg, Ana M. Aransay. Bioinformatics for High Throughput Sequencing. Springer, 2012. ISBN-13: 9781461407812.
4.	Stuart M. Brown. Review of Next-generation DNA sequencing informatics. Cold Spring Harbor Laboratory Press, Cold Spring Harbor: New York, 2013. ISBN-13: 978-1936113873.

ASSESSMENT AND EVALUATION PATTERN		
	CIE	**SEE**
WEIGHTAGE	**50%**	**50%**
QUIZZES		
Quiz-I	Each quiz is evaluated for 10 marks adding up to 2**0 MARKS.**	*****
Quiz-II		
THEORY COURSE (Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing,Evaluating, and Creating)		*****
Test – I	Each test will be conducted for 50 Marks adding upto 100 marks Finaltest marks will be reduced to 4**0 MARKS**	*****
Test – II		
EXPERIENTIAL LEARNING (Maximum of 40 Marks)		*****
Case Study-based Teaching-Learning	**20**	*****
Video based seminar (4-5 minutes per student)	**20**	
MAXIMUM MARKS FOR THE THEORY	**50 MARKS**	**50 MARKS**
TOTAL MARKS FOR THE COURSE	**50**	**100**

SEMESTER – IV				
Biostatistics and design of experiments (Theory)				
Course Code:	**21BT4A4**		**CIE Marks:**	**100**
Credits: L:T:P	**2:1:0**		**SEE Marks:**	**100**
Hours:	**38 L**		**SEE Duration:**	**3 Hrs**

Course learning objectives

1	To make every engineering student understand the importance of applied mathematics, so thatthey can use their domain knowledge and apply to Biotechnology.
2	To understand and explain the importance of applied mathematics in Biotech industries
3	To be aware of understand and use the probability and statistics theory in appliedmathematics.
4	To use these methods in the design and analysis of mathematical modeling in the field ofBiotechnology

UNIT-I	**6 hrs**
Experimental Design Strategy, Data types : Binomial distribution, Poisson Distribution, Normal **Introduction:** Distribution	
UNIT II	**5 hrs**
Distribution: Standardized Normal Distribution/ t-distribution, t-distribution/confidence interval, Statistical tests, t-Tests	
UNIT III	**5 hrs**
Testing of Hypothesis: ANOVA, F-tests, Normality test/ Odds ratio, Chi square distribution and Weibull Distribution	
UNIT IV	**6 hrs**
Non parametric tests: Introduction, Non parametric test/homogeneity of variance/beta distribution, Exponential/hypergeometric distributions, Hypergeometric/ Log normal distribution	
UNIT V	**5 hrs**
Design of experiments (DOE) – Introduction, Factorial Design, Full factorial design, Fractional factorial design, Other designs, Seconde order designs, Second order design, Regression analysis, Control charts	

Course Outcomes: After completing the course, the students will be able to

CO1	Understand and explain the fundamental concepts of Biostatistics
CO2	Design the experiments for biological tests
CO3	Derive the interpretation and standardise the experiments
CO4	Identify research topics using statistical methods and develop the project models.

Reference Books

1.	Khan and Khanum, Fundamentals of Biostatistics, Ukaaz publications, 2020, ISBN: 9788190044103
2.	Dr. K S. Chandrashekar, Engineering Mathematics-IV, Sudha publications, 2017, ISBN: 8193001087
3.	Pranab Kumar Banerjee, Introduction to Biostatistics, S. Chand & Co. Ltd, 2011, ISBN:9788121923293
4.	Marcello Pagano and Kimberlee Gauvreau, Principle of Biostatistics, Thomson Asia Pvt., Ltd., 2nd ed. 2018, ISBN: 9781138593145

ASSESSMENT AND EVALUATION PATTERN		
	CIE	**SEE**
WEIGHTAGE	**50%**	**50%**
QUIZZES		
Quiz-I	Each quiz is evaluated for 10 marks adding up to 2**0 MARKS.**	*****
Quiz-II		
THEORY COURSE (Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing,Evaluating, and Creating)		*****
Test – I	Each test will be conducted for 50 Marks adding upto 100 marks Finaltest marks will be reduced to 4**0 MARKS**	*****
Test – II		
EXPERIENTIAL LEARNING (Maximum of 40 Marks)		*****
Case Study-based Teaching-Learning	**20**	*****
Video based seminar (4-5 minutes per student)	**20**	
MAXIMUM MARKS FOR THE THEORY	**50 MARKS**	**50 MARKS**
TOTAL MARKS FOR THE COURSE	**50**	**100**

SEMESTER – IV				
Introduction to Mechanobiology (Theory)				
Course Code:	**21BT4A5**		**CIE Marks:**	**100**
Credits: L:T:P	**2:1:0**		**SEE Marks:**	**100**
Hours:	**38 L**		**SEE Duration:**	**3 Hrs**

Course learning objectives

CO1	Understand the structure, function, physiology and components of cells
CO2	Comprehend the cellular dynamics for the broader applications
CO3	Apprehend mechanical, regulatory and cellular undercurrents of Diseases
CO4	Apply various tools and techniques to understand Mechanobiology at cellular level

UNIT-I	**8 hrs**
Introduction to study Mechanobiology, Cell as a Tent, individual components, Cell-ECM crosstalk, ECM proteins: Collagen, Properties of collagen networks, Rheology, Rheology of biopolymer networks,	
UNIT II	**8 hrs**
Techniques in Mechanobiology: Hydrogels, Traction Force Microscopy, Trypson Deadhesion & Laser Ablation, techniques in Mechanobiology: Microfabrication, FRET. Atomic Force Microscopy (AFM),	
UNIT III	**8 hrs**
Mechanobiology of Stem Cell Fate l, ll & lll, Mechanobiology of Diseases: Cancer l, ll, lll, Atherosclerosis & Hypertension, Muscular Dystrophy	
UNIT IV	**8 hrs**
Nuclear Mechanotransduction: LINC complex in cell migration, Gene regulation, Mechanical Forces & DNA damage. Design of protein constructs and protein folding for AFM	
UNIT V	**6 hrs**
Focal adhesions: focal adhesion proteins, Focal adhesion organization, role of forces. Cytoskeleton: Actin, Force-velocity relationships of actin networks, Adhesion Independent & Collective Cell Migration, Mesenchymal cell migration, Actin dynamics during migration	

Course Outcomes: After completing the course, the students will be able to

CO1	Remember the principles of mechanobiology and its applications in biotechnology
CO2	Understand the importance of forces and actin dynamics
CO3	Comprehend the mechanobiology of stem cells and mechanobiology of diseases
CO4	Learn and apply the tools and techniques of mechanobiology

Reference Books

1.	Jacobs CR, Huang H, Kwon RY. Introduction to Cellular Mechanics and Mechanobiology. New York: Garland Science, 2012, ISBN: 9780429171277
2.	Glen Niebur, Mechanobiology From Molecular Sensing to Disease, Elsevier, 2019, ISBN: 9780128179314
3.	*Jiro Nagatomi, Eno Essien Ebong Mechanobiology Handbook, Second Edition, CRC Press, 2012 ISBN-13: 978-1498779463*
4	Simon C. F. Rawlinson, Medical Mechanobiology: Exploitation for Benefit, Wiley, 2017 ISBN: 978-1-118-96614-3

<table>
<tr><th colspan="3">ASSESSMENT AND EVALUATION PATTERN</th></tr>
<tr><td></td><td>CIE</td><td>SEE</td></tr>
<tr><td>WEIGHTAGE</td><td>50%</td><td>50%</td></tr>
<tr><td colspan="2">QUIZZES</td><td></td></tr>
<tr><td>Quiz-I</td><td rowspan="2">Each quiz is evaluated for 10 marks adding up to 20 MARKS.</td><td rowspan="2">*****</td></tr>
<tr><td>Quiz-II</td></tr>
<tr><td colspan="2">THEORY COURSE
(Bloom’s Taxonomy Levels: Remembering, Understanding, Applying, Analyzing,Evaluating, and Creating)</td><td>*****</td></tr>
<tr><td>Test – I</td><td rowspan="2">Each test will be conducted for 50 Marks adding upto 100 marks Finaltest marks will be reduced to 40 MARKS</td><td rowspan="2">*****</td></tr>
<tr><td>Test – II</td></tr>
<tr><td colspan="2">EXPERIENTIAL LEARNING (Maximum of 40 Marks)</td><td>*****</td></tr>
<tr><td>Case Study-based Teaching-Learning</td><td>20</td><td rowspan="2">*****</td></tr>
<tr><td>Video based seminar (4-5 minutes per student)</td><td>20</td></tr>
<tr><td>MAXIMUM MARKS FOR THE THEORY</td><td>50 MARKS</td><td>50 MARKS</td></tr>
<tr><td>TOTAL MARKS FOR THE COURSE</td><td>50</td><td>100</td></tr>
</table>

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ

ವಿಷಯ ಸಂಕೇತ (Course Code)	21KSK39/49	ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನದ ಅಂಕಗಳು	50
ಒಂದು ವಾರಕ್ಕೆ ಬೋಧನಾ ಅವಧಿ (Teaching Hours / Week (L:T:P: S)	0:2:0:1	ಸೆಮಿಸ್ಟರ್ ಅಂತ್ಯದ ಪರೀಕ್ಷೆಯ ಅಂಕಗಳು	50
ಒಟ್ಟು ಬೋಧನಾ ಅವಧಿ Total Hours of Pedagogy	25 ಗಂಟೆಗಳು	ಒಟ್ಟು ಅಂಕಗಳು	100
ಕ್ರೆಡಿಟ್ಸ್ (Credits)	01	ಪರೀಕ್ಷೆಯ ಅವಧಿ	01 ಗಂಟೆ

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಪಠ್ಯದ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು:

1. ವೃತ್ತಿಪರ ಪದವಿ ವಿದ್ಯಾರ್ಥಿಗಳಾಗಿರುವುದರಿಂದ ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ ಮತ್ತು ಕನ್ನಡದ ಸಂಸ್ಕೃತಿಯ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.
2. ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಪ್ರಧಾನ ಭಾಗವಾದ ಆಧುನಿಕ ಪೂರ್ವ ಮತ್ತು ಆಧುನಿಕ ಕಾವ್ಯಗಳನ್ನು ಸಾಂಕೇತಿಕವಾಗಿ ಪರಿಚಯಿಸಿ ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಸಾಹಿತ್ಯ ಮತ್ತು ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಅರಿವು ಹಾಗೂ ಆಸಕ್ತಿಯನ್ನು ಮೂಡಿಸುವುದು.
3. ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯವನ್ನು ಹಾಗೂ ಅವರುಗಳ ಸಾಧಿಸಿದ ವಿಷಯಗಳನ್ನು ಪರಿಚಯಿಸುವುದು.
4. ಕನ್ನಡ ಶಬ್ದಸಂಪತ್ತಿನ ಪರಿಚಯ ಮತ್ತು ಕನ್ನಡ ಭಾಷೆಯ ಬಳಕೆ ಹಾಗೂ ಕನ್ನಡದಲ್ಲಿ ಪತ್ರ ವ್ಯವಹಾರವನ್ನು ತಿಳಿಸಿಕೊಡುವುದು.

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವ್ಯವಸ್ಥೆ (Teaching-Learning Process - General Instructions) :

These are sample Strategies, which teacher can use to accelerate the attainment of the course outcomes.

1. ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡವನ್ನು ಬೋಧಿಸಲು ತರಗತಿಯಲ್ಲಿ ಶಿಕ್ಷಕರು ಪ್ರಸ್ತುತ ಪುಸ್ತಕ ಆಧಾರಿಸಿ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನವನ್ನು ಅನುಸರಿಸುವುದು. ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ತಯಾರಿಸಲು ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಪ್ರೇರೇಪಿಸುವುದು ಮತ್ತು ತರಗತಿಯಲ್ಲಿ ಅವುಗಳನ್ನು ಚರ್ಚಿಸಲು ಅವಕಾಶ ಮಾಡಿಕೊಡುವುದು.
2. ಇತ್ತೀಚಿನ ತಂತ್ರಜ್ಞಾನದ ಅನುಕೂಲಗಳನ್ನು ಬಳಸಿಕೊಳ್ಳುವುದು - ಅಂದರೆ ಕವಿ-ಕಾವ್ಯ ಪರಿಚಯದಲ್ಲಿ ಕವಿಗಳ ಚಿತ್ರಣ ಮತ್ತು ಲೇಖನಗಳು ಮತ್ತು ಕಥೆ ಕಾವ್ಯಗಳ ಮೂಲ ಅಂಶಗಳಿಗೆ ಸಂಬಂಧಪಟ್ಟ ಧ್ವನಿ ಚಿತ್ರಗಳು, ಸಂಭಾಷಣೆಗಳು, ಈಗಾಗಲೇ ಇತರ ವಿಮರ್ಶಕರು ಬರೆದಿರುವ ವಿಮರ್ಶಾತ್ಮಕ ವಿಷಯಗಳನ್ನು ಟಿಪಿಟಿ, ಡಿಜಿಟಲ್ ಮಾಧ್ಯಮಗಳ ಮುಖಾಂತರ ವಿಶ್ಲೇಷಿಸುವುದು.
3. ನವೀನ ಮಾದರಿಯ ಸಾಹಿತ್ಯ ಬೋಧನೆಗೆ ಸಂಬಂಧಪಟ್ಟ ವಿಧಾನಗಳನ್ನು ಶಿಕ್ಷಕರು ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಅನುಕೂಲವಾಗುವ ರೀತಿಯಲ್ಲಿ ಅಳವಡಿಸಿಕೊಳ್ಳಬಹುದು.

ಘಟಕ -1 ಲೇಖನಗಳು

1. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ - ಹಂಪ ನಾಗರಾಜಯ್ಯ
2. ಕರ್ನಾಟಕದ ಏಕೀಕರಣ : ಒಂದು ಅಪೂರ್ವ ಚರಿತ್ರೆ - ಜಿ. ವೆಂಕಟಸುಬ್ಬಯ್ಯ
3. ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ - ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ ಮತ್ತು ಪ್ರೋ. ವಿ. ಕೇಶವಮೂರ್ತಿ

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು

ಘಟಕ -2 ಆಧುನಿಕ ಪೂರ್ವದ ಕಾವ್ಯ ಭಾಗ	
1. ವಚನಗಳು : ಬಸವಣ್ಣ, ಅಕ್ಕಮಹಾದೇವಿ, ಅಲ್ಲಮಪ್ರಭು, ಆಯ್ದಕ್ಕಿ ಮಾರಯ್ಯ, ಜೇಡರದಾಸಿಮಯ್ಯ, ಆಯ್ದಕ್ಕಿ ಲಕ್ಕಮ್ಮ. 2. ಕೀರ್ತನೆಗಳು : ಅದರಿಂದೇನು ಫಲ ಇದರಿಂದೇನು ಫಲ - ಪುರಂದರದಾಸರು ತಲ್ಲಣಿಸದಿರು ಕಂಡ್ಯ ತಾಳು ಮನವೇ - ಕನಕದಾಸರು 3. ತತ್ವಪದಗಳು : ಸಾವಿರ ಕೊಡಗಳ ಸುಟ್ಟು - ಶಿಶುನಾಳ ಶರೀಫ	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು
ಘಟಕ -3 ಆಧುನಿಕ ಕಾವ್ಯಭಾಗ	
1. ಡಿವಿಜಿ ರವರ ಮಂಕುತಿಮ್ಮನ ಕಗ್ಗದಿಂದ ಅಯ್ದ ಕೆಲವು ಭಾಗಗಳು 2. ಕುರುಡು ಕಾಂಚಾಣ : ದಾ.ರಾ. ಬೇಂದ್ರೆ 3. ಹೊಸಬಾಳಿನ ಗೀತೆ : ಕುವೆಂಪು	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು
ಘಟಕ -4 ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯ	
1. ಡಾ. ಸರ್. ಎಂ. ವಿಶ್ವೇಶ್ವರಯ್ಯ : ವ್ಯಕ್ತಿ ಮತ್ತು ಐತಿಹ್ಯ - ಎ ಎನ್ ಮೂರ್ತಿರಾವ್ 2. ಕರಕುಶಲ ಕಲೆಗಳು ಮತ್ತು ಪರಂಪರೆಯ ವಿಜ್ಞಾನ : ಕರೀಗೌಡ ಬೀಚನಹಳ್ಳಿ	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು
ಘಟಕ -5 ಕಥೆ ಮತ್ತು ಪ್ರವಾಸ ಕಥನ	
1. ಯುಗಾದಿ : ವಸುಧೇಂದ್ರ 2. ಮೆಗಾನೆ ಎಂಬ ಗಿರಿಜನ ಪರ್ವತ : ಹಿ.ಚಿ. ಬೋರಲಿಂಗಯ್ಯ	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಕಲಿಕೆಯಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಆಗುವ ಪರಿಣಾಮಗಳು **(course Outcomes):**

1. ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ ಮತ್ತು ಕನ್ನಡದ ಸಂಸ್ಕೃತಿಯ ಪರಿಚಯವಾಗುತ್ತದೆ.
2. ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಆಧುನಿಕ ಪೂರ್ವ ಮತ್ತು ಆಧುನಿಕ ಕಾವ್ಯಗಳು ಮತ್ತು ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಆಸಕ್ತಿಯು ಮೂಡುತ್ತದೆ.
3. ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯವಾಗುತ್ತದೆ.
4. ಕನ್ನಡ ಭಾಷಾಭ್ಯಾಸ, ಸಾಮಾನ್ಯ ಕನ್ನಡ ಹಾಗೂ ಆಡಳಿತ ಕನ್ನಡದ ಪದಗಳ ಪರಿಚಯವಾಗುತ್ತದೆ.

ಮೌಲ್ಯಮಾಪನದ ವಿಧಾನ **(Assessment Details- both CIE and SEE) :**

(methods of CIE - MCQ, Quizzes, Open book test, Seminar or micro project)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The student has to obtain a minimum of 40% marks individually both in CIE and 35% marks in SEE to pass. Theory Semester End Exam (SEE) is conducted for 50 marks (01 hour duration). Based on this grading will be awarded.

Continuous Internal Evaluation:

Three Tests each of **20 Marks (duration 01 hour**)

a. First test at the end of 5th week of the semester
b. Second test at the end of the 10th week of the semester
c. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks : 1.** First assignment at the end of 4th week of the semester

2. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

3. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

ಸೆಮಿಸ್ಟರ್ ಅಂತ್ಯದ ಪರೀಕ್ಷೆಯು ಈ ಕೆಳಗಿನಂತಿರುತ್ತದೆ - **Semester End Exam (SEE):**

SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject.

1. The question paper will have 50 questions. Each question is set for 01 mark.

SEE Pattern will be in MCQ Model for 50 marks. Duration of the exam is 01 Hour.

ಪಠ್ಯಪುಸ್ತಕ :

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ

ಡಾ. ಹಿ.ಚಿ.ಬೋರಲಿಂಗಯ್ಯ ಮತ್ತು ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ,

ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.

ಬಳಕೆ ಕನ್ನಡ - baLake Kannada (Kannada for Usage)

ಕನ್ನಡ ಕಲಿಕೆಗಾಗಿ ನಿಗದಿಪಡಿಸಿದ ಪಠ್ಯಪುಸ್ತಕ - (Prescribed Textbook to Learn Kannada)

ವಿಷಯ ಸಂಕೇತ (Course Code)	21KBK39/49	ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನದ ಅಂಕಗಳು (Continuous Internal Evaluation Marks)	50
ಒಂದು ವಾರಕ್ಕೆ ಬೋಧನಾ ಅವಧಿ (Teaching Hours / Week (L:T:P: S)	0:2:0:1	ಸೆಮಿಸ್ಟರ್ ಅಂತ್ಯದ ಪರೀಕ್ಷೆಯ ಅಂಕಗಳು (Semester End Examination Marks)	50
ಒಟ್ಟು ಬೋಧನಾ ಅವಧಿ Total Hours of Pedagogy	25 ಗಂಟೆಗಳು	ಒಟ್ಟು ಅಂಕಗಳು (Total Marks)	100
ಕ್ರೆಡಿಟ್ಸ್ (Credits)	01	ಪರೀಕ್ಷೆಯ ಅವಧಿ (Exam Hours)	01 ಗಂಟೆ

ಬಳಕೆ ಕನ್ನಡ ಪಠ್ಯದ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು (Course Learning Objectives):

- To Create the awareness regarding the necessity of learning local language for comfortable and healthy life.
- To enable learners to Listen and understand the Kannada language properly.
- To speak, read and write Kannada language as per requirement.
- To train the learners for correct and polite conservation.

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವ್ಯವಸ್ಥೆ (Teaching-Learning Process - General Instructions) :

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. ಬಳಕೆ ಕನ್ನಡವನ್ನು ತರಗತಿಯಲ್ಲಿ ಶಿಕ್ಷಕರು ಬೋಧಿಸಲು ವಿಟಿಯು ಸೂಚಿಸಿರುವ ಪಠ್ಯಪುಸ್ತಕವನ್ನು ಉಪಯೋಗಿಸಬೇಕು.
2. ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ತಯಾರಿಸಲು ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಉತ್ತೇಜಿಸುವುದು ಮತ್ತು ತರಗತಿಯಲ್ಲಿ ಅವುಗಳನ್ನು ಚರ್ಚಿಸಲು ಅವಕಾಶ ಮಾಡಿಕೊಡುವುದು.
3. ಪ್ರತಿ ವಿದ್ಯಾರ್ಥಿ ಪುಸ್ತಕವನ್ನು ತರಗತಿಯಲ್ಲಿ ಬಳಸುವಂತೆ ನೋಡಿಕೊಳ್ಳುವುದು ಮತ್ತು ಪ್ರತಿ ಪಾಠ ಮತ್ತು ಪ್ರವಚನಗಳ ಮೂಲ ಅಂಶಗಳಿಗೆ ಸಂಬಂಧಪಟ್ಟಂತೆ ಪೂರಕ ಚಟುವಟಿಕೆಗಳಿಗೆ ತೊಡಗಿಸತಕ್ಕದ್ದು

1. ಡಿಜಿಟಲ್ ತಂತ್ರಜ್ಞಾನದ ಮುಖಾಂತರ ಇತ್ತೀಚೆಗೆ ಡಿಜಿಟಲೀಕರಣ ಗೊಂಡಿರುವ ಭಾಷೆ ಕಲಿಕೆಯ ವಿಧಾನಗಳನ್ನು ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ಮುಖಾಂತರ ಚರ್ಚಿಸಲು ಕ್ರಮಕೈಗೊಳ್ಳುವುದು. ಇದರಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ತರಗತಿಯಲ್ಲಿ ಹೆಚ್ಚು ಏಕಾಗ್ರತೆಯಿಂದ ಪಾಠ ಕೇಳಲು ಮತ್ತು ಅಧ್ಯಯನದಲ್ಲಿ ತೊಡಗಲು ಅನುಕೂಲವಾಗುತ್ತದೆ.
2. ಭಾಷಾಕಲಿಕೆಯ ಪ್ರಯೋಗಾಲಯದ ಮುಖಾಂತರ ಬಹುಬೇಗ ಕನ್ನಡ ಭಾಷೆಯನ್ನು ಕಲಿಯಲು ಅನುಕೂಲವಾಗುವಂತೆ ಕಾರ್ಯಚಟುವಟಿಕೆಗಳನ್ನು ಮತ್ತು ಕ್ರಿಯಾ ಯೋಜನೆಗಳನ್ನು ರೂಪಿಸುವುದು.

Module-1

1. Introduction, Necessity of learning a local language. Methods to learn the Kannada language.
2. Easy learning of a Kannada Language: A few tips. Hints for correct and polite conservation, Listening and Speaking Activities
3. Key to Transcription.
4. ವೈಯಕ್ತಿಕ, ಸ್ವಾಮ್ಯಸೂಚಕ/ಸಂಬಂಧಿತ ಸಾರ್ವನಾಮಗಳು ಮತ್ತು ಪ್ರಶ್ನಾರ್ಥಕ ಪದಗಳು - **Personal Pronouns, Possessive Forms, Interrogative words**

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು

Module-2

1. ನಾಮಪದಗಳ ಸಂಬಂಧಾರ್ಥಕ ರೂಪಗಳು, ಸಂದೇಹಾಸ್ಪದ ಪ್ರಶ್ನೆಗಳು ಮತ್ತು ಸಂಬಂಧವಾಚಕ ನಾಮಪದಗಳು - **Possessive forms of nouns, dubitive question and Relative nouns**
2. ಗುಣ, ಪರಿಮಾಣ ಮತ್ತು ವರ್ಣಬಣ್ಣ ವಿಶೇಷಣಗಳು, ಸಂಖ್ಯಾವಾಚಕಗಳು **Qualitative, Quantitative and Colour Adjectives, Numerals**
3. **ಕಾರಕ ರೂಪಗಳು ಮತ್ತು ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು – ಸಪ್ತಮಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯ – (ಆ, ಅದು, ಅವು, ಅಲ್ಲಿ) Predictive Forms, Locative Case**

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು

Module-3

1. **ಚತುರ್ಥಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯದ ಬಳಕೆ ಮತ್ತು ಸಂಖ್ಯಾವಾಚಕಗಳು –** Dative Cases, and Numerals
4. **ಸಂಖ್ಯಾಗುಣವಾಚಕಗಳು ಮತ್ತು ಬಹುವಚನ ನಾಮರೂಪಗಳು –** Ordinal numerals and Plural markers
5. **ನ್ಯೂನ / ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯಾಪದಗಳು ಮತ್ತು ವರ್ಣ ಗುಣವಾಚಕಗಳು Defective / Negative Verbs and Colour Adjectives**

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು

Module-4

1. ಅಪ್ಪಣೆ / ಒಪ್ಪಿಗೆ, ನಿರ್ದೇಶನ, ಪ್ರೋತ್ಸಾಹ ಮತು ಒತ್ತಾಯ ಆರ್ಥರೂಪ ಪದಗಳು ಮತ್ತು ವಾಕ್ಯಗಳು **Permission, Commands, encouraging and Urging words (Imperative words and sentences)**
2. ಸಾಮಾನ್ಯ ಸಂಭಾಷಣೆಗಳಲ್ಲಿ ದ್ವಿತೀಯ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು ಮತ್ತು ಸಂಭವನೀಯ ಪ್ರಕಾರಗಳು **Accusative Cases and Potential Forms used in General Communication**
3. "ಇರು ಮತ್ತು ಇರಲ್ಲ" ಸಹಾಯಕ ಕ್ರಿಯಾಪದಗಳು, ಸಂಭಾವ್ಯಸೂಚಕ ಮತ್ತು ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯಾ ಪದಗಳು - Helping Verbs "iru and iralla", Corresponding Future and Negation Verbs
6. ಹೋಲಿಕೆ (ತರತಮ) , ಸಂಬಂಧ ಸೂಚಕ ಮತ್ತು ವಸ್ತು ಸೂಚಕ ಪ್ರತ್ಯಯಗಳು ಮತ್ತು ನಿಷೇಧಾರ್ಥಕ ಪದಗಳ ಬಳಕೆ- Comparitive, Relationship, Identification and Negation Words

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು

Module-5

1. ಕಾಲ ಮತ್ತು ಸಮಯದ ಹಾಗೂ ಕ್ರಿಯಾಪದಗಳ ವಿವಿಧ ಪ್ರಕಾರಗಳು - ifferent types of forms of Tense, Time and Verbs
2. ದ್, -ತ್, - ತು, - ಇತು, - ಆಗಿ, - ಅಲ್ಲ, - ಗ್, -ಕ್, ಇದೆ, ಕ್ರಿಯಾ ಪ್ರತ್ಯಯಗಳೊಂದಿಗೆ ಭೂತ, ಭವಿಷ್ಯತ್ ಮತ್ತು ವರ್ತಮಾನ ಕಾಲ ವಾಕ್ಯ ರಚನೆ - Formation of Past, Future and Present Tense Sentences with Verb Forms
3. **Kannada Vocabulary List : ಸಂಭಾಷಣೆಯಲ್ಲಿ ದಿನೋಪಯೋಗಿ ಕನ್ನಡ ಪದಗಳು - Kannada Words in Conversation**

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು

ಬಳಕೆಯಾಗುವುದರ ಕಲಿಕೆಯಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಆಗುವ ಅನುಕೂಲಗಳು ಮತ್ತು ಫಲಿತಾಂಶಗಳು: **course Outcomes (Course Skill Set):** At the end of the Course, The Students will be able

1. To understand the necessity of learning of local language for comfortable life.
2. To Listen and understand the Kannada language properly.
3. To speak, read and write Kannada language as per requirement.
4. To communicate (converse) in Kannada language in their daily life with kannada speakers.
5. To speak in polite conservation.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Tests each of **20 Marks (duration 01 hour**)

a. First test at the end of 5th week of the semester
b. Second test at the end of the 10th week of the semester
c. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks : 1.** First assignment at the end of 4th week of the semester

7. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

8. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

ಸೆಮಿಸ್ಟರ್ ಅಂತ್ಯದ ಪರೀಕ್ಷೆಯು ಈ ಕೆಳಗಿನಂತಿರುತ್ತದೆ - **Semester End Exam (SEE):**

SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject.

2. The question paper will have 50 questions. Each question is set for 01 mark.
3. SEE Pattern will be in MCQ Model for 50 marks. Duration of the exam is 01 Hour.

Textbook :

ಬಳಕೆ ಕನ್ನಡ

ಲೇಖಕರು : ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ

ಪ್ರಸಾರಾಂಗ,

ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.

Semester: IV						
Course Title: National Service Scheme (Practical)						
Course Code	**:**	**21HSAE39A/21HSAE46A**		**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	**0:0:1**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**L + T + 13 P**		**SEE Duration**	**:**	**2 Hours**

Prerequisites:

1. Students should have service-oriented mind set and social concern.
2. Students should have dedication to work at any remote place, any time with available resources and proper time management for the other works.
3. Students should be ready to sacrifice some of the timely will and wishes to achieve service-oriented targets on time.

Content **13 Hours**

Students must take up any one activity on below mentioned topics and has to prepare contents for awareness and technical contents for implementation of the projects and has to present strategies for implementation of the same. Compulsorily must attend one camp.

CIE will be evaluated based on their presentation, approach, and implementation strategies. (Any one of the below mentioned activity)

1. Helping local schools to achieve good result and enhance their enrolment in Higher/technical/ vocational education.
2. Preparing an actionable business proposal for enhancing the village/ farmer income and approach for implementation.
3. Developing Sustainable Water management system for rural/ urban areas and implementation approaches.
4. Setting of the information imparting club for women leading to contribution in social and economic issues.
5. Spreading public awareness/ government schemes under rural outreach program. (Minimum 5 programs)
6. Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc..
7. Social connect and responsibilities
8. Plantation and adoption of plants. Know your plants
9. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing
10. Waste management – Public, Private and Govt organization, 5 R's
11. Water conservation techniques – Role of different stakeholders - Implementation
12. Govt. School Rejuvenation and assistance to achieve good infrastructure.
13. Organize National integration and social harmony events/ workshops / seminars. (Minimum 2 programs)

AND <u>ONE NSS-CAMP</u>

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand the importance of his/her responsibilities towards society.
CO2:	Analyze the environmental and societal problems/ issues and will be able to design solutions for the same.
CO3:	Evaluate the existing system and to propose practical solutions for the same for sustainable development.
CO4:	Implement government or self-driven projects effectively in the field.

ASSESSMENT AND EVALUATION PATTERN		
WEIGHTAGE	**50%**	**50%**
	CIE	**SEE**
Presentation 1- Selection of topic- (phase 1) Justification for Importance, need of the hour with surveyed data.	**10**	*****
EXPERIENTIAL LEARNING Presentation 2 (phase 2) Content development, strategies for implementation methodologies.	**10**	*****
Case Study-based Teaching-Learning	**10**	Implementation strategies of the project with report
Sector wise study & consolidation	**10**	
Video based seminar (4-5 minutes per student)	**10**	
TOTAL MARKS FOR THE COURSE	**50 MARKS**	**50 MARKS**

Semester: IV						
Course Title: National Cadet Corps (Practical)						
Course Code	**:**	**21HSAE39B/ 21HSAE46B**		**CIE**	**:**	**50 Marks**
Credits: L: T:P	**:**	**0:0:1**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**15 P**		**SEE Duration**	**:**	**2 Hrs**

Unit 1	**7 Hrs**
Drill (Contact Hrs. 12). Foot Drill- Drill ki Aam Hidayaten, Word ki Command, Savdhan, Vishram, Aram Se, Murdna, Kadvar Sizing, Teen Line Banana, Khuli Line, Nikat Line, Khade Khade Salute Karna	
Unit 2	**3 Hrs**
Weapon Training (WT): Introduction & Characteristics of 7.62 Self Loading rifle, Identification of rifle parts	
Unit 3	**3 Hrs**
Adventure activities: Trekking and obstacle course	
Unit 4	**2 Hrs**
Social Service and Community Development (SSCD): Students will participate in various activities throughout the semester e.g., Blood donation Camp, Swachhata Abhiyan, Constitution Day, All National Festival	

Course Outcomes: Cadets will be able to: -	
CO1	Understand that drill as the foundation for discipline and to command a group for common goal.
CO2	Understand the importance of a weapon its detailed safety precautions necessary for prevention of accidents and identifying the parts of weapon
CO3	Understand that trekking will connect human with nature and cross the obstacles to experience army way of life.
CO4	Understand the various social issues and their impact on social life, Develop the sense of self-less social service for better social & community life.

Reference Books	
1	NCC Cadet Hand Book by R K Gupta, Ramesh Publishing House, New Delhi, Book code:R- 1991, ISBN: 978-93-87918-57-3, HSN Code: 49011010
2	nccindia.ac.in

ASSESSMENT AND EVALUATION PATTERN		
WEIGHTAGE	**50%**	**50%**
	CIE	SEE
Drill Skill Test	**20**	*****
Weapon Training	**10**	*****
Adventure activities	**10**	Report on adventure and social service activities
Social service activities	**10**	
TOTAL MARKS FOR THE COURSE	**50 MARKS**	**50 MARKS**

Semester: IV						
PHYSICAL EDUCATION (SPORTS & ATHLETICS) (Practical)						
Course Code	**:**	**21HSAE39C/ 21HSAE46C**		**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	**0:0:1**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**30 P**		**SEE Duration**	**:**	**2.30 Hours**

Introduction of Physical Education and Sports			
General & Specific warm up exercises Conditioning exercises Any 2 Major Games Intramural Competitions			
Choose any one according to serial no			
1. Kho-Kho	Giving Kho, Single chain, Pole dive, Pole turning, 3-6 Up	**6. Kabaddi**	Hand touch, Chain hold, Ankle hold, Thigh hold, Getting bonus
2. Throwball	Service, Receive, Spin pass, Simple pass, Jump throw	**7. Volleyball**	Attack, Block, Service, Upper hand pass, Lower hand pass
3. Netball	Step with ball, Shooting, Passing, Blocking	**8. Handball**	Step with ball, Shooting, Passing, Blocking, Dribbling
4. Softball	Catching, Pitching, Slugging, Base Running, Stealing	**9. Football**	Dribbling, Chest Drop, Ball Control, Thigh Drop, Shooting
5. Ball badminton	Service, Fore hand receive, Back hand receive, Spin smash, Rally	**10. Table Tennis**	Service, Fore hand receive, Back hand receive, Smash, Rally

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the basic principles and practices of Physical Education and Sports.
CO2	Instruct the Physical Activities and Sports practices for Healthy Living
CO3	To develop professionalism among students to conduct, organize & Officiate Physical Education and Sports events at schools and community level

Topics for Viva:

1. On rules and regulations pertaining to the games / sports
2. On dimensions of the court, size / weight of the ball and standards pertaining to that sports / game
3. Popular players and legends at state level / National level/ International level
4. Recent events happened and winner / runners in that particular sport / game
5. General awareness about sport / game, sports happenings in the college campus

Reference Books	
1	Muller, J. P. (2000). Health, Exercise and Fitness. Delhi: Sports.
2	Vanaik.A (2005) Play Field Manual, Friends Publication New Delhi
3	IAAF Manual

4	M.J. Vishwanath, (2002) Track and Field Marking and Athletics Officiating Manual, Silver Star Publication, Shimoga
5	Steve Oldenburg (2015) Complete Conditioning for Volleyball, Human Kinestics.
Note: Skills of Sports and Games (Game Specific books) may be referred	

ASSESSMENT AND EVALUATION PATTERN CIE-50 MARKS	
Activity book- **10** marks	
QUIZZES	
Quiz-I	Each quiz is evaluated for 10 marks adding up to **20 MARKS.**
Quiz-II	
Test – I	Demonstration of skills is evaluated for 10 marks adding up to **20 MARKS.**
Test – II	
ASSESSMENT AND EVALUATION PATTERN SEE-50 MARKS	
Practical	**30 marks**
Viva voce	**20 marks**
Total	**50 marks**

Rubric for CIE (2022 Scheme)		
Sl. No.	**Content**	**Marks**
1	Attendance	10
2	Performing Skills (Any Two)	20
3	Court measurement (Markings)	20
	Total:	**50**

Rubric for SEE (2022 Scheme)		
Sl. No.	**Content**	**Marks**
1	Performing Skills (Any Two)	30
2	Viva	20
	Total:	**50**

Semester: IV					
Course Title: Music (Practical)					
Course Code	**:**	**21HSAE39D1/ 21HSAE46D1**	**CIE**	**:**	**50 Marks**
Credits: L:T:P		**0:0:1**	**SEE**	**:**	**50 Marks**
Total Hours	**:**	**13P**	**SEE Duration**	**:**	**2 Hours**

Prerequisites:

1. Students should know basics of music.
2. Students should have dedication to learn and improve on their musical skills.
3. Students should have participated in musical events and have basic knowledge on how to present their music.

Content	**13 Hours**

1. Introduction to different genres of music
2. Evolution of genres in India: Inspiration from the world
3. Ragas, time and their moods in Indian Classical Music
4. Identification of ragas and application into contemporary songs
5. Adding your touch to a composition
6. Maths and Music: A demonstration
7. Harmonies in music
8. Chords: Basics and application into any song
9. Music Production-I
10. Music Production-II

Students have to form groups of 2-4 and present a musical performance/ a musical task which shall be given by the experts. The experts shall judge the groups and award marks for the same.

CIE will be evaluated based on their presentation, approach and implementation strategies. Students need to submit their certificates of any event they participated or bagged prizes in. This shall also be considered for CIE evaluation.

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand basics of Music and improve their skills
CO2	Appreciate the impacts on health and well being
CO3	Perform and present music in a presentable manner
CO4	Develop skills like team building and collaboration

Reference Books

1.	Music Cognition: The Basics by Henkjan Honing
2.	Basic Rudiments Answer Book - Ultimate Music Theory: Basic Music Theory Answer Book by Glory St Germain
3.	Elements Of Hindustani Classical Music by Shruti Jauhari
4.	Music in North India: Experiencing Music, Expressing Culture (Global Music Series) by George E. Ruckert

ASSESSMENT AND EVALUATION PATTERN		
WEIGHTAGE	**50%**	**50%**
	CIE	**SEE**
Presentation 1- Selection of topic- (phase 1)	**10**	*****
EXPERIENTIAL LEARNING Presentation 2 (phase 2)	**10**	*****
Case Study-based Teaching-Learning	**10**	Implementation strategies of the project with report
Sector wise study & consolidation	**10**	
Video based seminar (4-5 minutes per student)	**10**	
TOTAL MARKS FOR THE COURSE	**50 MARKS**	**50 MARKS**

Semester: IV						
Course Title: Dance (Practical)						
Course Code	**:**	**21HSAE39D2/ 21HSAE46D3**		**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	**0:0:1**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**13P**		**SEE Duration**	**:**	**2 Hours**

Prerequisites:

1. Students should have the will and interest to learn dancing.
2. Students should have a positive mindset.
3. Students should be willing to interact and cooperate in group activities.

Content	**13 Hours**

1. Introduction to Dance
2. Preparing the body for dancing by learning different ways to warm up.
3. Basics of different dance forms i.e. classical, eastern, and western.
4. Assessing the interest of students and dividing them into different styles based on interaction.
5. Advancing more into the styles of interest.
6. Understanding of music i.e. beats, rhythm, and other components.
7. Expert sessions in the respective dance forms.
8. Activities such as cypher, showcase to gauge learning.
9. Components of performance through demonstration.
10. Introduction to choreographies and routines.
11. Learning to choreograph.
12. Choreograph and perform either solo or in groups.

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand the fundamentals of dancing.
CO2:	Adapt to impromptu dancing.
CO3:	Ability to pick choreography and understand musicality.
CO4:	To be able to do choreographies and perform in front of a live audience.

Reference Books

1. Dance Composition: A practical guide to creative success in dance making by Jacqueline M. Smith-Autard

ASSESSMENT AND EVALUATION PATTERN		
WEIGHTAGE	**50%**	**50%**
	CIE	**SEE**
Presentation 1- Selection of topic- (phase 1)	**10**	*****
EXPERIENTIAL LEARNING Presentation 2 (phase 2)	**10**	*****
Case Study-based Teaching-Learning	**10**	Implementation strategies of the project with report
Sector wise study & consolidation	**10**	
Video based seminar (4-5 minutes per student)	**10**	
TOTAL MARKS FOR THE COURSE	**50 MARKS**	**50 MARKS**

Semester: III						
Course Title: Lights Camera Drama (Practical)						
Course Code	**:**	**21HSAE39D3/ 21HSAE46D3**		**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	**0:0:1**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**13P**		**SEE Duration**	**:**	**2 Hours**

Prerequisites:

1. Students should have creative oriented mindset and social concern.
2. Students should have dedication to work with their classmates for long hours until a collective goal is reached.
3. Students should be ready to sacrifice some of the timely will and wishes to achieve targets on time.

Content **13 Hours**

1. **Break the ICE**
2. **Introduction to freedom** Talk to each and every single person for a period of 5 complete minutes**.** This is aimed at to make everyone in the room comfortable with each other. This helps everyone get over social anxiety, Shyness and Nervousness.
3. **Ura**
4. **Rhythm Voice Projection, Voice Modulation, Weeping & Coughing** Voice projection is the strength of speaking or singing whereby the voice is used powerfully and clearly. It is a technique employed to command respect and attention, as when a teacher talks to a class, or simply to be heard clearly, as used by an actor in a theatre.
5. **It's Leviosa, Not Leviosaaa!**
6. **Speech work: Diction, Intonation, Emphasis, Pauses, Pitch and Volume Tempo Dialogues delivery.** The art of dialogue delivery plays a vital role in in ensuring the efficacy of communication especially from the dramatic aspect of it, this unit discusses some tips to help the young actors improve their dialogue delivery skills:
7. **Elementary, My dear Watson.**
8. **Responsibilities of an actor tools of an actor character analysis** Observations aspects, Stage presence, concentration, conviction, confidence, energy and directionality.
9. **Show time**
10. **Pick a genre: COMEDY, THRILLER, HORROR, and TRAGEDY: Showcase a performance.** Stylized acting with reference to historical and mythological plays. **Mime**: conventional, occupational and pantomime **Mono acting:** different types of characters

Course Outcomes: After completing the course, the students will be able to	
CO1:	Develop a range of Theatrical Skills and apply them to create a performance.
CO2:	Work collaboratively to generate, develop and communicate ideas.
CO3:	Develop as creative, effective, independent and reflective students who are able to make inform ed choices in process and performance.
CO4:	Develop an awareness and understanding of the roles and processes undertaken in contemporary professional theatre practice.

CIE's will be evaluated through monoacting or dialogue. The students need to use whatever they've learnt through the course of the drama class. Judges/Teachers can award the marks accordingly.

Certificates won outside of college, can be submitted for evaluation as well.

For SEE's. Students need to form groups of 46. They need to pick a genre and enact a play of at least 20 mins long. The venue will be IEM auditorium. No mics should be used. They will be given 2 weeks to prepare.

Reference Books	
1	The Empty Space by Peter Brook
2	The Viewpoints Book: A Practical Guide to Viewpoints and Composition by Anne Bogart and Tina Landau

ASSESSMENT AND EVALUATION PATTERN		
WEIGHTAGE	**50%**	**50%**
	CIE	**SEE**
Presentation 1- Selection of Script (phase 1)	**10**	*****
EXPERIENTIAL LEARNING Presentation 2 (phase 2)	**10**	*****
Case Study-based Teaching-Learning	**10**	Implementation strategies of the project with report
Interpretation of Script	**10**	
Performance based seminar (20 mins long)	**10**	
TOTAL MARKS FOR THE COURSE	**50 MARKS**	**50 MARKS**

Semester: IV						
Course Title: Art (Practical)						
Course Code	**:**	**21HSAE39D4/ 21HSAE46D4**		**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	**0:0:1**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**13P**		**SEE Duration**	**:**	**2 Hours**

Prerequisites:

Although there are no prerequisite qualifications for this subject, students must have a basic understanding of and interest in the fields of art and design in order to enroll in it.

Content **13 Hours**

1. Use points, line and curves to create various shapes and forms
2. Use of shapes and forms to create various objects and structures
3. Recognizing distinctions in objects when viewed from various perspectives and grasping basic notions of perspective
4. Students will be introduced to the significance of color in art, as well as the principles of color theory and application.
5. Applied the concepts of unity, harmony, balance, rhythm, emphasis and proportion, abstraction and stylization to create a composition.
6. Learn how to use which materials and for what types of art and textures.
7. Use of the above concepts to create art through the medium of collage, mosaic, painting, mural, batik, tie and dye.
8. Real world application of the above concepts in the form of book cover design and illustration, cartoon, poster, advertisements, magazine, computer graphics and animation
9. Familiarization with the many art forms and techniques of expression found throughout India.

AND

ONE EDUCATIONAL VISIT TO AN ART MUSEUM / INSTITUTE / GALLERY

Students must turn in assignments for each of the above said topics on a weekly basis and have to compulsorily take part in the museum visit. CIE will be evaluated based on a still life piece, a composition using any one of the media of composition and a presentation on Indian art styles and creation of a piece pertaining to the presented art style.

Reference Books

1. Catching the Big Fish: Meditation, Consciousness, and Creativity by David Lynch
2. Art & Fear: Observations on the Perils (and Rewards) of Artmaking by David Bayles & Ted Orland

Course Outcomes: After completing the course, the students will be able to

CO1:	To use lines, shapes, and colors to depict the various sentiments and moods of life and nature.
CO2:	To use one's creativity to develop forms and color schemes, as well as the ability to portray them effectively in drawing and painting on paper.
CO3:	To develop the ability to properly use drawing and painting materials (surfaces, tools and equipment, and so on).
CO4:	To improve their observation abilities by studying everyday items as well as numerous geometrical and non- geometrical (i.e. organic) shapes found in life and nature and to hone their drawing and painting talents in response to these insights.

ASSESSMENT AND EVALUATION PATTERN		
WEIGHTAGE	**50%**	**50%**
	CIE	SEE
Presentation 1- Selection of topic- (phase 1)	**10**	*****
EXPERIENTIAL LEARNING Presentation 2 (phase 2)	**10**	*****
Case Study-based Teaching-Learning	**10**	Implementation strategies of the project with report
Sector wise study & consolidation	**10**	
Video based seminar (4-5 minutes per student)	**10**	
TOTAL MARKS FOR THE COURSE	**50 MARKS**	**50 MARKS**

Semester: IV						
Course Title: Photography (Practical)						
Course Code	**:**	**21HSAE39D5/ 21HSAE46D5**		**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	**0:0:1**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**13P**		**SEE Duration**	**:**	**2 Hours**

Prerequisites:

1. Students should know basics of photography and cinematography.
2. Students should have dedication to learn and improve on their photography and film making skills.
3. Students should have participated in photography events.
4. Students should have a DSLR camera.

Content	**13 hours**

1. Introduction to photography.
2. Understanding the terminologies of DSLR.
3. Elements of photography.
4. Introduction to script writing, storyboarding.
5. Understanding the visualization and designing a set.
6. Basics of film acting
7. Video editing using software
8. Introduction to cinematography.
9. Understanding about lighting and camera angles.
10. Shooting a short film.

Students must form groups of 2-4 and present a short film which shall be given by the experts. The experts shall judge the groups and award marks for the same.
CIE will be evaluated based on their presentation, approach and implementation strategies. Students need to submit their certificates of any event they participated or bagged prizes in. This shall also be considered for CIE evaluation.

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand basics of photography and videography and improve their skills
CO2:	Appreciate the skills acquired from photography
CO3:	Perform and present photos and films in a presentable manner
CO4:	Develop skills like team building and collaboration

Reference Books	
1.	Read This If You Want to Take Great Photographs – Henry Carroll

2.	The Digital Photography Book: Part 1 – Scott Kelby

ASSESSMENT AND EVALUATION PATTERN		
WEIGHTAGE	**50%**	**50%**
	CIE	**SEE**
Presentation 1- Selection of topic- (phase 1)	**10**	*****
EXPERIENTIAL LEARNING Presentation 2 (phase 2)	**10**	*****
Case Study-based Teaching-Learning	**10**	Implementation strategies of the project with report
Sector wise study & consolidation	**10**	
Video based seminar (4-5 minutes per student)	**10**	
TOTAL MARKS FOR THE COURSE	**50 MARKS**	**50 MARKS**

Semester: III						
Bridge Course: C Programming (Theory) (Common to all Branches)						
Course Code	**:**	**21DCS37**		**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	**2:0:0**		**SEE**	**:**	**---**
Total Hours	**:**	**30L**		**SEE Duration**	**:**	**2 Hours**

Unit-I	**08 Hrs**
Introduction-Perspectives **Business Domains:** Programming. **Applications:** Design games, GUI, DBMS, Embedded Systems, Compilers and Operating Systems. **Introduction to Computer Concepts:** Introduction to Computer Hardware, Software and its Types. **Introduction to C programming:** Programming paradigms, Basic structure of C program, Process of compiling and running a C program, Features of C language, Character set, C tokens, Keywords and Identifiers, Constants, Variables, Data types, Pre-processor directives. **Handling Input and Output operations and operators:** Formatted input/output functions, Unformatted input/output functions with programming examples using all functions.	
Unit – II	**10 Hrs**
Operators: Introduction to operator set, Arithmetic operators, Relational operators, Logical Operators, Assignment operators, Increment and Decrement operators, Conditional operators, Bit-wise operators, Special operators. **Expressions:** Arithmetic expressions, evaluation of expressions, Precedence of arithmetic operators, Type conversion in expressions, Operator precedence and associativity. **Decision Making and Branching:** Decision making with 'if' statement, Simple 'if' statement, the 'if…else' statement, nesting of 'if…else' statements, The 'else if' ladder, The 'switch' statement, The '*?:'* operator, The '*goto'* statement.	
Unit –III	**12 Hrs**
Programming Constructs: Decision making and looping: The 'for','while','do-while' statements with examples, Jumps in loops**. Arrays:** Introduction to Arrays, Types of arrays, Declaration arrays, Initializing dimensional arrays (One Dimensional and Multidimensional Array) with examples. **String Operations:** Introduction, Declaration and Initializing String Variables using arrays, String operations and functions with examples. **Functions:** Need for Functions, Types of functions (User Defined and Built –In), working with functions, Definition, declaration and its scope. **Pointers:** Introduction, Benefits of using pointers, Declaration and Initialization of pointers, Obtaining a value of a variable.	

Course Outcomes: After completing the course, the students will be able to:-	
CO 1	Apply logical skills to solve the engineering problems using C programming constructs.
CO 2	Evaluate the appropriate method/data structure required in C programming to develop solutions by investigating the problem.
CO 3	Design a sustainable solution using C programming with societal and environmental concern by engaging in lifelong learning for emerging technology

CO 4	Demonstrate programming skills to solve inter-disciplinary problems using modern tools effectively by exhibiting team work through oral presentation and written reports.

Reference Books	
1.	Programming in C, P. Dey, M. Ghosh, 2011, 2nd Edition, Oxford University press, ISBN (13): 9780198065289.
2.	Algorithmic Problem Solving, Roland Backhouse, 2011, Wiley, ISBN: 978-0-470-68453-5
3.	The C Programming Language, Kernighan B.W and Dennis M. Ritchie, 2015, 2nd Edition, Prentice Hall, ISBN (13): 9780131103627.
4.	Turbo C: The Complete Reference, H. Schildt, 2000, 4th Edition, Mcgraw Hill Education, ISBN-13: 9780070411838.
	Rasberry pi: https://www.raspberrypi.org/documentation/
6.	Nvidia: https://www.nvidia.com/en-us/
7.	Ardunio: https://www.arduino.cc/en/Tutorial/BuiltInExamples
8.	Scratch software: https://scratch.mit.edu/

PRACTICE PROGRAMS
Implement the following programs using cc/gcc compiler 1. Develop a C program to compute the roots of the equation $ax^2 + bx + c = 0$. 2. Develop a C program that reads N integer numbers and arrange them in ascending or descending order using selection sort and bubble sort technique. 3. Develop a C program for Matrix multiplication. 4. Develop a C program to search an element using Binary search and linear search techniques. 5. Using functions develop a C program to perform the following tasks by parameter passing to read a string from the user and print appropriate message for palindrome or not palindrome. 6. Develop a C program to compute average marks of 'n' students (Name, Roll_No, Test Marks) and search a particular record based on 'Roll_No'. 7. Develop a C program using pointers to function to find given two strings are equal or not. 8. Develop a C program using recursion, to determine GCD , LCM of two numbers and to perform binary to decimal conversion.

ASSESSMENT AND EVALUATION PATTERN		
	CIE	**SEE**
WEIGHTAGE	**100%**	**---**
QUIZZES		
Quiz-I	Each quiz is evaluated for 10 marks adding up to 1**0 MARKS.**	
Quiz-II		
THEORY COURSE (Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating)		
Test – I	Each test will be conducted for 50 Marks adding upto	

Test – II	100 marks. Final test marks will be reduced to 3**0 MARKS**	
EXPERIENTIAL LEARNING	**10**	
TOTAL MARKS FOR THE COURSE	**50**	**---**

Semester: IV						
Universal Human Values 2 (Theory & Practical)						
Course Code	**:**	**21HSS48**		**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	**1:0:1**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**28L+0T+14P**		**SEE Duration**	**:**	**2.00 Hours**

Unit-I	**05 Hrs**
Course Introduction - Need, Basic Guidelines, Content and Process for Value Education: Purpose and motivation for the course, recapitulation from Universal Human Values-I, Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfil the above human aspirations: understanding and living in harmony at various levels. Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.	
Unit – II	**06 Hrs**
Understanding Harmony in the Human Being - Harmony in Myself!: Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - happiness and physical facility, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Health. Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease	
Unit –III	**06 Hrs**
Understanding Harmony in the Family and Society- Harmony in Human Human Relationship: Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship, Understanding the meaning of Trust; Difference between intention and competence, Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family. Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives	
Unit –IV	**05 Hrs**
Understanding Harmony in the Nature and Existence - Whole existence as Coexistence: Understanding the harmony in the Nature, Interconnectedness and mutual fulfilment among the four orders of nature recyclability and self-regulation in nature, Understanding Existence as Co-existence of mutually interacting units in all pervasive space, Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in	

nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

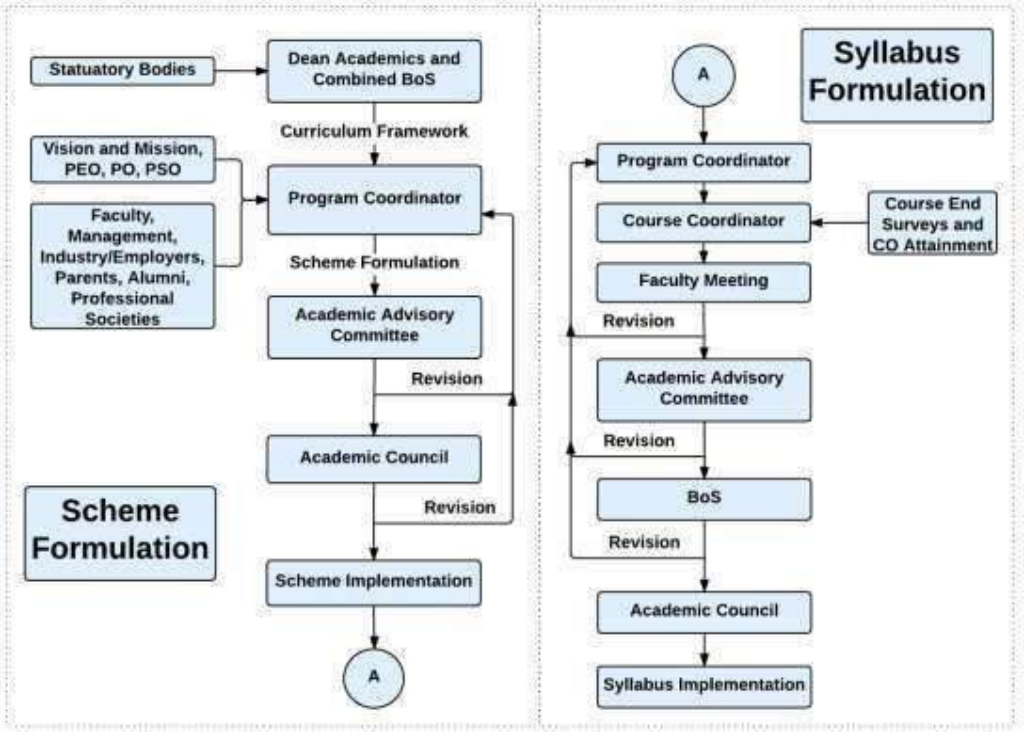
Unit –V	06 Hrs
Implications of the above Holistic Understanding of Harmony on Professional Ethics, Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations, Sum up. Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.	

Course Outcomes: After completion of the course the students will be able to	
CO1	By the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions,
CO2	While keeping human relationships and human nature in mind. They would have better critical ability.
CO3	They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
CO4	It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction

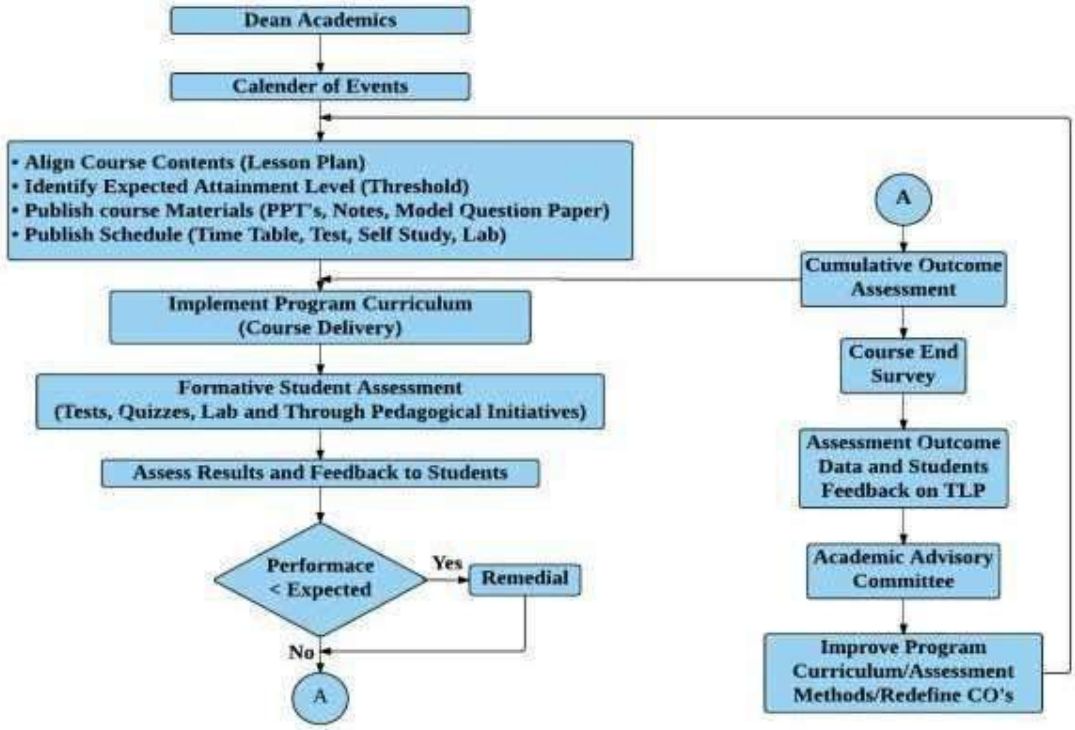
Reference Books	
1	Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004
3	The Story of Stuff (Book).
4	The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5	Small is Beautiful - E. F Schumacher.
6	Slow is Beautiful - Cecile Andrews.

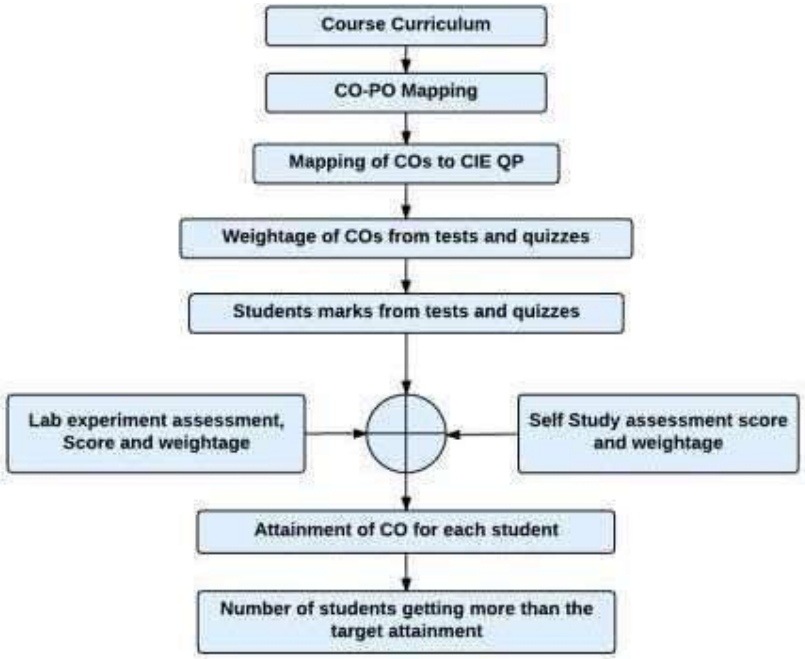
ASSESSMENT AND EVALUATION PATTERN
This is a compulsory credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self-assessment, peer assessment etc. will be used in evaluation. Example: Assessment by faculty mentor: 10 marks Self-assessment: 10 marks Assessment by peers: 10 marks Socially relevant project/Group Activities/Assignments: 20 marks Semester End Examination: 50 marks. The overall pass percentage is 40%. In case the student fails, he/she must repeat the course

Curriculum Design Process



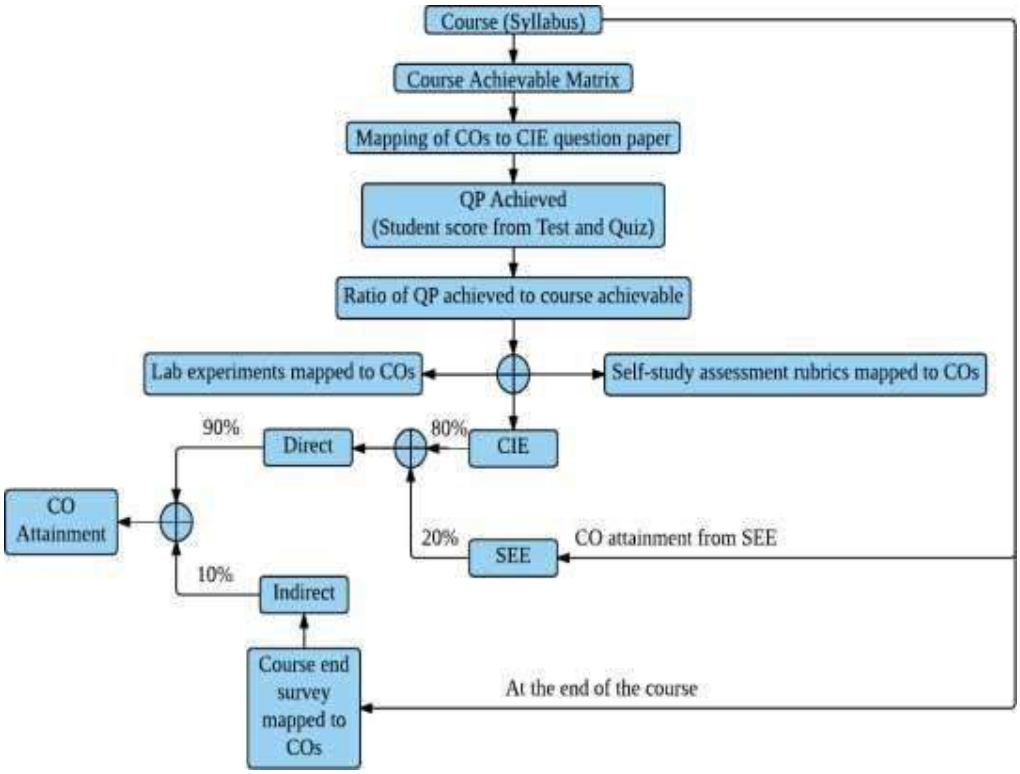
Academic Planning and Implementation



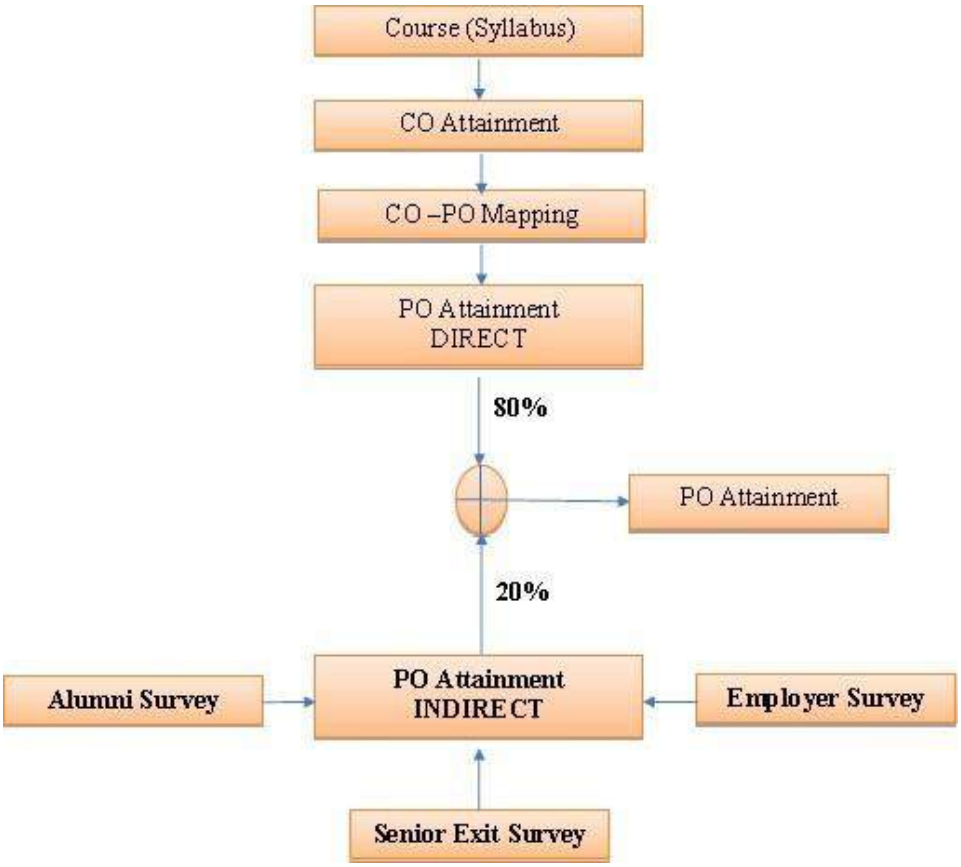


Process for Course Outcome Attainment

Final CO Attainment Process



Program Outcome Attainment Process



PROGRAM OUTCOMES (POs)

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation for the solution of complex engineering problems.

2. **Problem analysis:** Identify, formulate, research literature, and analyse 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 public health and safety, and 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 modelling 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 the 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:** Recognise the need for, and have the preparation and ability to engage inindependent and life-long learning in the broadest context of technological change.