JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY
WAKNAGHAT, P.O. – WAKNAGHAT,
TEHSIL – KANDAGHAT, DISTRICT – SOLAN (H.P.)
PIN – 173234 (INDIA) Phone Number- +91-1792-257999
(Established by H.P. State Legislature vide Act No. 14 of 2002)

JAYPEE EDUSPHERE
IGNITED MINDS INSPIRED SOULS

Revision of Syllabus in 2023-24

Programme Code	Programme name	Year of Introduction	Status of implementation of CBCS / Elective Course System (ECS)	Year of implemetation of CBCS / Elective Course System (ECS)	Year of revision (if any)	If revision has been carried out in the syllabus during last 5 years, Percentage of content added or replaced
BTBI	BTech Bioinformatics	2002	CBCS : Yes ECS: Yes	CBCS:2017 ECS: 2002	2018, 2021	80
BTBT	BTech Biotechnology	2005	CBCS : Yes ECS: Yes	CBCS:2017 ECS: 2005	2018, 2021	80
BTCE	BTech Civil Engineering	2003	CBCS : Yes ECS: Yes	CBCS:2017 ECS: 2003	2018, 2021	50
BTECE	BTech Electronics & Communication Engineering	2002	CBCS : Yes ECS: Yes	CBCS:2017 ECS: 2002	2018, 2021	50
BTCSE	BTech Computer Science Engineering	2002	CBCS : Yes ECS: Yes	CBCS:2017 ECS: 2002	2018, 2021	0
BTIT	BTech Information Technology	2002	CBCS : Yes ECS: Yes	CBCS:2017 ECS: 2002	2018, 2021	0
BTECE	BTech Electronics & Computer Engineering	2021	CBCS : Yes ECS: Yes	CBCS: 2021 ECS: 2021	2023	20
BTCEC	BTech Civil Engineering with Computer Applications	2022	CBCS : Yes ECS: Yes	CBCS: 2022 ECS: 2022	--	-

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Revision of Syllabus in 2023-24

BSCMA	B.Sc. Hons (Mathematics and Computing)	2023	CBCS : Yes ECS: Yes	CBCS: 2023 ECS: 2023		
BBA	Bachelor of Business Administration	2023	CBCS : Yes ECS: Yes	CBCS: 2023 ECS: 2023		
MTCE	MTech Civil Engineering	2011	CBCS : Yes ECS: Yes	CBCS:2017 ECS:2011	2019	24
MTCSE	MTech Computer Science & Engineering	2004	CBCS : Yes ECS: Yes	CBCS:2017 ECS:2004	2019	24
MTECE	MTech Electronics & Computer Engineering	2005	CBCS : Yes ECS: Yes	CBCS:2017 ECS:20005	2019	24
MSBT	MSc Biotechnology	2019	CBCS : Yes ECS: Yes	CBCS:2019 ECS:2019	2020	60
MTBT	MTech Biotechnology	2003	CBCS : Yes ECS: Yes	CBCS:2017 ECS: 2003	2021	10
MSMB	MSc Microbiology	2021	CBCS : Yes ECS: Yes	CBCS:2021 ECS:2021	2022	20
PHD	PhD	2003	CBCS : Yes ECS: Yes	CBCS:2017 ECS:2003	2022	70

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Metric 1.1.2 (Syllabus Revision)			
S.No.	**Course Code**	**Course Name**	**Year of Revision**
1	18B11BT312	Biochemistry	2023-24
2	18B11BT313	Thermodynamics & Chemical Processes	2023-24
3	18B17BT372	Biochemistry Lab	2023-24
4	18B17BT372	Thermodynamics & Chemical Processes Lab	2023-24
5	19B11CI	Problem Solving and Programming	2023-24
6	19B17CI	Problem Solving and Programming Lab	2023-24
7	18B11BT411	Cell Biology and Culture Technologies	2023-24
8	18B11BT412	Molecular Biology	2023-24
9	18B11BT414	Microbiology	2023-24
10	18B17BT471	Cell Biology and Culture Technologies lab	2023-24
11	18B17BT472	Molecular Biology Lab	2023-24
12	18B11BT511	Bioprocess Engineering	2023-24
13	18B11BT512	Genetic Engineering	2023-24
14	18B11BT513	Immunology	2023-24
15	18B17BT571	Bioprocess Engineering Lab	2023-24
16	18B17BT573	Immunology Lab	2023-24

17	18B11BT611	Downstream Processing	2023-24
18	18B17BT671	Downstream Processing Lab.	2023-24
19	18B11BI611	Machine Learning for Bioinformatics	2023-24
20	18B11BI612	Computer Aided Drug Design	2023-24
21	18B17BI671	Machine Learning for Bioinformatics lab	2023-24
22	18B17BI672	Computer Aided Drug Design Lab	2023-24
23	18B17BI673	Advanced Algorithms for Bioinformatics Lab	2023-24
24	23B11GE411	Environmental Studies	2023-24
25	21MS1MB212	Microbial Genetics and Physiology	2023-24
26	18B11CE313	Building Materials and Construction	2023-24
27	18B11CE412	Fluid Mechanics	2023-24
28	18B11CE312	Surveying	2023-24
29	18B11CE414	Water Resource Engineering	2023-24
30	18B11CE612	Design of Steel Structures	2023-24
31	NA	Analog and Digital Communication	2023-24
32	NA	Analog and Digital Communication Lab	2023-24
33	NA	Microprocessors and Microcontrollers	2023-24
34	NA	Microprocessors and Microcontrollers Lab	2023-24
35	18B11EC513	Electromagnetic Waves	2023-24

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36	NA	Digital Signal Processing	2023-24
37	NA	Digital Signal Processing Lab	2023-24
38	NA	VLSI Design	2023-24
39	18B11EC611	Wireless and Data Communication	2023-24
40	21B1WPH831	Biosensors	2023-24
41	22B1WPH731	Computational Nanotechnology	2023-24
42	18B11PH111	Engineering Physics-I	2023-24
43	18B11PH211	Engineering Physics-II	2023-24
44	18B11PH112	Basic Engineering Physics - I	2023-24
45	18B1WPH212	Bioinstrumentation Techniques	2023-24
46	18B1WPH531	Science and Technology of Materials	2023-24
47	18B1WPH532	Applied Materials Science	2023-24

Prof. Ashok K. Gupta
(Dean A& R)

Jaypee University of Information Technology Waknaghat Dean (A&R)

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY IQAC WAKNAGHAT

BIOCHEMISTRY

COURSE CODE: 18B11BT312

COURSE CREDITS: 3

ELECTIVE/CORE: CORE

L-T-P: 3-0-0

Pre-requisite: Cell Biology, Chemistry

Course Objectives:

1. To provide an understanding of the basic bio-molecule structures, their origin and their involvement in life processes.
2. To provide an insight into the main metabolic pathways of living organisms and their integration with other biological pathways.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	to understand the structural fundaments of various biochemical present in organisms.	Familiarity
CO-2	to understand the principles of structural-functional relationship of biomolecules.	Familiarity
CO-3	to understand primary metabolic pathway of energy production in organism.	Assessment
CO-4	to understand the regulation of various metabolic pathway of organism.	Assessment
CO-5	to integrate knowledge of biochemical pathways for understanding the various disorders and their rectification.	Usage

Course Contents:

Unit	Contents	Lectures required
1	**Bio-molecules and their bi role in metabolism:** Biological importance structural polysaccharides, Properties and function of lipids in fat metabolis enzymatic regulation in metabolism, Importance of nucleic acids in liv system,	8
2	**Carbohydrate Metabolism:** Introduction to Intermediary metabolism, central role of glucose in metabolism of plants, animals. Glycolysis, reactions of glycolysis. Fermentation: anaerobic fate of pyruvate. Regulation of glycolytic pathway. Overview of TCA, Metabolic sources of Acetyl-Coenzyme A. TCA Cycle inhibitors. Gluconeogenesis and its Regulation, Glyoxalate Cycle reactions. Glycogen metabolism, Synthesis and breakdown, glycogen synthetase and phosphoryllase and their regulation, Glycogen Storage diseases.	8
3	**Lipid Metabolism:** Biosynthesis of lipids, fatty acid synthesis and its regulation, biosynthesis of triacylglycerols, phospholipids. Lipid digestion, absorption and transport. Fatty acids oxidation, oxidation of saturated, unsaturated fattys in mitochondria, transport of fatty acids to mitochondria. Ketone Bodies synthesis and degradation.	8
4	**AminoAcids metabolism:**Overview; assimilation of inorganic nitrog in biomolecules.Positive and negative nitrogen balance, Protein calc	7

	malnutrition, Kwashiorkor and Marasmus. Glucogenic and ketogenic amino acids, catabolic pathways for the 20 standard amino acids; Metabolism of one-carbon units. Disorders of amino acid metabolism:Phenylketonuria, Alkaptonuria, Maple syrup urine disease etc.	
5	**Purine andPyrimidinemetabolism:** Biosynthesis of IMP; pathwa from IMP to AMP and GMP; conversion to triphosphates; regulation purine nucleotide biosynthesis, salvage pathways. Inhibitors of nucleotide metabolism and their use as anti bacterial / anticancer drugs.Degradation of purine and pyrimidine nucleotides. Disorders of nucleotide metabolism: LeschNyhan syndrome, Gout, SCID, Adenosine deaminase deficiency.	**7**
6	**Vitamins:**Structure of fat soluble vitamins A, D, E & K. Water soluble vitamins, their co- enzyme forms and deficiency disorders, Thiamine, riboflavin, pantothenic acid, niacin, pyridoxine, biotin, cobalamine, folic acid and ascorbic acid.	**4**
	Total	**42**

Suggested Text Book(s):

1. Lehninger Principles of Biochemistry Cox, M.M. and Nelson, D.L. and Lehninger A. L. 4th edition.
2. Biochemistry- J.M. Berg, J.L.Tymoczko, and LubertStryer; 5th edition W.H. Freeman and Company, New York, USA.
3. Voet, D. and Voet, J.G.(2011), 4th edition. Biochemistry, John Wiley & Sons, Inc. USA.
4. Robert Murray, David Bender, Kathleen M. Botham, Peter J. Kennelly, Victor Rodwell, P. Anthony Weil Rodwell, (2012) 29th edition. Harper's Illustrated Biochemistry, Lange, McGrawHill.

EvaluationScheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment, Quizzes & Attendance

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Average
CO1	3	1	2	2	-	1	1	-	-	1	-	3	**1.17**
CO2	2	2	2	1	1	3	1	1	-	2	1	3	**1.58**
CO3	2	2	2	1	1	2	2	1	1	1	2	2	**1.58**
CO4	2	2	2	2	2	1	2	-	2	2	2	2	**1.75**
CO5	2	2	2	2	1	2	2	2	1	2	2	3	**1.92**
Average	**2.20**	**1.80**	**2.00**	**1.60**	**1.00**	**1.80**	**1.60**	**0.80**	**0.80**	**1.60**	**1.40**	**2.60**	

Thermodynamics and chemical processes

COURSE CODE:18B11BT313

COURSE CREDITS: 4

CORE/ELECTIVE: CORE

: 3-1-0

Pre-requisite: General Chemistry and Basic Physics

Course Objectives:

1. Learn the concept of thermodynamics, bioenergetics.
2. Learn Reaction kinetics, mass and energy balances as well as fluid flow mechanics.
3. Learn heat transfer and mixing equipments.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Use of correct Thermodynamical terms to describe &analyze phenomena/problems in physico-chemical processes	Familiarity
CO-2	Understanding the concept of thermodynamics for biological processes as in bioenergetics.	Assessment
CO-3	Understanding basic reaction theory and general reaction kinetics for biological systems in terms of Michaelis – Menten Kinetics.	Assessment
CO-4	To familiarize basic principles for macroscopic analysis of cell growth and product formation. Calculation of nutrient and oxygen requirements during various fermentation processes for both material balances and energy balances.	Familiarity and Usage
CO-5	To know the flow behaviour of different fermentation fluids, their Classification, flow curves for Non- Newtonian fluids with examples from biotechnology as well as Rheological properties of fermentations Broths.	Assesment
CO-6	Understanding the principles governing heat transfer with applications in bioprocess design. Modes of heat transfer, Heat - Transfer equipmentsand Heat transfer coefficients.	Familiarity and Usage

Course Contents:

Unit	Contents	Lectures required
1	**Introduction andfundamentalconceptsofthermodynamics:** Processes, Components (single/multi), Phases(G/L/S), ideality, Concept of continuum for biological processes, Entropy, enthalpy, Gibbs Free energy, Specific heats /heat capacity. Laws of Thermodynamics and its applications.	3
2	**Bioenergetics (Biological Thermodynamics):** Principles of bioenergetics. Energetics of metabolic pathways by metabolic flux, Energy coupling (ATP and NADH), Biological oxidation and reduction reactions. Understanding thequantitative relationships among free energy, enthalpy and entropy. Concept of G_o, $G_{o'}$ to biochemical reactions, Endergonic and exergonic reactions, Catabolic and anabolic mechanisms.	5
3	**Homogenoeus Reactions/Reaction kinetics:** Basic reaction theory, Reaction Thermodynamics, Calculation of reaction rates from	6

	experimental data, General reaction kinetics for biological systems, Michaelis – Menten Kinetics, Kinetics of enzyme deactivation.	
4	**MaterialBalances ofBiochemicalProcesses:** Aspects of metabolic stoichiometry, principlesfor macroscopic analysis of cell growth and product formation. Calculation of nutrient and oxygen requirements during various fermentation processes. Analysis of batch culture of growing cells. Stochiometric coefficients for cell growth, Elemental and electron balances, Biomass yield, Product stochiometry, Theoretical oxygen demand, Thermodynamic maximum biomass and product yields.	**7**
5	**Energy Balancesof BiochemicalProcesses:** Stochiometric and energetic analysis of cell growth and product formation, elemental study of energy flow within the living systems. Enthalpy calculations for reactive and nonreactive biological processes, Heat of reaction for the process of biomass production, Thermodynamics of microbial growth, Energy balance equation for aerobic and anaerobic cell culture and various other fermentation processes.	**7**
6	**Fluid mechanics:** Flow behavior of different fermentation fluids. Introduction, Classification of fluids, Newton's Law of viscosity, flow curves for Non- Newtonian fluids with examples from biotechnology, Reynolds number, Boundary layer separation, Fluids in motion, flow patterns– Laminar, turbulent and transition flow, Rheological properties of fermentations Broths, properties of Fluids (Viscosity, Surface Tension), Factors affecting broth viscosity, cell morphology.	**7**
7	**Heat Transfer:** Principles governing heat transfer with applications in bioprocess design. Modes of heat transfer, Heat - Transfer equipments. Analogy between Heat and momentum transfer, Heat transfer between fluids, Heat transfer coefficients, Design equations for heat transfer systems and its application.	**7**
	Total lectures	**42**

Suggested Text Book(s):

1. Heat Thermodynamics and Statistical Physics: By B. Lal, N. Subramanyam and P. S. Hemne
2. Biochemistry : By Jeremy M. Berg, John L. Tymoczkao, L. Stryer; .
3. Bioprocess Engineering Principles: By P.M. Doran.

Suggested Reference (s):

1. Thermodynamics: A Core Course By: R. C. Srivastava, S.K.Saha and A.K.Jain
2. Engineering Thermodynamics, By: Lynn D. Russsell and George A. Adebiyi
3. Lehninger's Principles of Biochemistry 4th Editoin : By D L Nelson, Cox Lehninger
4. Himmelblau, D.M., "Basic Principles and Calculations in Chemical Engineering", 6th ed.

Other useful resource(s):

1. Link to NPTEL course contents:https://nptel.ac.in/courses/106104019/
2. Link to topics related tocourse:
   i. https://nptel.ac.in/courses/102104063
   ii. https://nptel.ac.in/courses/102106069/
   iii. https://nptel.ac.in/courses/102106026/

EvaluationScheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment, Quizzes&Attendance

Course Outcomes (COs) contribution to the ProgrammeOutcomes(POs)

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	Average
CO1	3	3	2	-	2	-	1	1	-	1	2	-	1.25
CO2	-	2	-	2	2	1	-	1	2	3	-	-	1.08
CO3	2	3	-	2	3	1	1	1	3	3	3	2	2
CO4	2	-	3	3	3	1	-	1	2	-	3	2	1.66
CO5	3	2	3	-	2	-	1	1	-	2	-	-	1.16
CO6	3	3	-	3	2	-	1	1	3	2	1	3	1.91
Average	2.1	2.1	1.33	1.66	2.33	0.5	0.66	1	1.66	1.8	1.5	1.1	

BIOCHEMISTRY LAB

COURSE CODE: 18B17BT372

COURSE CREDITS: 1

CORE/ELECTIVE: CORE

L-T-P: 0-0-2

Pre-requisite: Cell biology, basic chemistry

Course Objectives:

1. The objective of this course is to familiarize the students with laboratory techniques related to identification and quantification of various biomolecules required to meet the metabolic needs of body.
2. To develop basic practical biochemical skills for the handling and analysis of biomolecules.

Course Outcomes:

S.N.	Course Outcomes	Level of Attainment
CO I	to familiarize with introduction to basic biochemistry laboratory practices and safety.	Familiarity
CO II	to calculate different identities in terms of molarity, normality and independently handle different instruments utilized in a biochemistry lab.	Familiarity
CO III	to identify qualitatively the biomolecules in given solution.	Assessment
CO IV	to estimate the concentration of a biomolecules in given solution.	Assessment
COV	to understand ethics, team work and discipline	Usage

List of Experiments

S.No.	Description	Hours
1	Basic guidelines for safety measures to avoid hazards in biochemistry lab.	1
2	To prepare buffer solution of varying pH by using Henderson-Hasselbalch equation and pH meter.	1
3	To identify and classify sugars into various categories based upon qualitative methods.	2
4	To determine concentration of carbohydrates by Anthrone method: a quantitative approach.	2
5	To identify a given sample for protein by using qualitative methods.	2
6	To estimate concentration of proteins by quantitative methods: Biuret method, Lowry's method, and Bradford's method.	2
7	To isolate plasma and serum from blood and visualize different proteins present in serum sample by SDS PAGE technique.	2
8	To perform the isoelectric precipitation of casein present in milk.	2
9	To determine presence of lipid in a given sample through qualitative method.	2

10	To estimate the amount of cholesterol present in the serum sample by ZAK's method.	2
11	To quantify the concentration of nucleic acid through spectrophotometer.	2
12	To determine uric concentration in a given serum sample.	2
13	To determine blood sugar concentration in a serum sample.	2
	Total Lab hours	**24**

Suggested books /Resources:

1. Lab manual
2. An Introduction to Practical Biochemistry - David T Plummer
3. Practical Biochemistry, Principles and Techniques - Keith Wilson and John Walker
4. Practical Biochemistry-Geetha Damodaran K
5. E-portal of V-labs by Amrita University (vlab.amrita.edu)

Evaluation Scheme:

Mid Term Test	20
End Term Test	20
Teacher Assessment (Based on day to day work, performance in experiments, lab notebook etc.)	60
Total	100

Course Outcomes (COs) contribution to the Programme Outcomes (POs):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Average
CO1	3	1	2	2	1	1	1	-	-	1	-	3	**1.25**
CO2	2	3	2	1	2	1	1	1	-	2	3	3	**1.75**
CO3	2	2	2	2	1	2	2	1	1	1	2	2	**1.67**
CO4	2	2	2	2	2	1	2	-	2	2	2	2	**1.75**
CO5	1	1	2	1	1	2	1	3	1	2	2	3	**1.67**
Average	**2.00**	**1.80**	**2.00**	**1.60**	**1.40**	**1.40**	**1.40**	**1.00**	**0.80**	**1.60**	**1.80**	**2.60**	

Thermodynamics and chemical processes Lab

COURSE CODE:18B17BT373

COURSE CREDITS: 1

CORE/ELECTIVE: CORE

: 0-0-2

Pre-requisite: None

Course Objectives:

1. Learn enthalpy calculations
2. Learn to calculate enzyme activity
3. Analyzing the Michael Menton kinetic constants.
4. Measurement of viscosity and surface tension of various biological liquids

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO1	Able to familiar with the various experiments involved with the flow of heat in terms of water equivalent/heat capacity, enthalpy calculation of various biological compounds as well as energy calculation of different food items.	Familiarity
CO2	Able to correlate the activity with the thermodynamic parameters: ΔH, ΔG, ΔS, and Cp	Assesment
CO3	To understand the variation of activity of enzymes with different physical parameters as pH, Temp. and concentration	Assesment
CO4	Able to correlate the chemical processes with reaction kinetics as well as Michael - Menton kinetics	Usage
CO5	Able to enhance practical skills related to all the measurements of different parameters of liquids as viscosity, surface tension.	Usage
CO6	Able to enhance practical skills related to all the measurements of fluid flow mechanics in order to check the flow patterns with the help of Reynolds number.	Familiarity

List of Experiments

S.No	Description	Hours
1	To determine Heat Capacity or Water equivalent of given thermos/ Dewar flask used as calorimeter	2
2	To determine enthalpy/heat of solution of some biological important compound	2
3	To determine heat of neutralization of strong acid and strong base media	2
4	Determination of the thermodynamic parameters: ΔH, ΔG, ΔS, and Cp of the protein lysozyme	2
5	To measure the energy in different food samples.	2
6	To determine the activity of amylase by spectrophotometric method.	2
7	To study the effect of different temperature on amylase activity	2
8	To study the effect of different pH on amylase activity	2
9	To calculate Km and Vmax of the amylase	2
10	To determine viscosities of various fluids: Glucose, Biological fluids and culture.	2
11	To determine surface tension of various fluids: Glucose, Biological fluids and Culture.	2
12	To study the flow pattern by changing the RPM.	2
Total Lab hours		**24**

Suggested/Resources:

1. Lab Manual : \\172.16.73.6/BT/BI
2. https://www.bvrit.ac.in/Freshman_Lab_Manuals/freshman_engineering_chemistry/Engineering%20Chemistry.pdf

EvaluationScheme:

1	Mid Sem. Evaluation	20 Marks
2	End Sem. Evaluation	20 Marks
3	Lab Assessment	60 Marks
	Total	100 marks

Course Outcomes (COs) contribution to the ProgrammeOutcomes(POs)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Average
CO1	3	2	2	1	2	1	1	--	-	-	2	-	**1.16**
CO2	2	3	3	3	3	-	-	1	2	2	2	-	**1.83**
CO3	3	3	3	3	3	-	-	2	3	1		2	**1.9**
CO4	1	3	1	3	1	-	1	1	2	-	2	-	**1.25**
CO5	1	3	1	1	1	1	-	-	2	1	2	-	**1.08**
CO6	3	3	3	3	3	-	-	-	3	2	3	-	**1.91**
Average	**2.5**	**2.83**	**2.83**	**2.83**	**2.83**	**1**	**1**	**1.33**	**2.4**	**1.5**	**2.2**	**2.0**	

Cell Biology & Cell Culture Technologies

COURSE CODE:18B11BT411

COURSE CREDITS: 4

ELECTIVE/CORE: CORE

: 3-1-0

Pre-requisite: Basic Understanding of Biology

Course Objectives:

1. The objective of this course is to introduce the student to basic cell biology, animal & plant tissue culture techniques and their application.
2. In cell biology component, the course is designed to understand fundamental concepts of cell and how it functions at the cellular level.
3. In animal tissue culture component, the course is designed to impart an understanding pertaining to why one needs animal cell cultivation, the basic ATC set-up, the biology of cultured cells, techniques to establish and propagate cell cultures of animal origin.
4. In plant tissue culture component, the course is designed to develop an understanding about the morphology of plant cell and its utilization through different techniques of plant tissue culture for propagation, conservation and production of different plant species and their products

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Successful student will understand fundamental concepts of cellular function.	Familiarity
CO-2	Be able to critically analyze, the scientific evidence underlying current understanding of cellular processes.	Assessment& Analytical Skills
CO-3	To enable students for applying the knowledge about basic techniques of plant tissue culture.	Technical Skills
CO-4	They will learn the strategies for analyzing, upscaling and commercialization of plant based products.	Technical Skills
CO-5	Basic understanding of animal tissue culture, Maintain aseptic condition, primary and continuous culture of cell lines, suspension and adherent cells, cryopreservation and revival of cell lines.	Awareness
CO-6	To understand functional assay at cellular level, cell morphology and survival, immunolabeling.	Analytical & Technical Skills

Course Contents:

Units	Contents	Lectures required
1	Introduction to the cell Prokaryotic and Eukaryotic cell; Animal and Plant cell, Structure of cell, cellular organelles and their structure and function. Biological membranes – Overview of Membrane structure and function - Structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active transport, membrane pumps, Protein Sorting, Intracellular Vesicular Traffic and regulation of intracellular transport, electrical properties of membranes.	3

2	Cell signalling - Hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors, signal transduction pathways, second messengers and regulation of signaling pathways. The Cytoskeleton, Cell Cycle and Programmed Cell Death, Cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, integrins, neurotransmission and its regulation. Methods and techniques - Manipulating proteins, DNA and RNA. Visualizing cells.	**8**
3	Plant structure, growth and development Introduction, definitions and history of plant cell and tissue culture Organization of tissue culture laboratory Cellular totipotency and cell differentiation, factors affecting differentiation	**8**
4	Isolation of single plant cells, suspension cultures, types of suspension cultures, Measurement of the growth in suspension cultures, Assessment of Viability of the cultured cells, bioreactors used for plant cell cultures	**8**
5	Type of cultures and their applications: Direct and indirect methods of culture; seed culture, embryo culture, organ culture, callus culture, somaclonal variation and applications	**7**
6	Somatic embryogenesis Micro-propagation and its applications, Advances in acclimatization of tissue cultured plants. Haploid and triploid production and applications Protoplast isolation and fusion and application Production of virus free plants through cell and tissue culture	**4**
7	Secondary metabolite production and bioconversions /biotransformation through plant cell cultures and plant stem cells	**4**
8	Introduction to human anatomy and Physiology, An overview of different Systems, organs and tissues of human body. Basics terms and definitions, historical background, Importance of animal cell culture technology, laboratory facilities-design, equipments and safety parameters, waste disposal in a cell culture set-up. Aseptic techniques for animal cell cultivation.	
9	Cell culture technology: Basic requirement for growing animal cells - Cell culture reagents, media, media supplements, media preparation and sterilization, Defined-Undefined media, Complete-Incomplete media, Importance of Serum and Serum free Media, culture conditions. Maintenance of cell culture: Culturing, sub- culturing, passaging.	
10	Studying biological system using cell culture techniques: Functional assays based on cell culture: Cell morphology, Quantitation, Growth pattern, Cytotoxicity assays, Study of Cell Death: senescence, apoptosis and necrosis, Cell proliferation, Cell viability measurements, FISH. Immunolabeling of cells to study molecular expression pattern– Microscopy, Flow cytometry, Immunohistochemistry, etc. Application of Cell culture Technology Hybridoma technology for monoclonal antibody production.	
Total Lectures		**42**

Suggested Text Book(s):

1. Michael Butler, “Animal Cell Culture and Technology”, BIOS Scientific Publishers
2. John R.W. Masters, “ Animal Cell Culture-A Practical Approach”, Oxford University Press
3. R. Ian Freshney, “Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications”.

4. Introduction to Plant biotechnology H S Chawala
5. Plant tissue culture: theory and Practice S.S.Bhojwani and M K Razadan
6. Plant tissue culture S.S.Bhojwani and M K Razadan
7. Elements of Biotechnology P K Gupta
8. Plant cell and tissue culture Narayan Swamy

Suggested Reference Book(s)

1. Molecular Biology of the Cell: by Bruce Alberts, 4th Edition 2002.
2. Lodish, et al. Molecular Cell Biology. 5th ed. New York, NY: W.H. Freeman and Company, 2003.

Other useful resource(s):

1. Link to NPTEL course contents:https://nptel.ac.in/
2. https://nptel.ac.in/courses/102103012/
3. https://nptel.ac.in/courses/102104059/
4. https://nptel.ac.in/courses/102103016/

EvaluationScheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment, Quizzes&Attendance

Course Outcomes (COs) contribution to the ProgrammeOutcomes(POs)

Course outcomes (Cell Biology & Cell Culture Technologies)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	2	2	2	2	2	2	2	1	1	1	2	2	**1.75**
CO-2	2	2	2	2	2	2	1	1	1	1	2	2	**1.66**
CO-3	3	3	3	3	2	1	2	1	1	1	2	2	**2**
CO-4	3	3	3	3	2	1	2	1	1	1	2	2	**2**
CO-5	2	2	2	2	2	2	1	1	1	1	2	2	**1.66**
CO-6	3	3	3	3	2	2	1	1	1	1	2	2	**2**
Average	**2.5**	**2.5**	**2.5**	**2.5**	**2**	**1.6**	**1.5**	**1**	**1**	**1**	**2**	**2**	

Cell Biology & Cell Culture Technologies Lab

COURSE CODE: 18B17BT471

COURSE CREDITS: 1

CORE/ELECTIVE: CORE

L-T-P: 0-0-2

Pre-requisite: Basic Biology

Course Objectives:

4. The objective is to familiarize students with the various Cell biology and cell culture techniques.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO1	To understand, design, analyze and interpret experiments related to cell biology and link practical knowledge to theoretical.	Familiarity
CO2	To understand, design, analyze and interpret experiments related to Animal cell culture and link practical knowledge to theoretical	Analytical Skills
CO3	To understand, design, analyze and interpret experiments related to Plant tissue Culture and link practical knowledge to theoretical	Analytical Skills
CO4	Able to perform cell count using haemocytometer and maintain aseptic condition.	Technical Skills
CO5	To understand team work, ethics and work discipline.	Use

List of Experiments

S.No	Description	Hours
1	Laboratory Safety and To Study various parts of compound microscope	2
2	To prepare and study temporary or permanent slides of mitosis, meiosis, stem and root cells/sections and differentiate the plant cells and animal cells	2
3	To study the effect of salinity on biological membranes of cells	2
4	To prepare the blood smear slides, visualization and cell count of the components of blood using light microscopy	2
5	Introduction to ATC, Fluid Transfer using aseptic technique, Preparation of stock media from powder and filter sterilization	2
6	Sub culturing, Cryopreservation and Revival of Cell culture	2
7	Assessment of cytotoxicity using MTT assay/Biological screening of herbal/synthetic molecules.	2
8	Introduction to various equipments and their working in plant tissue culture lab setup and Preparation of stocks solutions, hormones culture medium	2
9	Establishment of Callus and Suspension cultures and measuring cell	2

	growth	
10	Plant regeneration from callus and somatic embryogenesis	2
11	Microproapagation of different plant species by axillary shooting	2
12	Hardening or Acclimatization of cultured plantlets to field conditions	2
13	Meristem culture for virus elimination. Anther and pollen culture for haploid production	2
14	Protoplast isolation and determining the protoplast viability	2
Total Lab hours		**28**

Suggested/Resources:

1. Lab Manual
2. Plant Cell and Tissue Culture - A Tool in Biotechnology: Basics and Application (Principles and Practice) by: Karl-Hermann Neumann publisher: Springer
3. Tissue Culture for Plant Propagators by R.A. de Fossard
4. Plant Culture Media, Volume 1,Formulations and Uses by E.F. George
5. Micropropagation: Technology and Application by P.C. Debergh and R.H. Zimmerman Kluwer Academic Publishers
6. Virtual Lab. (http://vlab.amrita.edu)

EvaluationScheme:

1	Mid Sem. Evaluation	20 Marks
2	End Sem. Evaluation	20 Marks
3	Lab Assessment	60 Marks
	Total	100 marks

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Average
CO1	3	3	3	3	2	2	1	1	1	1	1	1	**1.83**
CO2	3	3	3	3	3	1	1	1	1	1	1	3	**2.00**
CO3	3	3	2	3	2	3	2	1	1	1	2	1	**2.00**
CO4	3	3	3	2	3	2	1	1	1	1	1	1	**1.83**
CO5	2	2	3	3	3	3	1	1	1	1	1	1	**1.83**
Average	**2.8**	**2.8**	**2.80**	**2.80**	**2.60**	**2.20**	**1.20**	**1.00**	**1.00**	**1.00**	**1.20**	**1.40**	

Molecular Biology

COURSE CODE: 18B11BT412

COURSE CREDITS: 3

CORE/ELECTIVE: CORE

L-T-P: 3-0-0

Pre-requisite: Fundamental biology Cell biology, Biochemistry

Course Objectives:

1. This course covers the basic principles of molecular biology and its practical applications.
2. The main objective of the course is to equip students with a detailed knowledge of molecular biology in the context of human diseases.
3. To prepare students for future research and also enhance their career prospects in the expanding life sciences sector including public-funded research laboratories or private industry.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	To understand the basic structures of various genetic materials of cells.	Familiarity
CO-2	To understand the structural-functional relationship of genetic material with other biomolecules of cells.	Familiarity
CO-3	To understand foundational genetic processes of molecular biology.	Familiarity
CO-4	To Understand how molecular machines within the cell are regulated so that they can accurately copy, repair, and interpret genomic information.	Assessment
CO-5	To integrate knowledge of molecular biology principles for understanding the various disorders and their rectification.	Usage

Course Contents:

Units	Contents	Lectures required
1	**Basics of Molecular Biology:** Why Molecular Biology? How molecular biology came about? Major events in molecular biology, Nucleic acids; DNA and RNA and their structure and function in detail, Protein structure, basic functions, DNA-Protein interactions, molecular details of protein purification , DNA structures and their implication in diseases	4
2	**Molecular Biology Techniques and their Applications:**Polymerase chain reaction, DNA sequencing, Western blot Southern and northern blotting, DNA foot-printing, Immuno-fluorescence	8
3	**DNA replication:**Avery Mcleod and Mccarty experiments, Hershey Chase Experiment, Maintenance of DNA sequence, Linking number of DNA, Forces which stabilize the DNA secondary structure, DNA polymerase,Replication process: Initiation, Extension, leading strand, lagging strand, Dynamics at the replication fork, termination, DNA replication protein,DNA replication regulation: Eukaryotes and prokaryotes	8
4	**DNA transcription and RNA processing:**History, RNA polymerases, Major steps in transcription: Pre-initiation, Initiation, promoter, elongation,termination mRNA splicing mechanisms, rRNA modifications	8

	Reverse transcription, Transcription inhibitor, Post-transcription modification	
5	**Translation:** Basic mechanism-Eukaryotic and Prokaryotic translations,composition of Ribosomes, Genetic codes; Role of tRNA in translation, mRNA translation mechanisms: initiation, elongation and termination process	**8**
6	**Gene regulation and Post-translational modification:**Why cells need to regulate genes, control of gene regulation, Operon (TrpOperon,Lac operon), Regulatory proteins; Helix turn-helix, Leucine Zipper, Zinc finger; Post translational modifications, Effects of post-translational modifications, Why protein post-translational modification are made , Types of post-translational modifications, Methods used to study post-translational modifications	**6**
Total Hours		**42**

Suggested Text books:

1. Stryer, Lubert (2002). Biochemistry; Fifth edition. W. H. Freeman and Company.
2. Lehninger "Principles of Biochemistry".

Suggested Reference books:

1. Lodish H, Berk A, Zipursky LS, Matsudaira P, Baltimore D, Darnell J (2000). *Molecular Cell Biology*. W. H. Freeman and Company
2. Lewin's GENES XI
3. Molecular Cell Biology Damell Jr. J., Lodish, H and Baltimore, D. Scientific American Inc., New York
4. Neill, Campbell (1996). Biology; Fourth edition. The Benjamin/Cummings Publishing Company. p. 309,310. ISBN 0-8053-1940-9.

EvaluationScheme:

Exam	**Max. marks**	**Duration**	**Course Covered**
T1 Test	15	1 hr.	Unit 1-2
T2 Test	25	1.5 hrs.	Unit 1-4
End Term Test	35	2 hrs.	Whole Syllabus
Teacher Assessment(Based on Assignments, quizzes etc.)	25	Whole Semester(Quiz, short presentations)	Inform class time to time
Total	**100**		

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Average
CO1	3	1	1	1	1	1	1	1	0	0	0	2	1.00
CO2	1	2	3	1	1	1	1	0	0	2	2	2	1.33
CO3	1	2	2	2	1	2	1	1	1	2	2	1	1.50
CO4	2	2	2	3	1	1	3	1	1	1	1	3	1.75
CO5	1	2	3	2	2	2	1	2	2	2	2	3	2.00
Average	1.60	1.80	2.20	1.80	1.20	1.40	1.40	1.00	0.80	1.40	1.40	2.20	

Molecular Biology Lab

COURSE CODE: 18B17BT472

COURSE CREDITS: 1

CORE/ELECTIVE: CORE

L-T-P: 0-0-2

Pre-requisite: Fundamental biology Cell biology, Biochemistry

Course Objectives:

1. The objective of this course is to familiarize the students with laboratory techniques related to isolation and quantification of various biomolecules required to maintain the cellular processes at molecular level.
2. To develop basic practical skills for the handling and analysis of biomolecules.

Course Outcome:

S.N.	Course Outcomes	Level of Attainment
CO1	Able to understand the fundamental procedures of isolation, visualization of various biomolecules from cellular or tissue organization.	Familiarity
CO2	Able to understand, and perform, molecular biology techniques accurately and safely.	Familiarity
CO3	Able to isolate, quantify and visualize various biomolecules having application in the field of biotechnology.	Assessment
CO4	Able to report experimental results in a standard written format and to write coherently and persuasively about conclusions from such results and their significance.	Assessment
CO5	Able to interpret experimental results and conclusions for their understanding various biological processes and abnormalities.	Usage

List of Experiments

S.No.	Description	Hours
1	Good Lab Practice and Calculations of molarity and normality of the solutions	2
2	To isolate genomic DNA from *E. coli* (DH5-α) using heat boiling method.	2
3	Quantification of DNA concentration and purity by nanodrop method.	2
4	To perform agarose gel electrophoresis.	2
5	To isolate *E. coli* (DH5-α) genomic DNA using phenol chloroform method.	2
6	Isolation of genomic DNA from human blood sample.	2
7	To isolate plant genomic DNA using CTAB method.	2
8	To isolate *E. coli* (DH5-α) plasmid DNA by alkaline lysis method.	2
9	To isolate RNA from bacterial cell.	2
10	Introduction to Polymerase Chain Reaction and to amplify gene using genomic DNA of *E. coli*.	2
11	To perform restriction digestion using *E. coli* plasmid DNA.	2
12	To separate serum and plasma proteins from human blood.	2
13	To visualize human serum and plasma proteins using SDS-PAGE technique.	2
	Total	**26**

Suggested Resource(s):

a. Lab manual
b. Michael R. Green and Joseph Sambrook. Molecular Cloning, A Laboratory Manual. fourth edition.
c. Keith Wilson and John Walker (2010).Principles and Techniques of Biochemistry and Molecular Biology, seventh edition.

Evaluation Scheme:

Mid Term Test	20
End Term Test	20
Teacher Assessment (Based on day to day work, performance in experiments, lab notebook etc.)	60
Total	100

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

Course outcomes (Molecular Biology Lab)	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**Average**
CO1	3	2	3	2	3	1	1	3	3	2	3	3	**2.4**
CO2	3	2	2	3	2	1	-	2	3	2	2	2	**2.18**
CO3	3	3	1	3	3	1	-	1	3	1	3	3	**2.27**
CO4	2	2	1	3	2	1	-	1	3	1	2	2	**1.8**
CO5	2	1	1	2	2	1	-	1	3	1	2	2	**1.6**
Average	**2.6**	**2**	**1.6**	**2.6**	**2.4**	**1**	**1**	**1.6**	**3**	**1.4**	**2.4**	**2.4**	

Microbiology

COURSE CODE: 18B11BT414

COURSE CREDITS: 4

ELECTIVE/CORE: CORE

: 3-1-0

Pre-requisite: Knowledge of Biology (10+2)

Course Objectives:

1. To provide an understanding of the principles of microbiology and techniques that can serve as a platform for other courses built on microbiological concepts**.**
2. Scientific evaluation of role of microorganisms in various situations like health, industry, agriculture, environment.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Exhibit competence in fundamental aspects of Microbiology (e.g. Microbial Genetics, Classification, functions	Familiarity
CO-2	Scientifically test the hypothesis provided under a given situation involving microbial world and demonstrate practical skills in basic microbiological techniques	Assessment & Analytical Skills
CO-3	Designate vital role of the microorganisms in the environment and their association with human beings.	Awareness
CO-4	Analyze and interpret the experiments/pathways relevant to Microbes	Analytical & Technical Skills
CO-5	Retrieve and use cotemporary information related to microbial world.	Assessment & Analytical Skills

Course Contents:

Unit	Contents	Lectures required
1	**History of Microbiology:** Discovery of microbial world, A timeline with emphasis on Pasteur's experiments disproving spontaneous generation, Koch's postulates.	3
2	**Microbial diversity, taxonomy and phylogeny:** Taxonomic ranks, classificati systems (phonetic, numerical, phylogenetic), major characteristics used for classification (classical and molecular approaches), the three domain syste	6
3	**Methods in microbiology:** Pure culture techniques, theory and practice of sterilization, Principles of microbial nutrition, culture media and types (simple, complex, enriched, enrichment, selective & differential), replica plating techniques, Preservation of Cultures, Microscopy	6
4	**Growth of microorganisms:** Media & their types, Growth curve; Mathematical expression of exponential growth phase; Measurement of growth and growth yields; Synchronous growth; Continuous culture; Effect of environmental factors on growth. conditions on growth, preservation techniques	5
5	**Microbial metabolism:** Photosynthetic mechanisms, CO_2 fixation mechanisms, fermentation, anaerobic respiration	4

6	**Microbial Ecology and Extremophiles:** Carbon, sulphur and nitrogen cycles, Thermo & hyperthermophiles, alkaliphiles, acidophiles, halophiles, psychrophiles, radiophiles	3
7	**Pathogenic microbes and Control Measure :**(Bacteria, fungi, protozoa and viruses), host-pathogen interactions - defense mechanisms against microbes, control of microbes, antimicrobial agents (physical, chemical and biological), Bioterrorism	6
8	**Microbial genetics:** Types of mutations; UV and Chemical mutagenesis, Ames test for mutagenesis, Conjugation, Transformation, Transduction, plasmids, transposons, Operon Model, Bacterial genome with special reference to *E. coli*	5
9	**Industrial applications with case studies:** Biofertilizers, Biopesticides, Biofilms, Biosensors, Fermented foods and beverages, Medicines, Single cell protein.	4
	Total lectures	**42**

Suggested Text Books:

1. Prescott, Harley and Klein: Microbiology, 6th Edition, McGraw Hill 2005.
2. Gerard J. Tortura, Berdell R. Funke, and Christine L: Microbiology An Introduction: Case. 8th Ed., Pearson/Benjamin Cummings, 2004.
3. Pelczar, Chan and Krieg: Microbiology by; Tata McGraw Hill.

Suggested Reference Books:

1. Madigan, M.T., Martinko, J.M., Parker, J: Brock Biology of Microorganisms. 10th Edition.: Publisher: Prentice Hall 2003
2. Nester : Microbiology Study Guide McGraw Hill.
3. Black : Microbiology : Principles and Applications Prentice Hall

EvaluationScheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment, Quizzes & Attendance

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

Course outcomes (Microbiology)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	1	2	2	3	2	3	2	2	3	1	1	3	2.18
CO-2	3	3	3	2	2	2	2	2	3	2	2	3	2.4
CO-3	2	1	2	3	2	2	3	3	2	1	2	2	2
CO-4	2	2	2	3	3	3	2	2	3	2	1	3	2.3
CO-5	3	2	2	3	3	3	2	2	2	1	1	3	2.25
Average	2.2	2	2.2	2.8	2.4	2.6	2.2	2.2	2.6	1.4	1.4	2.6	

Bioprocess Engineering

COURSE CODE:18B11BT511

COURSE CREDITS: 4

CORE/ELECTIVE: CORE

L-T-P: 3-1-0

Pre-requisite: Thermodynamics and Chemical Processes, Microbiology, Biochemistry

Course Objectives:

1. Learn various bioprocess related terms and principles
2. Learn about microbial growth kinetics in various mode of fermentation
3. Learn about the principles and application of Mass transfer and Sterilization
4. Develop an understanding of important concepts and design aspects of bioreactors
5. Learn about the functioning of various bioreactors
6. Learn about the principle of scaling up and scaling down of bioprocesses

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Able to use correct biological terms to describe & analyze phenomena/ problems in bioprocesses	Familiarity
CO-2	Able to apply engineering principles to address issues in various bioprocesses	Assessment
CO-3	Able to analyze bacterial growth kinetics (homogeneous reaction) in batch /continuous/ Fed-batch reactor and sterilization	Assessment
CO-4	Able to understand and to solve problems related to bioprocess phenomena including mixing, Mass transfer and sterilization	Assessment
CO-5	To develop a strong foundation about bioreactor designs and their applications	Usage
CO-6	Able to understand the basis of bioprocess scale up and the related basic design calculations	Usage

Course Contents:

Unit	Contents	Lectures required
1	**Introduction:**Role of bioprocess engineer, Microbial process development, Quality control management, Fermentation Economics	3
2	**Kinetics of Microbial growth:**Batch culture, Kinetic implications of endogenous and maintenance metabolism. Continuous culture, Modifying continuous reactors: Chemostat with recycle and multistage Chemostat Systems. Modifying batch reactors: Fed- batch operation, Perfusion systems.	7
3	**Sterilization:**Design of batch and continuous sterilization processes, kinetics of thermal death of cells and spores.	2
4	**Mixing:**Mixingequipments, flow patterns in reactors, mixing mechanism, power consumption and shear properties of sparged and agitated vessels and various mixing agitators.	4
	Mass Transfer: Role of diffusion in bioprocessing, film theory, convective mass transfer, oxygen uptake in cell cultures. Oxygen transfer in fermenters:	

5	measuring dissolved-oxygen concentration, estimating oxygen solubility, mass transfer correlation, measurement of k_La, oxygen transfer in large vessels.	**7**
6	**Strain Improvement and Media Formulation:**Strain improvement of industrially important microorganisms, Media formulation industrial fermentations.	**5**
7	**Immobilized Cell Systems (ICS):** Immobilization and its limitations, Active and passive immobilization, applications of immobilized cell biocatalysts. Diffusional limitations in ICS. Bioreactor considerations.	**3**
8	**Bioreactor design and analysis:**Bioreactor configurations and its utilities, Analysis of ideal and non-ideal reactors. Multiphase reactors: packed-bed reactors, bubble-column bioreactors, fluidized bed bioreactors, trickle-bed reactors. Practical considerations for bioreactor construction, Bioreactors instrumentation and control. Bioprocess Considerations: Animal cell cultures & plant cell cultures	**6**
9	**Scale up and Scale down:**Scale up of bioprocesses and its difficulties. Scale up criteria for bioreactors based on oxygen transfer, power consumption and impeller tip speed. Scale down.	**5**
Total Lectures		**42**

Suggested Text Book(s):

1. Pauline M. Doran, “Bioprocess Engineering Principles”, 8th ed., Academic press, New York, 2003.
2. M.L. Shuler and F. Kargi, "Bioprocess Engineering--basic Concepts", 2nd Edn. Prentice-hall Of India Pvt Ltd (2008).
3. Peter F. Stanbury, Stephen J. Hall & A. Whitaker, "Principles of Fermentation Technology", Â Elsevier India Pvt Ltd. (2007).

Suggested Reference (s):

1. KlaasVan’t Riet, Johannes Tramper, “Basic Bioreactor Design”, 2nd ed., Marcel Dekker, Inc., New York, 1991.
2. Bailey and Ollis, “Biochemical Engineering Fundamentals”, 2nd ed., McGraw-Hill Book Company, New York, 1986.
3. MccabeL.Warren, Smith C. Julian and Peter Harriott, “Unit Operations of Chemical Engineering”, 6th ed., McGraw Hill International Edition, New York, 2001.
4. Abhilasha S. Mathuriya, “Industrial Biochnology” 1st ed., Ane Books Pvt. Ltd., New Delhi, 2009.

Other useful resource(s):

1. NPTEL Course Content:
   - i) Bioreactors by Prof. Suraish Kumar, IIT Madras https://nptel.ac.in/courses/102106053/
   - ii) Industrial Biotechnology by Prof. Debabrata Das, IIT Kharagpur…. https://nptel.ac.in/courses/102105058/
   - iii) Aspects of Biochemical Engineering by Prof. Debabrata Das, IIT Kharagpur https://nptel.ac.in/courses/102105064/
2. Link to topics related tocourse:
   - i) Mass Transfer by Prof. Bishnupada Mandal, IIT Guwahati https://nptel.ac.in/courses/103103034/13#

EvaluationScheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Unit 1-2
2	T-2	25	1.5 Hours	Unit 1-5
3.	T-3	35	2 Hours	Whole Syllabus
4.	Teaching Assessment	25	Entire Semester	Inform class time to time (Quizzes, Presentation, Assignments)

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

Course outcomes (Bioprocess Engineering)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	-	1	1	1	-	-	2	1	3	2	-	3	1.75
CO-2	3	2	2	1	-	-	-	1		1	-	3	1.86
CO-3	3	3	3	3	2	-	2	1	2	1	-	2	2.20
CO-4	3	3	3	1	-	-	-	1	2	1	-	1	1.88
CO-5	3	1	2	1	2	2	-	1	-	2	-	1	1.67
CO-6	3	3	3	3	-	2	2	1	3	1	2	2	2.27
Average	3.00	2.17	2.33	1.67	2.00	2.00	2.00	1.00	2.50	1.33	2.00	2.00	

Bioprocess Engineering Lab

COURSE CODE:18B17BT571

COURSE CREDITS: 1

CORE/ELECTIVE: CORE

L-T-P: 0-0-2

Pre-requisite: Microbiology Lab, Biochemistry Lab

Course Objectives:

1. Provide exposure to the students with hands on experience on various practices in Bioprocess Engineering.
2. Enable students to link the theoretical knowledge of bioprocess engineering with the experiments.
3. Learn how to operate bench scale fermentor
4. Learn how to determine various Monod's Kinetics parameter

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO1	Able to apply practical knowledge to understand the various important process engineering aspects involved in biotechnology industries	Familiarity
CO2	Able to design experiments and analyze various data related to various practices in bioprocess engineering	Assessment
CO3	Ability to apply theoretical concepts for data analysis and interpretation and their documentation	Assessment and Usage
CO4	Able to run fermenter and also to analyze their results	Usage
CO5	Able to understand and determine various growth kinetics parameters in a batch culture	Assessment and Usage
CO6	Able to work in a team to accomplish the experiments and to document the experiments properly in lab note books	Assessment

List of Experiments

S.No.	Description	Hours
1	Introduction of Lab and lab safety	1
2	Describe the various parts of the bench-top fermenter (bioreactor) along with their functions.	1
3	To determine the thermal death point of a microbial culture.	2
4	To determine the thermal death time of a microbial culture.	2
5	To estimate the reducing sugar concentration in a given sample using DNS method.	2
6	To estimate the sugar concentration in fresh and spent media using DNS method.	2
7	To establish the correlation between OD and dry cell weight.	2
8	To study the different phase of microbial growth.	2
9	To study growth kinetics parameters of *E. coli*. a) Specific growth rate (μ) h^{-1}	4

	b) Maximum specific growth rate (μ_m) h^{-1} c) Saturation constant (K_s) gm/l d) Growth yield coefficient ($Y_{x/s}$) gm cell/gm substrate. e) Productivity of biomass gm cell/litre/h.	
10	To study the effect of varying carbon substrate on specific growth rate	2
11	Determination of Volumetric mass transfer coefficient (K_La) using dynamic gassing out method (Virtual Lab)	2
12	Preparation of Immobilized yeast cells in calcium alginate beads	2
Total Lab hours		**24**

Suggested/Resources:

1. M.L. Shuler and F. Kargi, "Bioprocess Engineering--basic Concepts", 2nd Edn. Prentice-hall Of India Pvt Ltd (2008).
2. Lab Manual
3. Pauline M. Doran, “Bioprocess Engineering Principles”, 8th ed., Academic press, New York, 2003.
4. Peter F. Stanbury, Stephen J. Hall & A. Whitaker, "Principles of Fermentation Technology", Â Elsevier India Pvt Ltd. (2007).
5. http://iitd.vlab.co.in/?sub=63

EvaluationScheme:

1	Mid Sem. Evaluation	20 Marks
2	End Sem. Evaluation	20 Marks
3	Lab Assessment	60 Marks
	Total	100 marks

Course Outcomes (COs) contribution to the Programme Outcomes(POs):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Average
CO1	3	3	3	3	1	3	1	2	1	2	1	3	**2.17**
CO2	3	3	3	3	2	2	1	2	1	2	-	3	**2.27**
CO3	3	3	3	3	2	2	1	2	1	2	-	3	**2.27**
CO4	3	3	3	3	1	2	2	3	2	2	2	3	**2.42**
CO5	3	3	3	3	1	2	3	3	3	2	2	3	**2.58**
CO6	-	-	-	-	-	-	-	-	3	3	1	3	**2.5**
Average	**3.00**	**3.00**	**3.00**	**3.00**	**1.40**	**2.20**	**1.60**	**2.40**	**1.83**	**2.17**	**1.50**	**3.00**	

Genetic Engineering

COURSE CODE: 18B11BT512

COURSE CREDITS: 4

CORE/ELECTIVE: CORE

L-T-P: 3-1-0

Pre-requisite: Genetics, Molecular Biology

Course Objectives:

1. Familiarize the students with the basic concepts in genetic engineering;
2. Acquaint the students to versatile tools and techniques employed in genetic engineering and recombinant DNA technology
3. Apprise students about applications genetic engineering

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Students will become aware of concept of genetic engineering and its applications	Familiarity and Basics
CO-2	Students will have knowledge of tools and strategies used in genetic engineering	Technical and strategies
CO-3	Student will acquire knowledge about gene libraries and isolation of genes, DNA and genome sequencing technologies	Technical and application
CO-4	Student will have acquaintance about protein expression hosts and genetic manipulation of plants and animals	Familiarity and Basics
CO-5	Can use and apply the knowledge of genetic engineering in problem solving and in practice from academic and industrial perspective	Application

Course Contents:

Unit	Contents	Lectures required
1	**Introduction:** Genetic engineering, Recombinant DNA technology: gene cloning - concept and basic steps - rDNA Glossary	2
2	**DNA modifying enzymes and cloning techniques:** Restriction Endonucleases, DNA Ligation Enzymes and, DNA, Gene cloning methods and strategies: Cloning of PCR products, TA and TOPO TA cloning, Gateway cloning, DNA Modifying Enzymes: Nucleases, Kinases, phosphatases, Reverse transcriptase, RFLP and AFLP	8
3	**Cloning and Expression Vectors:** Plasmid Vectors, Vectors based on Lambda Bacteriophage, Cosmids, M13 Vectors, Vectors for Cloning	10
	Large DNA Molecules, Expression Vectors, Transcriptional & Translational Fusions, Adding Tags and Signals overproducing Proteins.	
4	**Construction & Screening of genomic libraries:** Genomic library, cDNA library, Growing& Storing Libraries, cDNA Cloning (5'&3' RACE)	5
5	**Identification and isolation of genes:** Screening Libraries with Gene Probes, Screening Expression Libraries with Antibodies, Susbtacrtive hybridization, DDRT-PCR, Positional Gene Cloning, Functional Complementation	4
6	**DNA and Genome Sequencing:** Basics fo DNA Sequencing, Next generation sequencing technologies, Whole genome sequencing	6

7	**Gene Expression in Microbial and Eukaryotic Systems:** Microbial, Yeast *Saccharomyces Cerevisiae* and Other Fungi as heterologoues protein expression platforms	3
8	**Genetic Manipulation of Plants and Animals:** Gene transfer methods, Application of Genetically Engineered Strains of Plants and Animals	4
Total lectures		**42**

Suggested Text Book(s):

a. Principles of Gene Manipulation and Genomics SEVENTH EDITION S.B. Primrose and R.M. Twyman.
b. Recombinant DNA: A Short Course by JD Watson, J. Tooze and DT Kurtz.
c. Genetic Engineering :Amita Rastogi and Neelam Pathak

Suggested Reference Book(s):

1. From Genes to Genomes: Concepts and Applications of DNA Technology by JW Dale and M Schantz
2. Molecular Biotechnology: Principles & Applications of Recombinant DNA Glick BR and Pasternak JJ
3. Genetic Engineering :Amita Rastogi and Neelam Pathak

EvaluationScheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment, Quizzes & Attendance

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course outcomes (Genetic Engineering)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	3	3	3	3	3	2	2	2	3	3	2	3	**2.67**
CO-2	3	3	3	3	3	2	2	2	3	3	2	3	**2.67**
CO-3	3	3	3	3	3	2	2	2	3	3	2	3	**2.67**
CO-4	3	3	3	3	3	2	2	2	3	3	2	3	**2.67**
CO-5	3	3	3	3	3	2	2	2	3	3	2	3	**2.67**
Average	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**2.00**	**2.00**	**2.00**	**3.00**	**3.00**	**2.00**	**3.00**	

Immunology Lab

COURSE CODE:18B17BT573
COURSE CREDITS: 1
CORE/ELECTIVE: CORE
: 0-0-2

Pre-requisite: Immunology/Basic Biology

Course Objectives:

1. The objective is to familiarize students with the various immunological techniques that include antigen-antibody interactions, quantitation of antigens or antibody, ELISA, agglutination reactions etc.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO1	To understand, design, analyze and interpret experiments related to immunology and link practical knowledge to theoretical.	Familiarity
CO2	To detect antigen and check quality of antigen.	Assessment
CO3	To quantitate antigen using techniques various techniques.	Assessment
CO4	To check changes in the number of leucocytes and their isolation from the blood.	Assessment
CO5	To understand team work, ethics and work discipline.	Usage

List of Experiments

S.No.	Description	Hours
1	To perform Radial Immunodiffusion (RID) by Mancini's technique.	2
2	To perform Double Immunodiffusion (DID) by using Ouchterlony method.	2
3	To perform the Quantitative precipitation assay-test.	2
4	To perform hemagglutination assay for ABO blood group typing determination of and Rh factor.	2
5	To perform Immuno-electrophoresis of given sample.	2
6	To perform Immuno-electrophoresis of given sample.	2
7	To determine the concentration of antigen by sandwich ELISA method.	2
8	To determine Total Leukocytes Count (TLC) of the given sample.	2
9	To determine Differential Leukocytes Count (DLC) of the given sample.	2
10	Isolation of lymphocytes from peripheral blood by ficoll method and check the viability of isolated lymphocytes.	2
11	Amplification of Interleukin-28b gene using Polymerase Chain Reaction assay.	2
12	Lysis of red blood cells (hypotonic lysis with H_2O and ammonium chloride)	2
13	To isolate the lymphocyte from whole blood by density gradient centrifugation method. (Virtual Lab)	2
14	To understand the concepts of mouse Euthanasia. To learn the basic procedures involved in rodent dissection and how to identify and remove lymphoid organs. (Virtual Lab)	2
Total Lab hours		**28**

Suggested/Resources:

1. Lab Manual
2. Hay FC and Westwood OMR (2003) Practical Immunology, 4th Ed., Blackwell Publishing.
3. Virtual Lab. (http://vlab.amrita.edu/?sub=3&brch=70)

EvaluationScheme:

1	Mid Sem. Evaluation	20 Marks
2	End Sem. Evaluation	20 Marks
3	Lab Assessment	60 Marks
	Total	100 marks

Course Outcomes (COs) contribution to the ProgrammeOutcomes(POs)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Average
CO1	3	3	3	3	2	2	1	2	3	2	2	3	**2.4**
CO2	3	1	2	2	1	1	-	2	1	1	1	2	**1.5**
CO3	3	2	2	2	2	1	-	2	1	1	1	2	**1.7**
CO4	3	2	2	2	2	1	-	2	1	1	1	2	**1.7**
CO5	1	1	2	1	1	2	1	3	3	3	2	3	**1.9**
Average	**2.6**	**1.8**	**2.2**	**2**	**1.6**	**1.4**	**1**	**2.2**	**1.8**	**1.6**	**1.4**	**2.4**	

Immunology

COURSE CODE:18B11BT513

COURSE CREDITS: 4

CORE COURSE

L-T-P: 3-1-0

Pre-requisite: Basic Biology

Course Objectives:

1. Basics of Immunology: types of immunity, T-cells and B-cells, antigen-antibody reaction and major histocompatibility complex (MHC).
2. Mechanisms of regulation of immune responses and immunological tolerance.
3. Role played by immune response in: infectious diseases, autoimmunity, hypersensitivity reactions, immunodeficiency diseases and vaccines.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	To understand and apply basic concepts of immunology.	Familiarity
CO-2	To understand the role of immune cells, major histocompatibility complex, antigen-antibody interactions in diagnostics.	Assessment
CO-3	To understand the mechanisms of regulation of immune responses and immunological tolerance.	Assessment
CO-4	To understand the roles played by immune response in: infectious diseases, autoimmunity.	Assessment/ Usage
CO-5	To understand hypersensitivity reactions, immunodeficiency diseases and vaccines.	Assessment/Usage

Course Contents:

Unit	Contents	Lectures required
1	**Basic immunology:** Historical perspectives, Cells and organs of the immune system	3
2	**Types of immunity:** innate and acquired immunity	3
3	**Antigens:** Immunogenicity, antigenicity, epitopes, haptens, mitogens	2
4	**Immunoglobins : structure and function:** Basic structure and fine structure of Igs, immunoglobin classes, hybridoma technology, antibody engineering	4
5	**Antigen- antibody interactions:** Theory, cross reactivity, precipitation reactions, agglutination reactions, RIA, ELISA, Western blotting, immunofluorescence	4
6	**B cell and T cell receptor:** Organization and expression of	4
	immunoglobulin genes : Generation of antibody diversity, class switching, T cell receptor complex, TCR coupled signaling pathways, co-stimulatory signals	
7	**Major histocpmatibility complex (MHC) and HLA:** General organization and inheritance of MHC, structure of MHC class I and II molecules, peptide binding by MHC molecules, MHC and susceptibility to	3

	disease, Tissue and organ transplantation	
8	**Regulation of immune response and immunological tolerance:** Cytosolic and endocytic pathway, Responses in humoral and cell mediated branch and immunological tolerance	**2**
9	**Immune effector mechanisms:**Complement system, Cytokines	**3**
10	**Autoimmunity:** Types of autoimmune diseases (organ specific and systemic), Mechanisms of autoimmunity.	**2**
11	**Hypersensitivity reactions:** Type I, II, II and IV, hypersensitivity reactions	**2**
12	**Tumor immunity:** Malignant transformation of cells and immune responses, tumor antigens, tumor evasion of the immune system, cancer immunotherapy.	**2**
13	**Vaccines:** Types, active and passive immunization	**3**
14	**Immune response to infectious diseases and tumor immunity:** Viral, bacterial, protozoan diseases, parasitic infections	**3**
15	**Immunodeficiency diseases:** Primary and secondary immunodeficiency diseases, Acquired immunodeficiency syndrome (AIDS)	**2**
	Total lectures	**42**

Suggested Text Book(s):

1. Kindt TJ, Goldsby RA and Osborne BA (2007) KubyImmunology .W.H. Freeman and Co., New York, 6th Ed.
2. Abbas AK, Lichtman AH and Pillai S (2011) Cellular and Molecular Immunology. Elsevier, USA, 7th Ed.
3. Coico R and Sunshine G (2009) Immunology: A Short Course. Wiley – Liss, 6th Ed.
4. Delves PJ, Martin SJ, Burton DR and Roitt IM (2011) Roitt's Essential Immunology. Wiley-Blackwell, 12th Ed.

EvaluationScheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment, Quizzes&Attendance

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

Course outcomes (Immunology)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	3	3	3	3	2	2	1	2	2	2	1	3	2.25
CO-2	2	2	3	2	2	1	-	2	2	2	1	3	2.0
CO-3	2	1	2	3	1	1	-	2	2	2	1	2	1.72
CO-4	2	1	2	2	1	2	2	3	1	1	1	2	1.6
CO-5	2	3	3	2	1	2	3	3	1	1	1	3	2.0
Average	2.2	2	2.6	2.4	1.4	1.6	2	2.4	1.6	1.6	1	2.6	

Downstream Processing

COURSE CODE:18B11BT611

COURSE CREDITS: 4

CORE/ELECTIVE: CORE

: 3-1-0

Pre-requisite: Thermodynamics and Chemical Processes, Biochemistry, Bioprocess Engineering

Course Objectives:

1. Learn about the financial importance of Downstream Processing of bioproducts
2. Learn about the differences in recovery processes of intracellular and extracellular products
3. Learn about the principles and application of various separation techniques involved in bioproducts recovery
4. Learn about the recovery of various products through case studies

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Able to understand the importance and financial considerations of downstream processing in compare to upstream processing	Familiarity
CO-2	Conceptually sound in understanding about the difference between the downstream processing of intracellular and extracellular products	Assessment
CO-3	Able to understand various separation techniques used in downstream processes	Assessment
CO-4	Able to apply principles of various unit operations in designing and optimization of downstream processes	Assessment
CO-5	Able to understand the requirements for successful operation of downstream processes	Usage
CO-6	Able to apply the principles of major unit operations used in downstream processing for the purification and formulation of final products obtained from Fermentation Technology.	Usage

Course Contents:

Unit	Contents	Lectures required
1	**Scope of Downstream processing:** Importance of DSP in biotechnology, characteristics of bioproducts, Criteria for selection of bio-separation techniques, Role of DSP methods in bioprocess economics	**4**
2	**Cell Disruption:** Various cell disruption methods: Mechanical viz; sonicators, dyno mill, homogenizer, chemical and biological methods.	**4**
3	**Solid-Liquid Separation:** Centrifugation: Principles, Centrifuges viz; basket centrifuge, tubular centrifuge, disc-bowl centrifuge. Filtration: Principles, Filter units viz; filter press, Applications.	**6**
4	**Membrane Technology:** Merits and Demerits, Reverse osmosis, Ultrafiltration, Microfiltration, Dialysis, Electrodialysis	**3**
	Separation of soluble products: Liquid-liquid extraction, Aqueous two-	

5	phase extraction, Adsorption, Precipitation	**6**
6	**Chromatographic Techniques:** Gel filtration, Ion-exchange, Hydrophobic Interaction and Affinity Chromatography, HPLC, FPLC, Applications	**5**
7	**Finishing steps for purification:** Crystallization, Drying, Lyophilization	**4**
8	**Stabilization of bioproducts:** Formulation. Integration of reaction and separation	**2**
9	**Case-Studies:**Process design of Industrial Bio-products **Anaerobic bioprocesses:** Ethanol, Lactic acid production	**4**
	Aerobic bioprocesses: Citric acid, Gluconic acid, Penicillin production	**4**
	Total lectures	**42**

Suggested Text Book(s):

1. Raja Ghosh, “Principles of Bioseparation Engineering”, World Scientific Publishing Co. Pte. Ltd., Singapore, 2006.
2. Pauline M. Doran, “Bioprocess Engineering Principles”, 8th ed., Academic press, New York, 2003.
3. Peter F. Stanbury, Stephen J. Hall & A. Whitaker, "Principles of Fermentation Technology", Â Elsevier India Pvt Ltd. (2007).
4. Wulf Crueger, Anneliese Crueger, K.R. Aneja, “A Textbook of Industrial Microbiology”, Medtech,Scientific International Pvt. Ltd. 3rd Ed. (2017)
5. M.L. Shuler and F. Kargi, "Bioprocess Engineering--basic Concepts", 2nd Edn. Prentice-hall Of India Pvt Ltd (2008).

Suggested Reference (s):

1. P.A. Belter, E. L. Cussler, and W.S. Hu, “Bioseparations: Downstream Processing in Biotechnology”, John Wiley and Sons, New York, 1998.
2. B. Sivasankar, “Bioseparations : Principles and Techniques”, PHI Learning Private Limited, New Delhi, 2009.
3. Roger G. Harrison, Paul W. Todd, Scott R. Rudge, Demetri Petrides, “Bioseparations Science and Engineering”, 1stEdn. Oxford University Press, 2002
4. Abhilasha S. Mathuriya, “Industrial Biochnology” 1sted., Ane Books Pvt. Ltd., New Delhi, 2009.

Other useful resource(s):

1 . NPTEL Course Content:

iv) Downstream Processing by Prof. Mukesh Doble, IIT Madras
https://nptel.ac.in/courses/102106022/

v) Industrial Biotechnology by Prof. Debabrata Das, IIT Kharagpur
https://nptel.ac.in/courses/102105058/

vi) Principles of Downstream Techniques in Bioprocess by Prof. Mukesh Doble, IIT Madras
https://nptel.ac.in/courses/102106048/

2. Link to topics related tocourse:

ii) Aspects of Biochemical Engineering by Prof. Debabrata Das, IIT Kharagpur
https://nptel.ac.in/courses/102105064/

EvaluationScheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Unit 1-2

Approved in Academic Council held on 28 June 2023

2	T-2	25	1.5 Hours	Unit 1-5
3.	T-3	35	2 Hours	Whole Syllabus
4.	Teaching Assessment	25	Entire Semester	Inform class time to time (Quizzes, Presentation, Assignments)

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

Course outcomes (Bioprocess Engineering)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1		2	1	1			2	1		1	3	3	1.75
CO-2	2	2	2	1	2	1	2	1		2		3	1.80
CO-3	2	2	2	2	2	2	2	1	2	1		3	1.91
CO-4	3	3	3	2	2	2	2	1	2	2		3	2.27
CO-5	2	3	3	2	2	1	1	1	1	2	2	3	1.92
CO-6	3	3	3	3	2	2	2	1	2	2	2	3	2.33
Average	2.40	2.50	2.33	1.83	2.00	1.60	1.83	1.00	1.75	1.67	2.33	3.00	

Downstream Processing Lab

COURSE CODE:18B17BT671

COURSE CREDITS: 1

CORE/ELECTIVE: CORE

L-T-P: 0-0-2

Pre-requisite: Microbiology Lab, Biochemistry Lab, Bioprocess Engineering

Course Objectives:

1. Provide exposure to the students with hands on experience on various practices in Fermentation Technology.
2. Enable students to link the theoretical knowledge of Downstream Processing with the experiments.
3. Learn how to recover the various bioproduct after their production
4. Learn how to characterize the products after their recovery

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO1	Able to set up of different kind of fermentation processes for biomass and product production	Familiarity
CO2	Able to describe and to apply the principles of various unit operations such as sonication, centrifugation, filtration, precipitation etc. used in DSP	Assessment
CO3	Able to strategize the downstream processes for the purification of various bioproducts such as enzymes, wine etc.	Assessment and Usage
CO4	Able to design experiments and analyze various data related to various practices in DSP	Usage
CO5	Able to analyze and characterize the synthesized bioproducts for further applications	Assessment and Usage
CO6	Able to work in a team to accomplish the experiments and to make proper documentation of lab experiments carried out in the lab	Assessment

List of Experiments

S.No.	Description	Hours
1	Introduction to DSP Lab and related lab safety	2
2	Setting up of yeast fermentation processes using fruit juice	2
3	Downstream processing of the yeast fermented product (Sedimentation, Filtration, Bottling, Pasteurization)	2
4	Quality analysis of the yeast fermented product i) pH, TSS content ii) Sugar content using DNS method iii) Anti-oxidant content iv) Phenolic content v) Alcohol content using alcoholometer	2

5	To determine the effect of speed and time of exposure over the settling of the cells during centrifugation	2
6	Disruption of yeast cells using sonication to recover intracellular Invertase enzyme	2
7	Determination of protein and enzyme content in the cell lysate after the cell disruption	2
8	Setting up of a fermentation process for production of extracellular industrial enzyme (Amylase) from *Bacillus licheniformis*	2
9	Clarification of the fermentation broth & Estimation of the yield of the industrial enzyme produced by the fermentation process.	2
10	Concentration of invertase/amylase using salt-induced precipitation	2
11	Organic Solvent Precipitation	2
12	Set up of dialysis to remove the additional salt from the enzyme solution	2
Total Lab hours		**24**

Suggested/Resources:

1. Keith Wilson, John Walker, "Principles and Techniques of Biochemistry and Molecular Biology, 7th ed., Cambridge University Press, Singapore, 2010.
2. Lab Manual
3. Raja Ghosh, "Principles of Bioseparation Engineering", World Scientific Publishing Co. Pte. Ltd., Singapore, 2006.
4. Pauline M. Doran, "Bioprocess Engineering Principles", 8th ed., Academic press, New York, 2003.
5. Peter F. Stanbury, Stephen J. Hall & A. Whitaker, "Principles of Fermentation Technology", Â Elsevier India Pvt Ltd. (2007).
6. Downstream Processing by Dr. Mukesh Doble, IIT Madras

https://nptel.ac.in/courses/102106022/

EvaluationScheme:

1	Mid Sem. Evaluation	20 Marks
2	End Sem. Evaluation	20 Marks
3	Lab Assessment	60 Marks
	Total	100 marks

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Average
CO1	2	2	3	2	3	1	2	2	2	2	2	3	**2.17**
CO2	3	2	3	2	2	2	2	2	2	2	1	3	**2.17**
CO3	2	2	2	3	2	3	3	2	2	2	2	3	**2.33**
CO4	2	3	3	3	2	2	2	2	2	2	2	3	**2.33**
CO5	1	2	2	3	2	2	2	2	2	2	3	3	**2.17**
CO6						1	1	2	3	3	1	3	**2.00**
Average	**2**	**2.20**	**2.60**	**2.60**	**2.20**	**1.83**	**2.00**	**2.00**	**2.17**	**2.17**	**1.83**	**3.00**	

Machine learning for Bioinformatics

COURSE CODE:18B11BI611

COURSE CREDITS: 3

CORE/ELECTIVE: CORE

L-T-P: 3-0-0

Pre-requisite: Molecular biology, Python

Course Objectives:

1. Learn what is machine learning
2. Learn algorithms used in machine learning.
3. Learn how to implement machine learning for biological problems.
4. Apply machine learning to practical projects.
5. Use machine learning and data mining in one project.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Different types of machine learning and its utility in bioinformatics	Familiarity
CO-2	Application of Hidden Markov Model and Artificial neural networks to different types of bioinformatics data	Assessment
CO-3	Determination of Bayesian Network (BN) from expression data.	Assessment
CO-4	Application of symbolic machine learning (SML) methods to predict cleavage site of HIV- protease from training data of positive and negative cases.	Assessment
CO-5	Optimization of weights in a supervised and unsupervised neural network, and application of supervised learning to predict sub- cellular localization of a protein.	Assessment
CO-6	Application of stochastic context-free grammar (SCFG) to predict RNA secondary structure.	Assessment

Course Contents:

Unit	Contents	Lectures required
1	**Introduction:** Overview of intelligent systems and machine learning	1
2	**Hidden Markov Model (HMM):** Viterbi algorithm, Forward algorithm,	10
	Backward algorithm, Profile-HMM, Baum-Welch algorithm to optimize HMM-profile, Multiple alignment and database searching using profile- HMM	
3	**Symbolic Machine Learning:** Nearest neighbour approach to predict secondary structure, Decision tree methods, Identification tree methods	6
4	**Bayesian Network (BN):**Calculation of statistical significance by using Bayesian methods, Factorization and Markov blanket rule, d-separation, Equivalence classes, Learning of Bayesian network, Learning of Gaussian network	9
5	**Artificial Intelligence (AI):**Search strategies, logic, deduction, and pathways comparison	4

6	**Artificial Neural Network (ANN):**Basics and introduction to terminologies, Supervised and non-supervised learning, Feed forward back propagation error method, Application of ANN methods: Protein sub-cellular localization and secondary structure prediction	**7**
7	**Stochastic Context Free Grammar (SCFG):**Transformational grammar, Parsing, Chomsky hierarchy (regular, context-free, context-sensitive, and unrestricted grammar), Automata, Context-free grammar, Application of SCFG for prediction of secondary structure of RNA	**5**
Total Lectures		**42**

Suggested Text Book(s):

a. R. Durbin, S. Eddy, A. Krogh, and G. Mitchison (1998), Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids. Cambridge University Press
b. Edward Keedwell and Ajit Narayanan (2005), Intelligent Bioinformatics: The Application of Artificial Intelligence Techniques to Bioinformatics Problems, Wiley
c. P Baldiand S Brunak, BIOINFORMATICS: The Machine Learning Approach

Suggested Reference Book(s):

1. Olson et al., 2018. Data-driven advice for applying machine learning to bioinformatics problems
2. Husmeier D, Dybowski R, and Roberts S (2005), Probabilistic Modeling in Bioinformatics and Medical Informatics, Springer
3. Nat Cell Biol. 2001 Aug;3(8):E190-5. Review. PubMed PMID: 11483980
4. Kim JB, Porreca GJ, Song L, Greenway SC, Gorham JM, Church GM, Seidman CE, Seidman JG. Polony multiplex analysis of gene expression (PMAGE) in mouse hypertrophic cardiomyopathy. Science. 2007 Jun 8;316(5830):1481-4. PubMed PMID: 17556586
5. MacBeath G, Schreiber SL. Printing proteins as microarrays for high-throughput function determination. Science. 2000 Sep 8;289(5485):1760-3. PubMed PMID: 10976071.
6. Shankar J, Wu TD, Clemons KV, Monteiro JP, Mirels LF, et al. (2011) Influence of 17b-Estradiol on Gene Expression of Paracoccidioides during Mycelia-to- Yeast Transition. PLoS ONE 6(12): e28402. doi:10.1371/journal.pone.0028402
7. Mary V. Relling, William E. Evans Nature. Author manuscript; available in PMC 2016 Jan 13.
8. Published in final edited form as: Nature. 2015 Oct 15; 526(7573): 343–350. doi: 10.1038/nature15817

Other useful resource(s):

1. Link to NPTEL course contents:https://nptel.ac.in/courses/106104019/
2. Link to topics related tocourse:
   i. https://www.advancedsciencenews.com/machine-learning-for-bioinformatics-and-neuroimaging/
   ii. https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_neural_networks.htm
   iii. https://www.analyticsvidhya.com/blog/2017/09/understaing-support-vector-machine-example-code/

EvaluationScheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment, Quizzes&Attendance

Course Outcomes (COs) contribution to the ProgrammeOutcomes(POs)

Course outcomes (Machine learning for Bioinformatics)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	2	2	2	2	2	2	2	2	2	2	1	2	**1.92**
CO-2	2	2	2	2	2	1	1	2	2	2	1	2	**1.75**
CO-3	2	2	2	2	2	1	1	1	2	-	2	2	**1.73**
CO-4	2	2	2	2	2	1	1	1	2	2	-	2	**1.73**
CO-5	2	2	2	2	2	1	1	1	2	-	-	2	**1.7**
CO-6	2	2	2	2	2	1	1	1	-	-	-	2	**1.67**
Average	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**1.16**	**1.16**	**1.33**	**2.0**	**2.0**	**1.33**	**2.0**	

Machine learning for Bioinformatics Lab

COURSE CODE:18B17BI671

COURSE CREDITS: 1

CORE/ELECTIVE: CORE

L-T-P: 0-0-2

Pre-requisite: None

Course Objectives:

1. Develop an understanding of important concepts and their implementation in machine learning in the context of biological problems.
2. Implementation in machine learning in the context of biological problems

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO1	Implementation of KNN using Perl/Python	Assessment
CO2	Implementation of ANN using Perl/Python	Assessment
CO2	Application of Hidden Markov Model for CpG island prediction	Assessment
CO3	Application of HMMER package and Pfam database	Assessment
CO4	Application of Transformational Grammars in bioinformatics	Assessment
CO5	Application of SVM in bioinformatics	Assessment

List of Experiments

S.No	Description	Hours
1	Calculation of sensitivity, specificity, accuracy for a given classifier	2
2	Implementation of crisp KNN for a microarray file	2
3	Implementation of fuzzy KNN for a microarray file	2
4	Identification tree construction using See5 and Weka	2
5	Implementation of perceptron on LOGIC GATES	2
6	Calculation of AAC and DPC for SVM and ANN input files	2
7	Calculation of pseudo amino acid composition	2
8	Implementation of ANN using SNNS software	2
9	Implemenation of SVM using SVM-light, LIBSVM and Weka	2
10	Implementation of HMM for prediction of CpG islands	2
11	HMM using HMMER package	2
12	Stochastic context free grammar	2
Total Lab hours		**24**

Suggested/Resources:

1. http://hmmer.org/.
2. https://www.cs.waikato.ac.nz/ml/weka/https://nptel.ac.in/courses/106104019/26
3. https://www.rulequest.com/download.html

EvaluationScheme:

1	Mid Sem. Evaluation	20 Marks
2	End Sem. Evaluation	20 Marks
3	Lab Assessment	60 Marks
	Total	100 marks

Course Outcomes (COs) contribution to the ProgrammeOutcomes(POs)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Average
CO1	3	3	3	3	2	2	1	1	1	1	1	1	**1.83**
CO2	3	3	3	3	3	1	1	1	1	1	1	3	**2.00**
CO3	3	3	2	3	2	3	2	1	1	1	2	1	**2.00**
CO4	3	3	3	2	3	2	1	1	1	1	1	1	**1.83**
CO5	2	2	3	3	3	3	1	1	1	1	1	1	**1.83**
Average	**2.67**	**2.83**	**2.80**	**2.80**	**2.60**	**2.20**	**1.20**	**1.00**	**1.00**	**1.00**	**1.20**	**1.40**	

Computer Aided Drug Design

COURSE CODE: 18B11BI612

COURSE CREDITS: 3

CORE/ELECTIVE: CORE

: 3-0-0

Pre-requisite: None

Course Objectives:

1. To design potential lead molecules against any disease that may be explored further as a potential candidate for the drug development.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Feasibility study of a drug development project	Familiarity
CO-2	Design and optimize lead molecules against drug target, and using ligand-basedapproach	Usage
CO-3	Determination of pharmacophore from lead molecules and active sites and use ofpharmacophore for lead discovery	Usage
CO-4	Development of potential drug molecule and pharmacophore databases for virtualscreening	Assessment
CO-5	Use of molecular fragments for lead discovery and implementation of statisticalapproaches for lead molecule discovery	Usage
CO-6	Bioavailability prediction of a drug and working capability in drug designing softwarelike, Discovery Studio and molecular dynamics software like AMBER 8.0, On-line tools, etc.	Assessment

Course Contents:

Unit	Contents	Lectures required
1	**Introduction:** Drug design: A billion dollar baby and drug design techniquesteam work, Economic factors involved in drug design, Irrational vs.	**4**
	rational approaches, Drug target identification & computer-aided drug design processes, Case study related to drug target identification (Viral Targets -HIV Example)	
2	**Computational Approaches to Drug Design:** Structure-based (receptor fitting)and ligand-based (receptor mapping) molecule design, lead molecules design in a research environment (crossing the barriers), tools used in both environments	**3**
3	**Receptor Fitting (Lead discovery& refinement)**: Utility, Binding-site predictions: Stereoelectronic factors, receptor flexibility, tight binding; Docking: Introduction, search algorithms, scoring (MM, Grid, etc.), validation of results, comparisons of search and scoring methods; Docking processes and analysis of results; *De novo* design, database searching & high throughput virtual screening(HTVS); and applications. Introductions to docking & molecular modeling packages (DS Studio; Schrodinger Inc, Ligbuilder, etc.)	**9**
4	**Receptor Fitting (Lead optimization)**: Molecular simulation methods used for binding and free energy calculation, Calculation on Free Energy Perturbation(FEP) of 1. Thermolysin with 2 ligands, Molecular mechanics Poisson-Boltzmann surface area methods: molecular basis of HIV protease drug	**4**

	resistance	
5	**Receptor Mapping (Pharmacophore)**: The pharmacophore concept, Determination of pharmacophore from a set of active molecules, Design of pharmacophore using various algorithms, Creating pharmacophore model from active site, Practical utility (searching compound databases) and A case study of new lead design	**5**
6	**Chemoinformatics:** Introduction, representing 2D & 3D structures, 2D chemical database applications & molecular descriptors and their classifications, database searching and applications in CADD	**4**
7	**Receptor Mapping (Quantitative structure activity relationship (QSAR))**: QSAR methodology, biological and physicochemical parameters, feature selection(PLS, PCA, MLR, etc.), model building and validation, QSAR applications in drug design, Quantitative structure-property relationships (QSPR), CoMFA, 3D and nD-QSAR methods	**6**
8	**Fragment-based Lead Discovery**: Fragment and substructure discovery and evaluation, virtual fragment scanning (trends, applications and web-based tools) & capture methods for fragment-based discovery	**4**
9	**ADMET**: Oral bioavailability, drug half-life in the bloodstream, BBB permeability, toxicity, Lipinski rule of five, The impact of physiochemical properties on the control of drug-like properties.	**4**
Total Lectures		**42**

Suggested Text Book(s):

1. David C Young : Computational Drug Design (A guide for computational and medicinal chemists) Wiley & Sons, Inc., New Jersey, USA
2. Holtje H.-D, Sippl W., Rognan D. and FolkersG. : Molecular Modeling, Basic Principles and Applications Wiley-VCHGmbH& Co. KGaA
3. Leach AR : Molecular Modeling: Principles and Applications: Prentice Hall, Edinburg UK.
4. Zartler ER & Shapiro MJ : Fragment-based Drug Discovery (A practical approach), Wiley & Sons, Inc., West Sussex, UK Flower DR : Drug design: cutting edge approaches, RSC publication, Cambrige, UK

Suggested Reference Book(s):

1. Merz KM, D Ringe, : Drug Design: Structure and Ligand-based Approaches. Reynolds CH Cambridge University Press
2. Opera TI :Chemoinformatics in Drug Discovery, Wiley-VCH, GMBH
3. Hubbard RE : Structure-based drug discovery (An overview), RSC publication, Cambrige, UK

EvaluationScheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment, Quizzes & Attendance

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Average
CO1	3	3	3	3	2	2	1	1	1	1	1	1	**1.83**
CO2	3	3	3	3	3	1	1	1	1	1	1	3	**2.00**
CO3	3	3	2	3	2	3	2	1	1	1	2	1	**2.00**
CO4	3	3	3	2	3	2	1	1	1	1	1	1	**1.83**
CO5	2	2	3	3	3	3	1	1	1	1	1	1	**1.83**
C06	2	3	3	3	2	2	2	2	2	2	2	2	**2.25**
Average	**2.67**	**2.83**	**2.80**	**2.80**	**2.60**	**2.20**	**1.20**	**1.00**	**1.00**	**1.00**	**1.20**	**1.40**	

Computer Aided Drug Design Lab

COURSE CODE: 18B17BI672

COURSE CREDITS: 1

CORE/ELECTIVE: CORE

L-T-P: 0-0-2

Pre-requisite: None

Course Objectives:

1. To design potential lead molecules against any disease that may be explored further as a potential candidate for the drug development.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO1	Feasibility study of a drug development project	Familiarity
CO2	Design and optimize lead molecules against drug target, and using ligand-basedapproach	Usage
CO3	Determination of pharmacophore from lead molecules and active sites and use ofpharmacophore for lead discovery	Usage
CO4	Development of potential drug molecule and pharmacophore databases for virtualscreening	Assessment
CO5	Use of molecular fragments for lead discovery and implementation of statisticalapproaches for lead molecule discovery	Usage
CO6	Bioavailability prediction of a drug and working capability in drug designing softwarelike, Discovery Studio and molecular dynamics software like AMBER 8.0, On-line tools, etc.	Assessment

List of Experiments

S.No	Description	Hours
1	Installation of various drug design software and assignment 'Project'	2
2	Generation of 3D optimized structure of a "Ligand" molecule	2
3	Preparation of target and ligand molecules for docking	2
4	"Virtual library Preparation" of lead molecules	2
5	Docking of ligands into a receptor (active site)	2
6	Flexible docking of ligand with target	2
7	Fragment docking using '*De Novo'* Receptor and '*De Novo'* Links (LUDI algorithm)	2
8	Pharmacophore modeling of ligands	2
9	Pharmacophore-based database searching and *de novo* design of ligand against an active site	2
10	Development of 3D QSAR model by using "Discovery Studio"	2
11	ADME property and toxicity predictions of lead molecule (using TOPKAT)	2
12	Energy minimization and molecular dynamics (MD) target molecule by using"Simulation" module of "Discovery Studio"	2
13	Estimates binding free energy of ligands and receptor using CHARMmimplicitsolvation models	2
Total Lab hours		**26**

Suggested Books/Resources:

1. David C Young : Computational Drug Design (A guide for computational and medicinal chemists) Wiley & Sons, Inc., New Jersey, USA

2. Holtje H.-D, Sippl W., Rognan D. and FolkersG. : Molecular Modeling, Basic Principles and Applications Wiley-VCHGmbH& Co. KGaA
3. Leach AR : Molecular Modeling: Principles and Applications: Prentice Hall, Edinburg UK.
4. Accelrys: User Manuals Discovery Studio.
5. AMBER : AMBER 11 Users' Manual, Scripps Research Institute, USA
6. GROMACS:Gromacs User Manual

EvaluationScheme:

1	Mid Sem. Evaluation	20 Marks
2	End Sem. Evaluation	20 Marks
3	Lab Assessment	60 Marks
	Total	100 marks

Course Outcomes (COs) contribution to the ProgrammeOutcomes(POs)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Average
CO1	3	3	3	3	2	2	1	1	1	1	1	1	**1.83**
CO2	3	3	3	3	3	1	1	1	1	1	1	3	**2.00**
CO3	3	3	2	3	2	3	2	1	1	1	2	1	**2.00**
CO4	3	3	3	2	3	2	1	1	1	1	1	1	**1.83**
CO5	2	2	3	3	3	3	1	1	1	1	1	1	**1.83**
CO6	2	3	3	3	2	2	2	2	2	2	2	2	**2.25**
Average	**2.67**	**2.83**	**2.80**	**2.80**	**2.60**	**2.20**	**1.20**	**1.00**	**1.00**	**1.00**	**1.20**	**1.40**	

Advanced Algorithms for Bioinformatics Lab

COURSE CODE:18B17BI673

COURSE CREDITS: 1

CORE/ELECTIVE: CORE

L-T-P: 0-0-2

Pre-requisite: Basics of algorithms and programming, data structures. Some knowledge of object-oriented technology and is also desirable

Course Objectives:

1. Develop the ability to design, implement and manipulate algorithms.
2. Develop computer programs for Bioinformatics solutions to life and health science problems.
3. Apply programming concepts to various biological examples and real life applications.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO1	Able to understand algorithmic principles	Familiarity
CO2	To write programs for specific computational biology problems	Assessment
CO3	Analyze problems in biology and able to design new protocols and algorithms for biological data analysis	Assessment
CO4	Able to analyze biological data through programs	Assessment
CO5	Implement algorithms for bioinformatics problems and their assessments	Assessment and Usage

List of Experiments

S.No	Description	Hours
1	Program to solve the US change problem.	2
2	Program to deal with Tower of Hanoi problem.	2
3	Program to generate Fibonacci series using recursive algorithm and few other programs.	2
4	Program to generate distinct sub-strings in a given DNA sequence using combinatorial and other methods.	2
5	Program to generate palindrome of a string and for a nucleotide sequence, translation and reverse translation, find out the GC content in a sequence.	2
6	Program to implement dynamic programming to solve local, semi-global, and global alignment of biological sequences.	2
7	Program to generate redundant nucleotide sequences from given amino acid sequence using standard genetic code system and ambiguous character codes.	2
8	Implementation of fragment assembly algorithms to make contigs.	2
9	Program to predict genes using statistical approaches.	2
10	Program to predict genes using similarity based approaches.	2
11	Program to generate restriction map of DNA sequence using Brute force algorithm.	2

12	Program to generate restriction map of DNA sequence using PDP (Partial Digest Problem) algorithm.	2
13	Motif finding algorithms implementations in DNA and Protein sequences.	2
14	RNA structure algorithms and their implementations.	2
Total Lab hours		**28**

Suggested/Resources:

a. P A Pevzner: Computational Molecular Biology: An algorithmic approach,PHI, 2004.
b. N C Jones and P A Pevzner: An Introduction to Bioinformatics Algorithms, Ane Books, 2004.
c. G. Benson and R. Page: Algorithms in Bioinformatics, Springer Verlag, 2004.
d. C J Date: An Introduction to Database Systems, Addison-Wesley Longman Publishing Co., USA, 1990.
e. I IMandoiu and A Zelikovsky: Bioinformatics Algorithms: Techniques and Applications, Wiley Interscience Press, 2008.
f. R Durbin*et al*: Biological Sequence Analysis: Probabistic models of proteins and nucleic acids, Cambridge University press, 1998.

EvaluationScheme:

1.	Mid Sem. Evaluation	20 Marks
2.	End Sem. Evaluation	20 Marks
3.	Lab Assessment	60 Marks
	Total	100 marks

Course Outcomes (COs) contribution to the ProgrammeOutcomes(POs)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Average
CO1	2	2	1	3	2	2	2	1	3	2	3	3	**2.17**
CO2	3	2	3	2	1	-	-	-	1	1	2	3	**2.00**
CO3	2	2	2	2	3	2	-	1	2	3	-	1	**2.00**
CO4	2	3	3	2	1	1	1	-	2	2	2	2	**1.91**
CO5	3	2	2	2	2	2	-	-	-	2	2	1	**2.00**
Average	**2.4**	**2.2**	**2.2**	**2.2**	**1.8**	**1.75**	**1.5**	**1**	**2**	**2**	**2.25**	**2**	

Environmental Studies

COURSE CODE: 23B11GE411

COURSE CREDITS: 2

CORE/ELECTIVE: Mandatory Course

L-T-P: 2-0-0

Pre-requisite: None

Course Objectives:

1. Identify environmental problems arising due to engineering and technological activities and the science behind those problems.
2. Estimate the population- economic growth, energy requirement and demand.
3. Analyze material balance for different environmental systems
4. Realize the importance of ecosystem and biodiversity for maintaining ecological balance.
5. Identify the major pollutants and abatement devices for environmental management and sustainable development.
6. Recognizing the major concepts of environmental studies, developing problem solving ability, forecasting the global climate change

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Introducing basic concept of environmental studies, interdisciplinary nature and scope of the subject	Familiarity
CO-2	Understanding ecosystem services and its functioning as well as equitable use of natural resources.	Assessment
CO-3	Understanding Pollution, A threat to the environment and finding its solutions, Pollutant sampling and monitoring of samples.	Assessment
CO-4	Correlating the concept of Biodiversity and its importance to human mankind	Usage
CO-5	Understanding social issues and their impact on the environment.	Usage
CO-6	Role of Information Technology in environment and human health	Usage

Course Contents:

Unit	Contents	Lectures required
1	**Unit 1: Multidisciplinary nature of environmental studies:** The Multidisciplinary nature of environmental studies: Definition, scope and importance, Need for public awareness, Types of Ecosystems, World Biomes, Ecosystem functioning, Biogeochemical cycles. Ecolabeling /Ecomark scheme	4
2	**Unit 2: Natural resources, their consumption & Protection:** Natural resources, their consumption & Protection: Water, Land Energy (Renewable, non-renewable, wind, solar, hydro, Biomass), Mineral, Forest, & Food resources, Role of an individual in conservation of natural resources, Equitable use of resources. Implications of energy use on the environment. Introduction to sustainable development: Sustainable Development Goals (SDGs)- targets and indicators, challenges and strategies for SDGs.	5
3	**Unit 3: Pollution- a threat to environment:** Pollution- a threat to environment: Air, Water & Land pollution, sources & causes, Space pollution, causes & effects, toxicity limits of pollutants. Critical issues concerning global Environment (Urbanization, population growth, global warming, climate change, acid rain, ozone depletion etc.) and the Roots in: Cultural, Social, Political, Commercial, industrial, territorial domains	5
4	**Unit 4: Environmental standards & Quality:** Environmental standards & Quality: Air, Water & Soil Quality, Pollutant sampling, pollution control systems. Green Chemistry and its applications	4
5	**Unit 5: Biodiversity and its conservation:** Biodiversity loss: Diversity of flora and fauna, species and wild life diversity, Biodiversity hotspots, threats to biodiversity	4
6	**Unit 6: Social Issues and the Environment:** Waste land reclamation, consumerism and waste products, eco-consumerism, dematerialization, green technologies, eco-tourism. Water conservation, rain water harvesting, watershed management. Major International organizations and initiatives: United Nations Environment Programme (UNEP), International Union for Conservation of Nature (IUCN),World Commission on Environment and Development (WCED), United Nations Educational, Scientific and Cultural Organization (UNESCO), Intergovernmental Panel on Climate Change (IPCC)	4
7	**Unit 7: Environmental Management:** Environment protection act, Air (prevention and control of population) act; Water (prevention and control of pollution) act, Wildlife protection act, Forest conservation act, Issues involved in the enforcement of environmental legislation National Environmental Policy; Function of pollution control boards (SPCB and CPCB), their roles and responsibilities Environmental management system. Life cycle analysis; Cost-benefit analysis, Environmental audit and impact assessment; Environmental risk assessment. Pollution control and management; Waste Management- Concept of 3R (Reduce, Recycle and Reuse) and sustainability;	4

8	**Case studies and fieldwork based upon projects**: The students are expected to be engaged in some of the following or similar identified activities: • Discussion on one national and one international case study related to the environment and sustainable development. • Field visits to identify local/regional environmental issues, make observations including data collection and prepare a brief report. • Documentation of campus biodiversity/Documentation of local biodiversity. • Campus environmental management activities such as solid waste disposal, water management, and sewage treatment.	**Self study hours (recommended 2 hours /week)***
Total lectures		**30**

*** Formal instructions /Guidance related to the project topics**

Suggested Text Book(s):

1. Environmental Studies By: M. P. Poonia and S.C. Sharma, Khanna Publishers
2. Textbook of Environmental Studies for UG Courses - Erach Bharucha, University Press
3. Joseph, B., 2005, Environmental Studies, Tata McGraw Hill, India.

Suggested Reference Book(s):

1. Nebel, B.J. & Wright, R.T., 1993, Environmental Science, 8th Edition, Prentice Hall, USA.
2. Chiras D D.(Ed.). 2001. Environmental Science – Creating a sustainable future. 6th ed. Jones & Barlett Publishers.
3. David Laurance. 2003. Environment Impact assessment, Wiley publications.
4. Chhokar KB, Pandya M & Raghunathan M. 2004. Understanding Environment. Sage publications, NewDelhi .

Other useful resource(s):

1. Issues of the journal: Down to Earth, published by Centre for Science and Environment.
2. Audio visuals from: Discovery, National Geographic etc.
3. https://nptel.ac.in/courses/120108002/
4. https://nptel.ac.in/courses/120108005
5.https://www.ugc.ac.in/pdfnews/1084504_Draft-Guidelines-and-Curriculum-Framework-for-Environment- Education-at-UG-level.pdf

MICROBIAL GENETICS AND PHYSIOLOGY COURSE CODE: 23MS1MB211 L-T-P: 3-0-0 CREDITS: 3	**Course objective** The objectives of this course are to take students through genetics and physiology covering prokaryotic/phage genetics to yeast and higher eukaryotic/ archea domains. Students will be exposed to concepts of complex traits encompassing, genetics and microbial metabolic regulation.	**Students Learning Outcomes** On successful completion of this course, student will be able to: ▪ Describe fundamental molecular principles of genetics. ▪ Describe the basics of genetic mapping. ▪ Understand the principles microbial genetic regulation. ▪ Various tools of the culturing and growth measurement of microorganisms. ▪ Acquaint with mechanisms of survival of various microorganisms.

Unit	Topics Covered
Unit I: **Genetics of bacteria, bacteriophages, and Yeast** 10 lectures	Concept of a gene in pre-DNA era; mapping of genes in bacterial and phage chromosomes by classical genetic crosses; fine structure analysis of a gene; genetic complementation and other genetic crosses using phenotypic markers; Yeast mating type switch; dominant and recessive genes/mutations, complementation groups
Unit II: **Mutants and Mutation** 7 lectures	Mutator genes, screening of mutations based on phenotypes and mapping the same, Loss of function mutants: null, leaky, and conditional mutations. Gain of function mutants, Are mutations random events or adaptive? Mutation rates, probability, and target theory, Uses of mutants
Unit III: **Genetic Exchange and restrictions** 5 lectures	Mechanisms of genetic exchange: Genotype vs phenotype, Genetic exchange in nature, Genetic exchange in the lab, Barriers to genetic exchange: host restriction and modification, Plasmids, Properties of some bacterial plasmids, Plasmid replication, Phage, General properties of phages, Lytic growth, Host specificity, Lysogenic phage, Phage Lambda

Unit IV: Microbial growth and metabolic regulations 10 lectures	Introduction, thermodynamics principles/ Eh-pH diagrams, Mitchell hypothesis and energetic, The Monod and Pirt models for microbial growth, Chemostats as an indispensible tool for physiological studies, Diversity of metabolism and selective enrichments, Mixed Cultures in the chemostat/selection, Metabolic genetic regulation, Regulatory systems during aerobic- anaerobic shifts.
Unit V: Growth and cell physiology of extremophilic microorganisms Lectures 10	Growth curve and diauxic growth curve and calculation of generation time and classification of microorganisms based upon nutrient and water activity. Determination of cell count by various methods. Cellular physiology of extremophilic microorganisms. Extremophilic physiological adaptations Methanotrophs, Thermophiles, Acidophiles , Sulfur reduction and SRBs, Mechanisms of survivals of various extremophiles.

Recommended Textbooks and References:

1. Hartl, D. L., & Jones, E. W. Genetics: Principles and Analysis. Sudbury, MA: Jones and Bartlett.
2. Pierce, B. A. Genetics: a Conceptual Approach. New York: W.H. Freeman.
3. Tamarin, R. H., & Leavitt, R. W. Principles of Genetics. Dubuque, IA: Wm. C. Brown.
4. Smith, J. M. Evolutionary Genetics. Oxford: Oxford University Press.
5. Klug, W.S., Cummings, R., Spencer, C. A., & Michael A. P., Concepts of Genetics. Pearson Publications
6. Albert G. M., & John W. F., Microbial Physiology, Wiley-Liss, A John Wiley& Sons, Inc. Publications.
7. Trudy T. A, Endang P. et al, Microbial Physiology and Genetics. Intelliz Press
8. Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press.
   Brock Biology of Microorganisms, Michael T. Madigan, Kelly S. Bender, Daniel H. Buckley, David Stahl, W. Matthew Sattley.
9. Prescott's Microbiology, By Joanne Willey and Kathleen Sandman and Dorothy Wood

Annexure II

Building Materials and Construction

COURSECODE:18B11CE313

COURSE CREDITS: 3

CORE/ELECTIVE: CORE

L-T-P: 3-0-0

Pre-requisite: None

Course Objectives:

1. To gain understanding of properties and usage of bricks, stones, timber and miscellaneous materials used in construction.
2. To become familiar with classification of buildings, walls, brick masonry and stone masonry
3. To be well versed with the properties and usage of plastering, roofs, floors, doors, damp proofing, stairs etc.
4. To gain state of the art knowledge of properties and usage of scaffolding, sound and fire proofing, paints and distempers.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Learn about properties and usage of bricks, stones, timber and miscellaneous materials used in construction.	Familiarity
CO-2	Learn about classification of buildings, walls, brick masonryand stone masonry	Familiarity
CO-3	Learn the properties and usage of plastering, roofs, floors, doors, damp proofing, stairs etc.	Familiarity
CO-4	Learn the properties and usage of scaffolding, sound and fire proofing, paints and distempers.	Familiarity

Course Contents:

Unit	Contents	Lectures required
1	**Bricks:** Classification, properties and selection criteria of bricks, burning of bricks, tests for bricks.	2
2	**Stones:** Stone classification, characteristics of good building stone, common building stones in India, Limestone.	1
3	**Timber:** Characteristics of good timber, defects in timber, seasoning of timber, plywood.	2
4	**Miscellaneous Materials:** Classification of Engineering Materials, Mechanical properties of Materials, (Added) Cement, Concrete, steel, glass, plastics, P.V.C., paint, varnish, adhesive materials, bitumen, ceramics, Geosynthetic material.	7
5	**Buildings and Walls**: Classification of buildings, types of walls	1
6	**Brick Masonry**: Technical terms, types of bonds, strength of brick masonry, defects in brick masonry, reinforced brickwork	2
7	**Stone Masonry**: Technical terms, stones, cutting and dressing, lifting of stones, joints in stone masonry, classification of stone masonry, selection of stone for masonry	1
8	**Plastering and Pointing**: Objects and requirements of plastering, terminologies, tools, methods of plastering, selection of good plaster, types of mortars, plaster finishes, defects, Pointing: Methods and types of pointing	4
9	**Roofs and Floors**: Types and construction of roofs, features, necessity, arches, lintels, types & construction of ground floor, upper floor, floor finishes	3
10	**Doors and Windows**: Location, Technical terms of door & window, door frame, size, designation of door and window, types of door & window	2
11	**Damp Proofing and Termite Proofing**: Causes, effects, various methods and material used for damp proofing and termite proofing	3
12	**Stairs**: Technical terms, requirements, dimension of step, types and classification of stairs	3
13	**Paints, Distemper, White wash and Color wash**: Paints and Paintings, characteristics of ideal paint, Constituents of paint, defects in paintings, painting on different surfaces,(Removed) classification and type of paints, Distempering & process of distempering, white washing & color washing	4
14	**Scaffolding**: Components and types of scaffolding	2
15	**Sound and Fire proof construction**: Sound Insulation, Insulation values for different type of walls, sound proof materials, Fire: Causes, fire hazards, fire load, grading of building according to fire resistance, ,(Removed) characteristics of fire resisting materials, fire alarms, fire extinguishing equipments. Concept of Sustainable Materials; Material Selection for sustainable design, Green buildings rating	5

	Systems(Added)	
Total lectures		**42**

Suggested Text Book(s):

1. S.K Duggal: Building Materials, 4th Edition, New Age International Publishers,2012.
2. B.C Punmia, Ashok Kr. Jain, Arun Kr. Jain: Building Construction,11th Edition, Lakshmi Publications,2016.
3. M.L Gambhir, Neha Jamwal, Building Materials, Mc Graw Hill, 2014

Suggested Reference Book(s):

1. Rangwala, Building Construction, 33rd Edition, Charotar Publishing House Pvt. Ltd.,
2. M.K Gupta, Practical Handbook on Building Construction, Nabhi , 2014.

Other useful resource(s):

1. Link to MIT Open Courseware :https://ocw.mit.edu/courses/architecture/4-461-building-technology-i-materials-and-construction-fall-2004/lecture-notes
2. Link to NPTEL course:https://nptel.ac.in/syllabus/syllabus.php?subjectId=105102088

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes (2) -10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

Course Outcomes (Building Materials and Construction)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	2	2	3	2	2	3	3	1	2	2	2	2	**2.17**
CO-2	3	1	3	3	3	1	3	3	3	3	2	3	**2.58**
CO-3	2	2	3	1	3	2	2	2	2	2	1	2	**2**
CO-4	3	3	3	3	2	3	1	2	3	1	3	3	**2.5**
Average	**2.5**	**2**	**3**	**2.25**	**2.5**	**2.25**	**2.25**	**2**	**2.25**	**2**	**2**	**2.25**	

Fluid Mechanics

COURSE CODE:

COURSE CREDITS: 3

CORE/ELECTIVE: CORE

L-T-P: 3-0-0

Pre-requisite: None

Course Objectives:

1. To get familiar with knowledge of fundamental of fluid and fluid flow characteristics.
2. To understand various methods to determine pressure measurement velocity measurement of fluid.
3. To understand various Principles of pipe flow losses occurred on pipe flow and its applications in real life.
4. To impart the knowledge of Dimensional analysis for solving the problems of fluid mechanics
5. To get familiar with the concept of flow phenomenon around the immersed bodies

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Knowledge of basic fundamentals of fluid and fluid flow characteristics.	Familiarity
CO-2	The students will understand basic methods to determine pressure measurement of fluid	Assessment
CO-3	Understanding of kinematics of fluid flow	Assessment
CO-4	Understanding of principles of pipe flow and basic fluid flow measurement instruments and techniques.	Assessment
CO-5	They will develop understanding of methods of dimensional analysis & modeling criteria.	Assessment
CO-6	Understanding the flow phenomenon around the immersed bodies	Assessment

Course Contents:

Unit	Contents	Lectures required
1	**Properties of fluid:** mass density, specific weight, specific volume, specific gravity; Viscosity, Newton's Law of viscosity, Types of Fluids, Surface tension and Capillarity.	3
2	**Pressure and its Measurement**: Pascal's Law, Pressure variation in a fluid at rest, Measurement of pressure: Manometers	4
3	**Hydrostatic forces on surfaces**: Total pressure and centre of pressure, Pressure measurement on Vertical plane surface, horizontal plane surface, curved surface and Inclined surface	3
4	**Buoyancy and Flotation:** Buoyancy, Metacentre, Metacentric height, Experimental method of determination of metacentric height	2
5	**Kinematics of fluid flow: S**teady& unsteady, uniform & non- uniform, rotational & irrotational, laminar & turbulent flow, Continuity equations for 1-D & 2-D flows, velocity and acceleration, velocity potential function, stream function, types of motion, vorticity.	5
6	**Dynamics of fluid flow**: Euler's equation, Bernoulli's equation & its applications, Impulse-momentum equation & its applications, Flow measurements: Venturimeter, Pitot-tube, Orifice-meter	6
7	**Dimensional analysis:** methods of analysis, Rayleigh's method, pie-Buckingham theorem, Dimensionless numbers.	3
8	**Boundary Layer Theory:** Concept of boundary layer, laminar and turbulent boundary layers, boundary layer thickness, Von Karman integral equation, laminar sublayer	4
9	**Forces on submerged bodies:** drag and lift force, Expression for grag and lift, Drag on a sphere, Drag on a cylinder, Karman vortex trail	4
10	**Flow through pipes:** Losses in pipe sections, hydraulic gradient line and total energy line, flow through pipes in series and parallel, compound pipes, Heigen Pousille's equation, Darcy-Weisbach'sequation, branching of pipes and pipe networks.	8
Total lectures		**42**

Suggested Text Book(s):

1. Modi and Seth: Fluid mechanics and hydraulic machines, 3rd Edition, Prentice-Hall of India, 2010.
2. R K Bansal: A text Book of Fluid mechanics, - Laxmi Publication, 2010
3. D S Kumar: Fluid mechanics and Fluid power Engineering,6th Edition S. K. Kataria& Sons,

2002

Suggested Reference Book(s):

1. Douglas, John F., Gasiorek, Janusz M., Swaffield, John A. 4TH Edition, Pearson Education Asia,2006
2. R J Garde, Fluid Mechanics Through Problems 3rd Edition,New Age International Publishers 2016

Other useful resource(s):

1. Link to NPTEL course contents:https://nptel.ac.in/courses/105101082/

2. Link to topics related to course:
   - **i.** https://nptel.ac.in/courses/105101082/**3**
   - ii. https://nptel.ac.in/courses/105101082/4
   - iii. https://nptel.ac.in/courses/105101082/6 -16

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (5) - 10 Quizzes (2) -10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course Outcomes (Fluid Mechanics)	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**Average**
CO-1	3	3	3	2	2	3	x	x	1	1	1	3	**2**
CO-2	3	3	3	2	2	3	x	x	2	1	2	3	**2.4**
CO-3	3	3	3	3	2	2	x	x	2	2	1	3	**2.4**
CO-4	3	3	3	3	3	2	x	x	2	3	2	3	**2.7**
CO-5	3	3	3	3	3	2	x	x	1	2	2	3	**2.5**
CO-6	3	3	3	3	2	3	x	x	2	2	2	3	**2.6**
Average	**3**	**3**	**3**	**2.67**	**2.33**	**2.5**	**0**	**0**	**1.67**	**1.8**	**1.67**	**3**	

Surveying

COURSE CODE:

COURSE CREDITS: 3

CORE/ELECTIVE: CORE

L-T-P: 3-0-0

Pre-requisite: None

Course Objectives:

Surveying is of special importance and interest to a Civil Engineer. Surveying is a general term that covers any survey work carried out in connection with the construction of an engineering project, such as buildings, dam, highways, railways, bridges, canals, water supply, drainage works and other civil engineering works. The main objectives are:

1. To produce up-to-date *Engineering Plans* of the areas in which the work will be carried out.
2. To determine the corrections in different measurements
3. To ensure that the construction takes place in the correct relative and absolute position on the ground.
4. Knowledge of advanced surveying methods; Remote Sensing and GIS

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
CO-1	Understanding of basic principles of various methods of surveying, and related problems.	Assessment
CO-2	Will be able to apply various corrections in different measurements.	Assessment
CO-3	Will be able to get the correct relative and absolute position on the ground where construction is required.	Assessment
CO-4	Knowledge of modern survey equipment, Implement procedures for its use and care of field equipment.	Assessment
CO-5	Understanding of the design of curves.	Assessment
CO-6	Understanding of advanced surveying methods; Remote Sensing and GIS	Familiarity

Course Contents:

Unit	Contents	Lectures required
1	**Introduction:** History of surveying and mapping, importance of geomatics engineering, plane and geodetic surveying, concept of datum and map projection system, Classification of Surveying, Principles of Surveying.	2
2	**Chain Surveying:** Instruments for chaining, Errors due to incorrect chain, Chaining on sloping ground, Errors in chaining, Tape corrections, Chain triangulation, setting out right angles, basic problems in chaining, conventional symbols used in chaining	2
3	**Compass surveying:** Instruments (prismatic and surveyor compass), bearing and angles, magnetic declination, local attractions.	3
4	**Leveling:** Instruments, Optical defects in lenses, Temporary adjustment of a level, and different types of leveling, curvature and refraction corrections, leveling problems, errors in leveling, the level tube.	5
5	**Contouring:** Contours, contour interval, contour gradient, characteristics of contours, methods of locating contours and their interpretation, uses of contour maps.	4
6	**Plane Table Surveying:** Instruments, principle and methods of plane- tabling, three-point problem, two-point problem, errors in plane tabling, advantages and disadvantages.	3
7	**Tacheometric and Theodolite:** Surveying: transit and non-transit, definition and terms, measurement of horizontal and vertical angles, instruments and tachometric method	4
8	**Modern Field Survey Systems:** Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments, Distomat, Total Station – Parts of a Total Station – Accessories –Advantages and Applications, Global Positioning, Systems- Segments, GPS measurements,	4
9	**Curves:** Elements of simple and compound curves – Method of setting out of simple circular curve – Elements of Reverse curve - Transition curve – length of curve – Elements of transition curve.	5
10	**Remote Sensing and GIS:** Introduction –Electromagnetic Spectrum, interaction of electromagnetic radiation with the atmosphere and earth surface, remote sensing data acquisition: platforms and sensors; visual image interpretation; digital image processing, Introduction to GIS, types of data, components of GIS.GIS architecture, vector data models, raster data models	7
12	**Photographic Surveying:** Principles, Types of photographs, Concept of Relief Displacement, advantages of aerial photography	3
Total lectures		**42**

Suggested Text Book(s):

1. S K Duggal: Surveying, 3rd Edition, Tata McGraw-Hill Publishing Company , 2012
2. A.M.Chandra: Plane Surveying,2nd Edition, New Age International Publishers, New Delhi, 2006
3. B.C.Punmia: Surveying-1, Surveying-2, Laxmi Publication Delhi, 2005
4. N.N.Basak: Surveying &Leveling Tata McGraw Hill Publishing Com. New Delhi

Reference Books:

1. B.C.Punmia: Surveying-3, Laxmi Publication Delhi, 2005

Suggested Reference Book(s):

1. Kavanagh, Barry F.: Surveying : Principles and applications, 7th Edition, Pearson Education Asia,2006
2. A.M.Chandra: Higher Surveying 2nd Edition, New Age International Publishers New Delhi, 2006
3. Clark David: Plane and Geodetic surveying for Engineers, vol-1 & vol-2,6th Edition, CBS Publishers, 2006

Other useful resource(s):

1. Link to NPTEL course contents: https://nptel.ac.in/courses/105107122/
2. Link to topics related tocourse:
   i. https://nptel.ac.in/courses/105107122/1-3
   ii. https://nptel.ac.in/courses/105107122/8-18
   iii. https://nptel.ac.in/courses/105107122/23-32

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (5) - 10 Quizzes (2)-10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course Outcomes (Surveying)	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**Average**
CO-1	3	2	2	1	2	2	2	3	2	3	2	3	**2.25**
CO-2	3	2	2	2	2	2	2	1	2	2	3	3	**2.16**
CO-3	3	3	3	3	2	1	2	2	2	2	3	3	**2.41**
CO-4	2	3	2	3	3	1	1	2	1	1	2	3	**2**
CO-5	3	2	3	3	3	2	1	2	3	3	2	3	**2.5**
CO-6	3	3	3	3	2	1	1	2	1	1	3	3	**2.16**
Average	**2.83**	**2.5**	**2.5**	**2.5**	**2.33**	**1.5**	**1.5**	**2**	**1.83**	**2**	**2.5**	**3**	

Water Resource Engineering

COURSE CODE:
COURSE CREDITS: 3
CORE/ELECTIVE: CORE
L-T-P: 3-0-0

Pre-requisite: Fluid Mechanics, Soil Mechanics

Course Objectives:

1. To impart the knowledge of hydrology that deals with the occurrence, distribution, movement and properties of water on the earth and beneath the surface as groundwater.
2. To supplement the knowledge of various irrigation techniques, water requirements of the crops and the estimation of the water supplies.
3. To learn about distribution systems for canal irrigation, design of unlined and lined irrigation canals design with their economic justification and sediment problems associated with canals.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Knowledge of various components of hydrologic cycle that affect the movement of water in the earth and their estimation techniques.	Familiarity and Assessment
CO-2	Ability to estimate stream flow through various stream flow measurements techniques.	Assessment
CO-3	Grasping of the concepts of movement of ground water beneath the earth and ability to estimate the yielding capacity of the source.	Familiarity and Assessment
CO-4	Knowledge of the basic requirements of irrigation and various irrigation techniques and estimation of water to be supplied for crop requirements.	Familiarity and Usage
CO-5	Understanding of distribution systems for canal irrigation and the basics of design of unlined and lined irrigation canals.	Familiarity and Usage

Lecture plan

S No.	Topic	No. of lectures
1	**Hydrology:** Hydrological cycle, precipitation and its measurement, DAD curve, mean rainfall over a drainage basin, snowfall and snowmelt, ~~ground and surface water resource, single and multipurpose projects~~	4
2	Evaporation, transpiration, depression storage, infiltration, overland flow, Φ index , w-index, infiltration capacity, measurement of infiltration rate	4
3	**Stream flow measurements**: direct measurements, measurement of stage, wire gauge , automatic stage recorder-float gauge recorder, bubble gauge recorder; current meter, area velocity method, moving boat method, , dilution technique, indirect methods-slope area method	4
4	Hydrograph, its application, factor affecting flood hydrograph, base flow separation methods, stream flow hydrograph, direct runoff hydrograph, unit hydrograph, S-Curve technique	5
5	Flood estimation , Rational methods, Empirical formulae, Envelope curve, flood frequency analysis-probability method, Gumbel's method, confidence limits	3
6	**Ground water flow** : Aquifer characteristics-Specific yield, storage coefficient, coefficient of permeability, confined and unconfined aquifers, aquitards, aquifuge	2
7	Flow through wells: Radial flow into a well under confined and unconfined conditions, tube wells, pumping and recuperation tests, ground water potential.	4
8	**Irrigation Engineering**: Water requirements of crops, Moisture-crop relationship, Irrigation requirements, duty and delta, Irrigation efficiencies, Design of conventional and modern methods of irrigation, ~~Irrigation of arid lands~~	6
9	Salinity of soil, Salinity control, Quality of irrigation water, Contaminants and their effects on various crop types, Rain water management, conjunctive use of water, Water logging causes and control, drainage system design.	3
10	**Canals :** Distribution systems for canal irrigation, canal capacity, canal losses, alignment of main and distributory canals, ~~drainage system~~	2
11	Alluvial and Non alluvial canals, design of alluvial channels, Kennedy's theory, lacey's theory, regime channels, design of non- alluvial channels, design of lined canals, most efficient section, ~~critical shear stress, bed load, local and suspended load transport, cost analysis of lined and unlined canals, drainage behind lining.~~	5
	Total	**42**

Text Books:

1. Garg, S. K., Irrigation Engineering and Hydraulic Structures, Khanna Publishers,1997.
2. Todd, D. K., Ground water Hydrology, John willey & sons, Newyork, 1995
3. Subramanya, K., Engineering Hydrology, McGraw Hill Education

Reference books:

1. Applied Hydrology - Ven T Chow, David R Maidment, Larry W Mays
2. Bharat Singh, Fundamentals of Irrigation Engineering, Nem Chand and Brothers.

TEACHING METHODOLOGY: The course will be covered through lectures supported by presentations and video demonstrations.

EVALUATION SCHEME:

Instrument	**Duration**	**Marks**
Mid term1	1	15
Mid Term2	1.5 hour	25
End term	2 hour	35
Internal Assessment*		25
Total		100

*** Internal Assessment is based on Assignments, Tutorials, Quizzes, and Regularity in Attendance**

	Total Nos.	Max. marks
Assignment		10
Attendance		5
Class Quiz 1	5(marks)	10
Class Quiz 2	5 (marks)	
	Total	25

Correlation of COs with POs

Course Out-comes	Programme Outcomes												Average
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	
CO1	3	2	1	3	2	2	3	2	3	2	2	2	**2.3**
CO2	3	3	2	1	3	2	3	2	3	2	1	2	**2.3**
CO3	3	2	2	1	3	2	2	3	2	2	1	2	**2.1**
CO4	3	3	3	1	3	1	3	2	3	3	2	2	**2.4**
CO5	3	3	2	2	3	2	2	2	3	2	2	2	**2.3**
Average	**3**	**2.6**	**2**	**1.6**	**2.8**	**1.8**	**2.6**	**2.2**	**2.8**	**2.2**	**1.6**	**2**	

Design of Steel Structures

COURSE CODE:

COURSE CREDITS: 3

CORE/ELECTIVE: CORE

L-T-P: 3-0-0

Pre-requisite: Mechanics of Solids

Course Objectives:

1. Learn to analyze algorithms for Time and Space Complexity
2. To provide a basic understanding of the mechanical properties and types of steels used in civil structures, and to develop technical competence in the design of tension and compression members, beams, and simple bolted and welded connections.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Design bolt and weld connections.	Familiarity
CO-2	Design tension and compression members.	Assessment
CO-3	Design beams and beam columns.	Assessment
CO-4	Design built up members and column base.	Usage
CO-5	Design of Plate Girder ad steel truss.	Usage

Course Contents:

Unit	Contents	Lectures required
1	**Introduction:** General- Types of Steel – Mechanical behavior of steel – Measures of Yielding – Measures of Ductility – Types of Structures – Structural Steel Sections**.**	**2**

2	**Methods of Structural design**: Introduction-Design Philosophies-Working Stress method-Ultimate Strength method-Load and Resistant factor- Limit State Method-Partial safety factor-Load-Load combinations-Classification of Cross sections- General aspects in the design.	**2**
3	**Design of Steel fasteners:** Types of fasteners – Riveted connections-Bolted connections- Assumptions- Failure of bolted joints – Strength of bolted joints – Design examples – Design of Welded connections – Butt weld- fillet weld – Design examples. **Design of Eccentric Connections**: Design of Brackets- Type-1 and Type 2 – Moment Resistant connections - Design Examples	**8**
4	**Design of Tension Members:** General – Modes of Failure of Tension member- Analysis of Tension members- Example - Design steps – Design examples – Lug angles – Design.	**6**
5	**Design of Compression Members:** Modes of Failure of a Column, Buckling Failure: Euler's Theory, Effective Length, Slenderness Ratio, Design Formula: I.S. Code Formula, Design of Compression Members, Design of Built-Up Compression Members: Laced and Battened Columns	**6**
6	**Design of Beams:** General- Lateral Stability of Beams- Bending Strength of Beams – Plastic Section Modulus - Design Examples	**4**
7	**Design of Beam Columns:** Behavior of members under combined loading – Modes of Failures – Design Examples.	**4**
8	**Design of Column Splices and Column Base:** Design of Column Splice-Design Examples, Slab Base- Gusseted Base- Design Examples	**4**
9	**Design of Plate Girder:** General- Components of Plate Girder- Optimum depth – Bending Strength – Shear Strength – Shear Buckling- Simple Post critical method- Tension Field method- Stiffeners-Bearing- Transverse stiffeners - Design Examples.	**4**
10	**Design of steel truss:** General - components of steel truss, design of purlins, moment resisting frames.(added)	**2**
Total lectures		**42**

Suggested Text Book(s):

1. Design of steel structures – N Subramanian, Oxford University Press – 2009.
2. Limit State Design of steel structures, S.K. Duggal, Tata McGraw- Hill, 2010.
3. IS - 800:2007.
4. IS – 808:1989.

Suggested Reference Book(s):

1. Design of Steel structures by K.S. Sai Ram, Person Education.

2. Design of Steel Structures Edwin H. Gaylord, Jr. Charles N. Gaylord and James Stallmeyer Tata McGraw-Hill Education Pvt. Ltd.
3. Design of Steel Structures Vol. 1 & 2 – Ramchandra, Standard Publications.
4. Design of steel structures, Structures, S.S. Bhavikatti, IK int Publication House, New Delhi, 2010.

Other useful resource(s):

1. Link to NPTEL course contents:https://nptel.ac.in/courses/105106112/

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (10) - 10 Quizzes(2) -10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

Course Outcomes (Design of Steel Structures)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	2	2	2	2	2	1	1	1	2	2	2	2	**1.75**
CO-2	2	3	3	3	3	1	1	1	2	2	1	2	**2**
CO-3	2	2	2	2	3	1	1	1	2	2	1	2	**1.75**
CO-4	2	3	3	3	2	1	1	1	2	3	2	2	**2**
CO-5	3	2	3	3	2	3	2	1	2	2	3	3	**2.4**
Average	**2.2**	**2.4**	**2.6**	**2.6**	**2.4**	**1.4**	**1.2**	**1**	**2**	**2.2**	**1.8**	**2.2**	

Electromagnetic Waves

COURSE CODE: 18B11EC513

COURSE CREDITS: 4

CORE/ELECTIVE: CORE

: 3-1-0

Pre-requisite: Basics of Engineering Mathematics

Course Objectives:

1. To lay the foundations of electromagnetic engineering and its applications in modern communication systems.
2. To analyze the wave propagation on transmission lines and wave guides.

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
CO-1	To apply vector calculus to static electric-magnetic fields in different engineering situations.	Familiarity
CO-2	To analyze Maxwell's equation in different forms (differential and integral) and apply them to diverse engineering problems.	Familiarity
CO-3	To examine the phenomena of wave propagation in different media and its interfaces and in applications of microwave engineering.	Usage
CO-4	To analyze the nature of electromagnetic wave propagation in guided medium which are used in microwave applications.	Assessment
CO-5	To analyze the wave propagation on two wire transmission lines and to study the applications of transmission lines in real time applications.	Assessment

Course Contents:

Unit	Contents	Lectures required
1	Review of Fields: Review of scalar and vector fields. Electrostatic and Magneto static Fields.	4
2	Maxwell's Equations: Inconsistency of Amperes law, Continuity equation, Displacement current, Maxwell's equations, Boundary conditions.	4
3	Wave propagation in space: Wave propagation in free space, Conductors and dielectrics, Polarization, Plane wave propagation in conducting and non conducting media, Phasor notation, Phase velocity, Group velocity; Reflection at the surface of the conductive medium, Surface Impedance, Depth of penetration. Transmission line analogy.	11
4	Poynting theorem: Poynting theorem, Poynting Vectors and power loss in a plane conductor.	4
5	Transmission Lines: Transmission line equations, characteristic impedance, open and short circuited lines, standing wave and reflection losses. Impedance matching, Smith Chart, Simple and double stub matching.	6
6	Waveguides: Rectangular and circular wave guides- Modes in rectangular and cylindrical coordinates, characteristics, power transmission and losses, excitation of modes. Microwave coaxial connectors. Rectangular, Circular and semi-circular cavity resonators, Q factor.	8
7	Radiation Basics: Scalar and vector potentials. Radiation from a current filament, half-wave dipole and small loop antennas. Antenna characteristics, radiation pattern, radiation intensity, directivity and power gain. Antenna arrays, effective area and Friss equation.	5

Total lectures	42

Suggested Text Book(s):

1. Hayt Jr, William H. John A. Buck, “Engineering Electromagnetic”. 8th Edition, Tata McGraw-Hill, 2013.
2. Pozar, David M. “Microwave engineering”4th Edition, John Wiley & Sons, 2011.
3. Ballanis, Constantine A. “Antenna theory analysis and design”, 3rd John Willey and Son's Inc., New York, 2005.

Suggested Reference Book(s):

1. Sunil Bhooshan, “Fundamentals of Engineering Electromagnetic”, 1st Edition, Oxford University press, 2012.
2. Cheng, David Keun. “Field and wave electromagnetic”, 2nd Edition Pearson Education India, 2011.
3. Elliot, Robert S. “Antenna theory and design”. Revised Edition, John Wiley & Sons, 2005.

Other useful resource(s):

1. Link to NPTEL course contents: https://nptel.ac.in/courses/117103065/
4. Link to topics related to course:
   - https://nptel.ac.in/courses/117103065/1
   - https://nptel.ac.in/courses/117103065/5
   - https://nptel.ac.in/courses/117103065/7
   - https://nptel.ac.in/courses/117103065/10

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes (2) - 10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course outcomes (Electromagnetic Waves)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	2	2	2	2	2	2	1	1	1	2	1	2	1.7
CO-2	2	3	2	3	2	2	1	1	1	2	1	2	1.8
CO-3	3	3	3	3	3	2	1	1	1	2	1	2	2.1
CO-4	2	2	2	2	2	2	1	1	1	3	1	2	1.8
CO-5	3	2	3	2	2	2	1	1	1	2	1	2	1.8
Average	2.4	2.4	2.4	2.4	2.2	2.0	1.0	1.0	1.0	2.2	1.0	2.0	

Wireless and Data Communication

COURSE CODE: 18B11EC611

COURSE CREDITS: 3

CORE/ELECTIVE: CORE

: 3-0-0

Pre-requisite: None

Course Objectives:

1. To understand the fundamentals of wireless and data communication networks.
2. To allow the students to learn network architecture and protocols of trending wireless networks.

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
CO-1	Understand the basics of wireless communication system and various wireless standards.	Familiarity
CO-2	Have the basic knowledge of computer networks and its applications in communication engineering.	Familiarity
CO-3	Understand the behavior of wireless channel.	Usage
CO-4	Have the knowledge of data sharing and their protocols.	Usage
CO-5	Brief the recent protocols and standards of various communication networks.	Assessment
CO-6	Get familiar with the recent wireless communication systems.	Assessment

Course Contents:

Unit	Contents	Lectures required
1	Review of Wireless Communication: Introduction to Wireless Communication, Basic building blocks of wireless system: source coding & channel coding, base band & band pass signal representation; 1G, 2G, 2.5G, 3G, 4G and 5G wireless standards and their Comparison; Multiple Access techniques: TDMA, FDMA, CDMA, OFDMA.	6
2	Wireless Channel: Linear Time Varying System; Path loss model; Multipath Propagation; Doppler Shift; Parameters of Wireless Multipath Channel; Small-scale and large-scale fading; Shadowing, Types of Fading: flat fading, frequency selective fading, slow fading and fast fading; Capacity of wireless channel: Capacity of AWGN, Flat Fading and Frequency Selective Channels.	10
3	Data Communication: OSI vs TCP/IP model; Wired vs Wireless; Circuit switching/ Packet switching; Flow control and error control; CRC; Connection oriented/connection less transmission; Bit stuffing.	7
4	MAC, Network and transport layer protocols: Dynamic multiple access methods: ALOHA, slotted ALOHA, CSMA/CD etc; Routing algorithms: DSDV, LSR, AODV; Broadcasting methods: flooding, spanning tree, multicasting; UDP, TCP, IP, IPv4, IPv6, QoS.	8
5	Wireless Networks: Introduction to WiFi; 802.11, 802.11a and 802.11 b Wireless LANs; Frame structure; Modes of operation; Data rates; Power management; Handoff strategies, Medium access control etc. Bluetooth networks: Piconet, scatternet, frame structure, data rates; synchronous and asynchronous services, power saving etc	8
6	Recent Trends: Introduction to WiMAX and ZigBee Networks; Software Defined Radio; UWB Radio; Wireless Adhoc Network and Mobile Portability; Security issues and challenges in a Wireless network.	3

Total lectures	42

Suggested Text Book(s):

1. T.S. Rappaport, "Wireless Communication", 2nd Edition, Prentice Hall., 2010.
2. A. Tanenbaum, "Computer Networks", 5th Edition, Prentice Hall, 2011.
3. Bahrouz Forouzan, "Data communication & Networking," 5th Edition, McGraw Hill, 2017.

Suggested Reference Book(s):

1. William Stallings, "Data and Computer Communications," 10th Edition, Pearson.,2013.

Other useful resource(s):

Link to NPTEL course contents:

1. https://nptel.ac.in/courses/117102062/36
2. https://nptel.ac.in/courses/106105082/31

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes (2) - 10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course outcomes (Wireless and Data Communication)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	3	2	1	3	1	1	1	1	1	2	1	2	1.58
CO-2	3	3	1	3	2	1	1	3	1	2	1	2	1.92
CO-3	3	3	2	3	2	1	2	3	1	2	1	2	2
CO-4	3	3	3	3	2	1	2	3	1	2	1	2	2.17
CO-5	3	3	3	3	3	1	2	3	2	2	1	2	2.33
CO-6	3	3	3	3	3	1	3	3	3	2	3	2	2.67
Average	3	3	2.17	3	2.17	1	1.83	2.67	1.5	2	1.33	2	

BIOSENSORS

COURSE CODE: 21B1WPH831

COURSE CREDITS: 3

CORE/ELECTIVE: ELECTIVE (OPEN)

L-T-P: 3-0-0

Pre-requisite: None

Course Description:

Biomaterials science, the study of the application of materials to problems in biology and medicine, is characterized by medical needs, basic research, and advanced technological development. Biomaterials directly impact many disciplines within the field of biomedical engineering. This interdisciplinary course introduces biomaterials research as related to medicine and biotechnology, emphasizing the interactions between materials and biological structures. Fundamental issues related to the function of biomaterials are explored based on their biocompatibility, stability, interfaces, and behavior in the body. Biomaterials testing methods, interaction with proteins and cells, cardiovascular, drug delivery, regulatory issues, and emerging research directions will also be discussed.

Course Objectives:

Over the last few years, there has been a significant shift in the understanding of the structure, function and behaviour of biomaterials, with the introduction of new types of biomaterials, extended clinical applications and indeed entirely new concepts of what constitutes a biomaterial. The objectives of this new course are:

I. To explore and introduce these new concepts of biomaterials science.

II. The subject matter will build upon the principles of materials science on the one hand, including materials chemistry and nanoscale materials, and the principles of biology and disease on the other hand, including cell biology and immunology and drug and gene therapies.

II. The overall aim will be to develop an understanding of the roles of materials science and biology principles in the structure and function of clinical biomaterials and the relationship between these properties and the current and future profile of health care products.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Development insight to the basics of biosensing technology. Significance of Biosensors	Familiarity
CO-2	Fundamentals principles and Applications of Biosensors	Familiarity
CO-3	Understanding of Biosensing Technology	Analytical skills
CO-4	Various strategies to apply the scientific theory and mechanisms to practical issues	Innovative Skills
CO-5	The students will be exposed to recent publications that highlight key advances in this field and learn how various chemical, biological and engineering concepts are used in synergy to achieve state-of-the-art sensing	Innovative Skills

Course Contents:

Unit	Contents	Lectures required
1	Introduction to Biosensor/sensor, Definitions, History, concepts and Biosensors- Advantages and limitations. Fundamental elements of biosensor devices and design considerations, calibration, dynamic range, signal to noise, sensitivity. Fundamentals of surfaces and interfaces, modifications of sensor surface.	**8**
2	Aspect of the sensors : Recognition event and element : Catalytic, Single and multiple enzyme, Transducers Method of immobilization and Enzyme Kinetics: adsorption, encapsulation, covalent attachment, diffusion issues. Bio Affinity: Labeled and Label free, whole cell sensing, Generations of Biosensor	**10**
3	Electrochemistry for biosensors: Red-ox potentials, membrane potential, Electrochemical Biosensors: potentiometric biosensors (ISE's and ISFETs); amperometric biosensors, Conductimetric and Impedimetric Biosensors. Applications	**12**
4	Optical Biosensor: fundamentals of optics- sources, detectors, and optical circuits; detection of absorbance, reflectance, and fluorescence; Surface plasmon resonance (SPR) based devices. Lab-on-a-chip: TAS and m-TAS devices, Sensors based on Fiber Optic. Applications	**7**

5	Nanomaterials in Biosensors: Quantum dots, Carbon based Nano Material such as CNT etc., Metal oxide based nano particles, Multifunctional nanomaterials, Core/shell nanoparticle system	**5**
Total lectures		**42**

Suggested Text Book(s):

1. B. R Eggins, Biosensors an Introduction , 1st ed. John Wiley & Sons Publishers, 1996.
2. L.J. Blum, P. R. Coulet, Biosensors Principles and Applications, 1st ed. Marcel Dekker Inc, 1991.
3. D. G. Buerk, Biosensors Theory and Applications, 1st ed. Technomic Publishing. Co Inc, 1993.
4. J.Y. Yoon, Introduction to Biosensors, 1st ed. Springer-Verlag New York, 2012.
5. M. Zourob, Recognition Receptors in Biosensors, 13th ed. Springer-Verlag New York, 2010.
6. Z. Liron, **N**ovel Approaches in Biosensors and Rapid Diagnostic Assays, 1st ed. Springer US, 2012.

Suggested Reference Book(s):

1. R. F. Taylo,r Handbook of Chemical and Biological Sensors, Ltd ed. IOP Publishing, 1996 .
2. A. Sadana & N. Sadana, Handbook of Biosensors and Biosensor Kinetics, Elsevier, 2011.
3. J. M. Cooper, Biosensors, Oxford University Press, 2003.
4. E. A. Hall, Biosensors, 1st ed., Open University, Milton Keynes, 1990.
5. G.Ramsay, Sensor Physics & Technology - Biosensors, 1st ed. Champan & Hall, 1993.
6. A. Pasquarelli, Biosensors and Biochips, Springer, 2021.

Other useful resource(s):

https://onlinecourses.nptel.ac.in/noc22_ph01/preview
https://onlinecourses.nptel.ac.in/noc22_ee50/preview

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes(2) -10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

Course outcomes (Biosensors)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average

CO-1	3	3		2	2	3	3	2				2	2.5
CO-2	3	1			2	2	2	2				3	2.14
CO-3	1	1	1		1			1				1	1
CO-4	2	2	2	2	1			1				2	1.7
CO-5	3	3	3	3	2				3	3		3	2.9
Average Score	2.4	2.5	2	3.5	1.6	2.5	2.5	1.5	3	3		2.2	2.04

Computational Nanotechnology

Course code: 22B1WPH731

Course credits: 3 (3-0-0)

Core/Elective: Elective (Open)

L-T-P: 3-0-0

Pre-requisite: None

Course Objectives:

I. To introduce students with science and technology involved with materials of nano dimension using computational methods

II. To enable the students in gaining problem solving capability

III. To familiarize students with numerical methods to solve real materials problem at very basic level

IV. To enhance student's ability to think about problems in nanotechnology to take future broader challenges in the area of science

Course Outcome:

S.No.	Course Outcomes	Level of Attachment
CO-1	To learn fundamentals and science aboutmaterialswith nano-dimension	Familiarity
CO-2	Learn writing programs to address physical properties of materials	Assessment and usage
CO-3	Learning computational methods and theories for solving science of materials	Assessment and usage
CO-4	Learning various computational tools to solve real material problems that may open a broader career opportunities	Assessment and usage
CO-5	To develop ideas about problems in real materials	Familiarity

Course Contents:

Unit	Contents	Lecture required
1	**Introduction: Quantum dots**, Bulk, quantum well, quantum wire and quantum dots; properties of nanomaterials in short; example of application of nanomaterials	**4**
2	**Typical nanomaterials:** Graphene, Carbon nanotubes, nanocomposite, Light emitting diodes	**2**
3	**Basic quantum mechanical ideas:** Time-independent Schrodinger equation**,** eigenvalue problems	**11**
4	**Numerical programming:** Solve eigenvalue problem using numerical methods, Algorithm development and understanding	**5**
5	**Basic solid-state physics:** Crystal structure, Block wave function, Some numerical exercises	**4**
6	**Theory of many-electron system:** Introduction to Hartree-Fock theory and Density functional theory,	**6**
7	**Exercises on numerical software:** Density functional theory (DFT) software; Tools to understand the behavior of nanomaterials, TB-LMTO-ASA/quantum espresso, installation, simulation of crystal structures	**7**
8	**Density functional theory running:** practically understanding DOS and band structure of any material	**8**
Total lectures		**42**

Suggested Text Book(s):

1. J. V. Guttag, Introduction to Computation and Programming Using Python: With Application to Understanding Data, 2nd ed. MIT Press Ltd, 2016.
2. K. N. ANAGNOSTOPOULOS, Computational Physics A: Practical Introduction to Computational Physics and Scientific Computing, National Technical University of Athens, Publisher Lulu.com, 2016.
3. K.K. Chattopadhyay and A.N. Banerjee, Introduction to Nanoscience and Nanotechnology, PHI Learning pvt Ltd., 2009.
4. J. Wang, Computational Modeling and Visualization of Physical Systems with Python, Wiley-VCH, 2016.
5. R.H. Landau, M. J. Páez, C. C. Bordeianu, Computational Physics: Problem Solving with Python, 3rd Edition, Wiley-VCH, 2015.

Suggested Reference Book(s):

1. J. Ramsden, Nanotechnology: An Introduction, Elsevier Publishers, 2011.

2. R.M. Martin, Electronic Structure: Basic Theory and Practical Methods, Cambridge University Press, 2012.
3. J. Izaac, J. Wang, Computational Quantum Mechanics, Springer International Publishing, 2019.
4. A. Scopatz and K. D. Huff, Effective Computation in Physics. Field Guide to Research with Python, O'Reilly, 2015.
5. R.Landau, M. J. Páez, and C. C. Bordeianu, Survey of Computational Physics, Princeton University Press, 2022.
6. W. R. Gibbs, Computation in Modern Physics, 3rd ed. New Mexico State University, USA: World Scientific Publishing Co Pte Ltd, 2006.

Other useful resource(s):
https://www2.fkf.mpg.de/andersen/LMTODOC/LMTODOC.html

https://www.youtube.com/watch?v=pOtnzAXlXvI&list=PLwdnzlV3ogoUY43XoMwVVCWDSImC9mVQB

https://www.youtube.com/watch?v=mLZTDccwtfg&list=PLy0giqEzkJNiUkrNqszvG39J9hHTEWRa5

EvaluationScheme:

S. No.	Exam	Marks	Duration	Coverage / Scope of Examination
1.	T-1	15	1 Hour.	Syllabus covered upto T-1
2.	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (3) -10 Quizzes(2) -10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

Course outcomes (Computational Nanotechnology)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	3	3	3	2	2	1	1	-	-	-	-	2	2.125

CO-2	2	3	3	3	3	1	1	-	-	-	-	3	2.375
CO-3	3	2	2	2	2	1	1	-	-	-	-	2	1.875
CO-4	3	2	2	2	2	3	3	-	-	-	-	2	1.875
CO-5	2	3	3	3	3	1	1	-	-	-	-	3	2.375
Average	2.6	2.6	2.6	2.4	2.4	1.4	1.4	-	-	-	-	2.4	

Engineering Physics-I

COURSE CODE: 18B11PH111

COURSE CREDITS: 4

CORE/ELECTIVE: CORE

L-T-P: 3-1-0

Pre-requisite: None

Course Objectives:

I. To enable the students to get better understanding about electromagnetics and its applications in engineering.
II. To enable the students to get better understanding about physical optics and its applications in engineering.
III. At the conclusion of the course, the ability of students should have enhanced to think logically about the problems of science and technology and obtain their solutions.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Students will get better understanding about electromagnetics and its applications in engineering.	Familiarity and Assessment
CO-2	Students will get better understanding about physical optics and its applications in engineering.	Familiarity and Assessment

CO-3	Students will be able to enhance logical thinking about the problems of science and technology	Assessment and Implementation
CO-4	Students will be able to apply learned concepts to obtain solutions to the problems	Assessment and Implementation

Course Contents:

Unit	Contents	Lectures required
1	**Basics of Electromagnetics:** Vector algebra, Electromagnetic Operations (Curl, Divergence, etc), Basics of EM theory, Maxwells equations. EM waves in different mediums (Conducting, Non Conducting). Concept of Poynting Vector and Theorem. Boundary conditions for EM transmissions. Applications of EM theory	**16**
2	**EM to Optics:** Bridge from EM to Wave Optics	**2**
3	**Interference:** Superposition of Waves, Coherence, Concept and phenomenon of Interference with Real and Virtual Sources. Michelson Morley and Fabry–Pérot interferometer and their applications	**12**
4	**Diffraction:** Fraunhofer diffraction by single, double and N slits, Resolving and dispersive power of Diffraction elements. Application of Diffraction (WDM and other applications).	**6**
5	**Polarization:** Introduction, Difference between unpolarized and polarized light, Means of production of polarized light, Optical activity, specific rotation, Lorentz half shade and biquartz polarimeter. Application of Polarizations (Communication and other applications)	**6**
	Total Lectures	**42**

Suggested Text Book(s):

1. D. J. Griffiths, Introduction to Electrodynamics, 4th ed. Eastern Economy Editions: PHI, 2012.
2. S. Sharma & J. Sharma, Engineering Physics, Pearson Pub, 2018.
3. N. Subrahmanyam and N. Subrahmanyam, A Textbook of Optics by, 23rd ed. S. Chand, 2006.
4. R. Fitzpatrick. (2007). Electromagnetism and Optics (An Introductory Course) [Electronic].

https://farside.ph.utexas.edu/teaching/302l/302l.html.

Suggested Reference Book(s):

1. F.A. Jenkins and H.E. White, Fundamentals of Optics, McGraw-Hill:Addison-Wesley Press, 1981.
2. A. Ghatak, Optics, 5th ed. Tata McGraw Hill, 2012.
3. F.A. Jenkins and H.E. White, Fundamentals of Optics, McGraw-Hill, 1981.
4. V. V. Mitin, D. I. Sementsov, An Introduction to Applied Electromagnetics and Optics, CRC Press:Taylor and Francis Group, 2017.

Other useful resource(s):

1. Link to topics related to course:
   i. https://nptel.ac.in/courses/122107035/
   ii. https://nptel.ac.in/courses/122103011/
   iii. https://nptel.ac.in/courses/122101002/28
   iv. https://nptel.ac.in/courses/122105023/

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes (2) - 10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course outcomes (Engineering Physics-I)													

CO-1	2	2				2				2		2	**1.25**
CO-2	2	2	2	2	2	2				2		2	**2**
CO-3	3	2				2				2		2	**1.4**
CO-4	3	3				2				2		2	**1.5**
CO-5	3	3	3	3	3	3				3		3	**3**
Average	**2.6**	**2.4**	**2.5**	**2.5**	**2.5**	**2.2**				**2.2**		**2.2**	

Engineering Physics-II

Course code: 18B11PH211
Course credits: 3
Core/Elective: Core
L-T-P: 3-0-0
Pre-requisite: None

Course Objectives:

I. To offer a broad aspect of those areas of Physics which are specifically required as an essential background to engineering students for their studies in higher semesters.
II. To enable the students in gaining problem solving capability
III. To enable the students in acquiring better understanding about quantum science and application for future technology
IV. To familiarize students with quantum information technology
V. To make the students knowledgeable about the thermodynamics and statistics
VI. In conclusion, the ability of students should have enhanced to think logically about the problems of science and technology

Course Outcomes:

S.No.	Course Outcomes	Level of Attachment
CO-1	To learn fundamentals of quantum applications, quantum information theory	Familiarity

CO-2	Knowledge of physical interpretation, and ability to apply ideas to solve problems in science	Familiarity/Problems solving
CO-3	Learning about thermodynamical problems and associated applications for future technology	Familiarity/Problem solving
CO-4	To understand basics of statistical distribution and use of Maxwell's distribution, Bose-Einstein distribution, and Fermi-Dirac distribution	Familiarity/Analytical skills/Problems solving
CO-5	To develop ideas about problems associated to quantum information	Familiarity/Knowledge

Course Contents:

Unit	Contents	Lecture required
1	Quantum nature of light:Photoelectric effect and Compton effect	**4**
2	Stability of atoms and Bohr's rules	**2**
3	Wave particle duality: de Broglie wavelength, phase and group velocity, Uncertainty principle, Double slit experiment	**4**
4	Schrodinger's equation,Physical interpretations of wave functions, elementary idea of operators, Eigenvalue problems	**4**
5	Solution of Schrodinger equations, simple boundary value problems, Harmonic Oscillator, Hydrogen atoms problems	**4**
6	Basics of quantum information: Hilbert's space, Dirac notation, Introduction to qubits, Quantum states, density operators, generalized measurements, quantum operations/channels, no-cloning theorem	**6**
7	Laws of thermodynamics, introduction to entropy, isothermal and adiabatic process, Reversible and irreversible processes. Carnot cycle andCarnot engine, Refrigerator, Clausius-Cleyperon equation	**10**
8	Introduction to macrostate, microstate, Classical and quantum statistics, Density of states M-B, B-E, and F-D statistical distribution, their applications	**8**
Total lectures		**42**

Suggested Text Book(s):

1. R. Eisberg and R. Resnick, Quantum Physics, 2nd ed. John Wiley, 2002.
2. J.J. Sakurai, Jim Napolitano, Modern quantum mechanics, 2nd ed. Addison Wesley:Pearson, 2011.
3. Mark M. Wilde, Quantum information Theory, Cambridge University Press, 2012.

4. B. Lal, N. Subrahmanyam and P.S. Hemne, Heat Thermodynamics and Statistical Physics, 3rd ed. S. Chand, 2012.
5. J. S. Faulkner, Modern Quantum Mechanics and Quantum Information, Department of Physics, Florida Atlantic University, Boca Raton, Florida, FL, USA: IOP Publishing Ltd, 2021.

Suggested Reference Book(s):

1. R. A. Silvio, Salinass, Introduction to Statistical Physics, Springer Verlag, 2004.
2. M. A. Nielsen & I.Chuang, Quantum Computation and Quantum Information, Cambridge University Press, 2000.
3. R. C. Lakhanpal, Modern Approach to Statistical Physics and Thermodynamics, Modern Publishers, 2003.
4. D. J. Griffiths, Introduction to Quantum Mechanics, Reed College: Prentice Hall, 1994.
5. A. N. Michael, and I. L. Chuang, Quantum Computation and Quantum Information, 10th ed. Cambridge university press, 2010.

Other useful resource(s):

1. https://www.qi.damtp.cam.ac.uk/part-iii-quantum-information-theory
2. https://www.youtube.com/watch?v=bE5flUzaU1w
3. https://www.youtube.com/watch?v=EuYBGnsCj14

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (3) -15 Quizzes(2) -5 Attendance - 5

Course Outcomes (COs) contribution to the ProgrammeOutcomes(POs)

Course outcomes (Engineering Physics - II)													Average

CO-1	3	3	3	2	2	1	1	-	-	-	-	2	**2.125**
CO-2	2	3	3	3	3	1	1	-	-	-	-	3	**2.375**
CO-3	3	2	2	2	2	1	1	-	-	-	-	2	**1.875**
CO-4	3	2	2	2	2	3	3	-	-	-	-	2	**1.875**
CO-5	2	3	3	3	3	1	1	-	-	-	-	3	**2.375**
Average	**2.6**	**2.6**	**2.6**	**2.4**	**2.4**	**1.4**	**1.4**	**-**	**-**	**-**	**-**	**2.4**	

Basic Engineering Physics - I

COURSE CODE: 18B11PH112

COURSE CREDITS: 4

CORE/ELECTIVE: CORE

L-T-P: 3-1-0

Pre-requisite: None

Course Objectives:

1. To understand the general scientific concepts required for technology.
2. To apply the concepts in solving BT/BI engineering problems.
3. To explain scientifically the new developments in engineering and technology
4. To get familiarized with the concepts, theories, and models behind many technological applications.

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
CO-1	Understand the basic concepts of nature light and matter.	Familiarity

CO-2	Apply the concept of light in physical optics, lasers and Optical fibers.	Assessment and usage
CO-3	Acquire the fundamental knowledge of surface tension and plasma physics	Assessment and usage
CO-4	Familiarized with the basic concepts of biomaterials	Familiarity and assessment
CO-5	Familiarized with the basic concepts of nanotechnology	Familiarity

Course Contents:

Unit	Contents	Lectures required
1	**Wave Optics: Interference, Diffraction and Polarization:** Wave nature of light, Particle nature of radiation, the wave nature of matter, Wave function, X-rays, Bragg's law. Interference by division of wave front, Interference by division of amplitude. Fraunhofer diffraction: Single slit, circular aperture, double slit, N-slit, resolving power and dispersive power of diffraction grating. Brewster's law, Malu's law, elliptically and circularly polarized light, optical activity, specific rotation.	**16**
2	**Lasers, Optical fibers and Plasma Physics:** Principle and working of laser, Different types of lasers (Three level and four level lasers). Optical Fibers: principle, types, material, mode, refractive index; Fibre loss, Expression for acceptance angle and numerical aperture. Application-Communication. Plasma Physics: Plasma state, types of plasma, applications of plasma.	**10**
3	**Biomaterials:** Introduction to Biomaterials: Biomaterial, Types of Biomaterials, Biocompatible, Biodegradable, Bio-resorbable Bio-inert Bio-active Biological materials, Pyrogenicity, Properties of Biomaterials, Interaction of biomaterials with bio-molecules, Performance and applications of Biomaterials.	**8**
4	**Introduction to Nanotechnology:** Origin of Nanotechnology, Nano Scale, Quantum Confinement, and Fabrication: Bottom-up and Top-down, Characterization, introduction to nano-biotechnology. Introduction to Active Colloids and Molecular motor proteins: functions, interaction and applications.	**8**

Total lectures	42

Suggested Text Book(s):

1. B. L. And N. Subramanyam, Optics, S. Chand & Company, 2012.
2. S. Sharma & J. Sharma, Engineering Physics, Pearson Pub, 2018.
3. N. Mehta, Applied Physics for Engineers, PHI India Limited, 2011.
4. K. K. Chattopadhyay, Introduction to Nanoscience and Nanotechnology, PHI India, 2009.
5. J.B. Part, Biomaterials Science and Engineering, Plenum Press, 1984.
6. J.Y. Wong and V. D. Bronzino (Eds), Biomaterials, CRC Press: Taylor and Francis, 2006.
7. Pignatello R. (Editor), Biomaterials Science and Engineering, InTech Publishing, 2011.
8. E. A. Ludwig , Biomaterial Science: Anatomy and Physiology Aspects, Walter de Gruyter GmbH & Co KG, 2022.

Suggested Reference Book(s):

1. A. Ghatak, Optics, Tata McGraw Hill, 2005.
2. A. Beiser, Concepts of Modern Physics, McGraw Hill, 1994.
3. B.B. Ratner, A.S. Hoffman, F. J. Schoen, J. E. Lemnos, Biomaterials Science: An Introduction to Materials in Medicine, Elsevier Academic Press, 2004.
4. R. Lakes, and J. D. Bronzino, *The Biomedical Engineering Handbook*, 2nd ed. Boca Raton: CRC Press LLC, 2000.
5. J. Park and R. S. Lakes, Biomaterials: An introduction, Springer, 2007.

Other useful resource(s):

1. https://nptel.ac.in/courses/122107035/
2. https://nptel.ac.in/courses/122103011/
3. https://nptel.ac.in/courses/122103010/
4. https://nptel.ac.in/courses/118107015/
5. https://nptel.ac.in/courses/118102003/
6. https://nptel.ac.in/courses/122101002/27

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus

4.	Teaching Assessment	25	Entire Semester	Assignment (3) -15 Quizzes (2) - 5 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course outcomes (Basic Engineering Physics - I)													**Average**
CO-1	3	3	3	2	2	1	1	-	-	-	-	2	**2.125**
CO-2	2	3	3	3	3	1	1	-	-	-	-	3	**2.375**
CO-3	3	2	2	2	2	1	1	-	-	-	-	2	**1.875**
CO-4	3	2	2	2	2	3	3	-	-	-	-	2	**1.875**
CO-5	2	3	3	3	3	1	1	-	-	-	-	3	**2.375**
Average	**2.6**	**2.6**	**2.6**	**2.4**	**2.4**	**1.4**	**1.4**	**-**	**-**	**-**	**-**	**2.4**	

Bioinstrumentation Techniques

COURSE CODE: 18B1WPH212

COURSE CREDITS: 4

CORE/ELECTIVE: CORE

L-T-P: 3-1-0

Pre-requisite: None

Course Objectives:

I. To learn concepts for strong foundation of biophysical methods and their application in the field of biotechnology.

II. Exposure to various instruments used in Biophysics.

III. To be able to use important biophysical methods to decipher problems relevant to biology.

IV. Understanding of the underlying theory of these methods and their practical applications in the laboratories.

V. Better understanding of the structure-function activity of biomolecules.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Basic concepts of spectroscopy, X-Ray Diffraction	Familiarity, assessment and usage
CO-2	Electron Microscopy, Electronic spectroscopy	Familiarity, assessment and usage
CO-3	Infrared spectroscopy, Raman Spectroscopy	Familiarity, assessment and usage
CO-4	Mass Spectroscopy and spin resonance spectroscopy	Familiarity, assessment and usage
CO-5	Particle analysis and Chromatography	Familiarity, assessment and usage

Course Contents:

https://www.spectroscopyonline.com/view/bioanalysis-instruments-0

Unit	Contents	Lectures Required
1	**Electron microscopy:** Optical to electron microscopy, Transmission electron microscope, Scanning electron Microscopy, Protein crystallography	**6**
2	**Electronic spectroscopy:** UV-VIS spectroscopy and Circular dichorism spectroscopy, Fluorescence Spectroscopy	**8**
3	**Infrared Spectroscopy and Raman Spectroscopy:** Fourier Transform Infrared Spectroscopy, Raman spectroscopy, Molecular polarisability, Applications in the field of biotechnology.	**8**
4	**Mass Spectroscopy and spin resonance spectroscopy:** Producing the ion, Detection of ions and Identifying of compounds. Analysis and applications. Interaction between spin and magnetic field, Nuclear Magnetic Resonance, NMR Applications in Biochemistry, Biophysics and Medicines.	**8**
5	**Imaging Techniques:** Fluorescence Microscopy, Fluorescence-activated Cell	**12**

	Sorting (FACS), Fluorescence In Situ Hybridization (FISH), X-rays, computed tomography (CT) scans, and magnetic resonance imaging (MRI) scans, X-rays, Atomic force microscopy **Particle Analysis:** Dynamic light scattering for size determination and zeta potential for surface charge determination: Concept and analysis	
Total Lectures		**42**

Suggested Text Book(s):

1. C. N. Banwell, Fundamentals of Molecular Spectroscopy. McGraw-Hill, 1994.
2. S.Svanberg, Atomic and Molecular Spectroscopy: Basic Aspects and Practical applications, Springer Science & Business Media, 2012.
3. G. Aruldhas, Molecular structure and spectroscopy, PHI Learning Pvt. Ltd., 2007.
4. J.Y. Wong and V. D. Bronzino (Eds), Biomaterials, CRC Press: Taylor and Francis, 2006.
5. H. S. Barbara, Infrared Spectroscopy: Fundamentals and Applications, Wiley, 2004.
6. S. O. Pillai, Solid State Physics, 7th ed. New age international publishers, 2016.
7. J. R. Lakowicz, Principles of Fluorescence Spectroscopy, Springer Science & Business Media, 2013.

Suggested Reference Book(s):

1. B. C. Smith, Fundamentals of Fourier Transform Infrared Spectroscopy, 2nd ed., CRC Press, 2011.
2. S. S. Mohapatra, S. Ranjan, N. Dasgupta, R. K. Mishra, S.Thomas, Characterization and Biology of Nanomaterials for Drug Delivery , Elsevier, 2019.
3. R. Tantra Editor(s):, Nanomaterial Characterization: An Introduction, (2016), John Wiley & Sons, Inc., 2016.

Other useful resource(s):

1. NPTEL course contents
2. Relevant research articles

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3	T-3	35	2 Hours	Entire Syllabus
4	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes (2) - 10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

Course outcomes (Bioinstrumentation Techniques)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	3	3	2	3	1	1	1	1	1	1	1	3	**1.75**
CO-2	3	3	3	3	2	1	1	1	2	1	1	3	**2.00**
CO-3	3	3	3	3	3	1	1	2	2	1	1	3	**2.16**
CO-4	3	3	3	3	3	2	2	2	2	1	2	3	**2.42**
CO-5	3	3	3	3	2	2	1	1	1	1	1	1	**1.83**
Average	**3.00**	**3.00**	**2.80**	**3.00**	**2.20**	**1.40**	**1.20**	**1.40**	**1.60**	**1.00**	**1.20**	**2.60**	

Science and Technology of Materials

COURSE CODE: 18B1WPH531

COURSE CREDITS: 3

CORE/ELECTIVE: ELECTIVE (ECE)

L-T-P: 3-1-0

Pre-requisite: None

Course Objectives:

I. To enable the students to get better understanding about materials, properties and their applications in engineering
II. To familiarize students for making proper selection of materials for different applications.
III. To enable the students to use the knowledge about materials for their projects and ultimately apply the materials knowledge in their respective professional career.
IV. At the conclusion of the course, the student should have a far greater capacity to read and

understand technical articles such as those seen in the IEEE Transactions on Electron Devices, IEEE Transactions on Nanotechnology, Computer-aided design, Computational Materials Science *etc*.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	To learn the fundamentals and Science of Materials.	Familiarity
CO-2	To implement the concepts and theories for analyzing the behaviour of the materials.	Familiarity
CO-3	To execute the concepts and theories in solving the problems related to material properties and their applications.	Analytical & Computational skills
CO-4	To introduce innovations in areas like Semiconducting Materials, Optoelectronic Materials and Engineering Materials Science, etc.	Innovative Skills
CO-5	To analyze various materials for scientific and technical applications	Technical skills

Course Contents:

Unit	Contents	Lectures required
1	Introduction to Dielectric materials, Capacitance, Polarization, Types of Polarization, Polarization mechanism & Dielectric Constant, Frequency Dependence of the Dielectric Constant, Ferro electricity, Piezoelectricity and pyro electricity, Applications of Dielectric Materials.	**10**
2	Introduction to Optoelectronic materials, Applications of Optical Phenomena Luminescence, Materials of Importance—Light-Emitting Diode Materials, photoconductivity	**6**
3	Semiconducting materials: Semiconductor basics, intrinsic and extrinsic semiconductors-n & p-type, Fermi level, carrier concentration, mobility, conductivity, p-n junctions-band diagram, forward and reverse I-V characteristics, C-V, Ideality factor, p-n-p and n-p-n transistor-basic concepts, Doping in solids	**6**

4	Introduction to Magnetic materials, Concept of magnetism, Classification, dia-, para-, ferro-, antiferro- and ferri-magnetic materials, Influence of Temperature on Magnetic Behavior; Domains and Hysteresis; Magnetic Anisotropy Applications in storage devices.	**8**
5	Introduction to Composite materials-Polymers & Ceramics, Various types of Polymers and their applications, Structure, Types, Properties and Applications of Ceramics, Electrical Conduction in Ceramics and Polymers. Applications.	**6**
6	New Engineering Materials: Metallic Glasses, Shape Memory Alloys, Memory Effect, Smart materials, Nano-materials- significance of nanoscale, 0, 1, 2 and 3- Dimensional nanostructures, Applications.	**6**
Total lectures		**42**

Suggested Text Book(s):

1. S. O. Pillai, Solid State Physics, 7th ed. New age international publishers, , 2016.
2. M.A. Wahab, Solid State Physics: Structure and Properties of Materials, 3rd ed. Narosa, , 2015.
3. S.M. Sze, Physics of Semiconductor Devices, 3rd ed. Wiley, 2008.
4. W. D. Callister, D. G. Rethwisch, Materials Science And Engineering: An Introduction , 10th ed. Hoboken, Nj : Wiley, 2018.

Suggested Reference Book(s):

1. C. Kittel, Introduction to Solid State Physics, 8th ed. John Wiley & Sons, 2005.
2. S. Sharma and J. Sharma, Engineering Physics, Pearson India, 2018.

Other useful resource(s):

1. http://www.advancedsciencenews.com/best-of-advanced-optical-materials/
2. https://onlinecourses.nptel.ac.in/noc19_ph04/preview

EvaluationScheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus

4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes(2) -10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

Course outcomes (Science and Technology of Materials)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	3	3										3	3
CO-2	3											3	3
CO-3	1	1	1									1	1
CO-4	2	2	2	2								2	2
CO-5	3	3	3	3					3			3	3
Average Score	2.4	2.25	2	2.5					3			2.4	2.425

Applied Materials Science

COURSE CODE: 18B1WPH532

COURSE CREDITS: 3

CORE/ELECTIVE: ELECTIVE (CSE, IT)

L-T-P: 3-0-0

Pre-requisite: None

Course Objectives:

I. To enable the students to get better understanding about materials, properties and their applications in engineering

II. To familiarize students for making proper selection of materials for different applications.
III. To enable the students to use the knowledge about materials for their projects and ultimately apply the materials knowledge in their respective professional career.
IV. At the conclusion of the course, the student should have a far greater capacity to read and understand technical articles such as those seen in the IEEE Transactions on Electron Devices, IEEE Transactions on Nanotechnology, Computer-aided design, Computational Materials Science *etc*.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	To learn the fundamentals and Science of Materials.	Familiarity
CO-2	To implement the concepts and theories for analyzing the behaviour of the materials.	Familiarity
CO-3	To execute the concepts and theories in solving the problems related to material properties and their applications.	Analytical & Computational skills
CO-4	To introduce innovations in areas like Display Technology , Thermoelectrics and Engineering Materials Science, etc.	Innovative Skills
CO-5	To analyze various materials for scientific and technical applications	Technical skills

Course Contents:

Unit	Contents	Lectures required
1	Dielectrics: Polarization mechanism & Dielectric Constant, Behavior of polarization under impulse and frequency switching, Dielectric loss, Spontaneous polarization, Piezoelectric and Pyroelectric materials, Applications of Dielectric Materials.	**9**
2	Polymers: Various types of Polymers and their applications; Mechanical behaviour of Polymers, synthesis of polymers. Conducting polymers	**3**
3	Ceramics: Structure, Types, Properties and Applications of Ceramics; Mechanical 24behaviour and Processing of Ceramics	**2**
4	Magnetism: Concept of magnetism, Classification, dia-, para-, ferro-, antiferro- and ferri-magnetic materials, Their properties and Applications; Hysteresis; Magnetic Storage devices.	**7**

5	Superconductivity: Meissner effect, Critical field, type-I and type-II superconductors; Field penetration and London equation; High temperature Superconductors, Flux quantization, Josephson junction and their Applications.	**5**
6	Introduction to Thermoelectric materials, Figure of merit, Heat Capacity, Conductivity (electronic and thermal), Applications in sensors, energy harvesting etc.	**6**
7	Display Devices: Fluorescent Materials, LED, LCD.	**3**
8	New Engineering Materials: Metallic Glasses, Shape Memory Alloys, Memory Effect, Smart materials, Nano-materials- significance of Nanoscale, 0-Dimensional, 1- Dimensional, 2- Dimensional, 3- Dimensional nanostructures, Applications.	**5**
9	Computational Materials Science: Atomistic theory of matter – from electrons to interaction potentials, Electronic structure theory, computational toolbox, determination of band structure using codes	**2**
Total lectures		**42**

Suggested Text Book(s):

1. S. O. Pillai, Solid State Physics, 7th ed. New age international publishers, , 2016.
2. M.A. Wahab, Solid State Physics: Structure and Properties of Materials, 3rd ed. Narosa, 2015.
3. R. M. Martin, Electronic Structure: Basic Theory and Practical Methods, 1st ed. Cambridge University Press, 2008.
4. W. D. Callister, D.G. Rethwisch, Materials Science and Engineering: An Introduction, 10th ed. Hoboken, Nj : Wiley, 2018.

Suggested Reference Book(s):

1. C. Kittel, Introduction to Solid State Physics, 8th ed. John Wiley & Sons, 2005.
2. G. S. Nolas , J. Sharp , H. J. Goldsmid, Thermoelectrics: Basic Principles and New Materials Developments, Springer Berlin: Heidelberg, 2010.
3. S. Sharma and J. Sharma, Engineering Physics, Pearson India, 2018.

Other useful resource(s):

1. http://www.advancedsciencenews.com/best-of-advanced-optical-materials/
2. https://onlinecourses.nptel.ac.in/noc19_ph04/preview

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes(2) -10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course outcomes (Applied Materials Science)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	3	3										3	3
CO-2	3											3	3
CO-3	1	1	1									1	1
CO-4	2	2	2	2								2	2
CO-5	3	3	3	3					3			3	3
Average Score	2.4	2.25	2	2.5					3			2.4	2.425

Environmental Studies

COURSE CODE: 23B11GE411

COURSE CREDITS: 2

CORE/ELECTIVE: Mandatory Course

L-T-P: 2-0-0

Pre-requisite: None

Course Objectives:

1. Identify environmental problems arising due to engineering and technological activities and the science behind those problems.
2. Estimate the population- economic growth, energy requirement and demand.
3. Analyze material balance for different environmental systems
4. Realize the importance of ecosystem and biodiversity for maintaining ecological balance.
5. Identify the major pollutants and abatement devices for environmental management and sustainable development.
6. Recognizing the major concepts of environmental studies, developing problem solving ability, forecasting the global climate change

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Introducing basic concept of environmental studies, interdisciplinary nature and scope of the subject	Familiarity
CO-2	Understanding ecosystem services and its functioning as well as equitable use of natural resources.	Assessment
CO-3	Understanding Pollution, A threat to the environment and finding its solutions, Pollutant sampling and monitoring of samples.	Assessment
CO-4	Correlating the concept of Biodiversity and its importance to human mankind	Usage
CO-5	Understanding social issues and their impact on the environment.	Usage
CO-6	Role of Information Technology in environment and human health	Usage

Course Contents:

Unit	Contents	Lectures required
1	**Unit 1: Multidisciplinary nature of environmental studies:** The Multidisciplinary nature of environmental studies: Definition, scope and importance, Need for public awareness, Types of Ecosystems, World Biomes, Ecosystem functioning, Biogeochemical cycles. Ecolabeling /Ecomark scheme	4
2	**Unit 2: Natural resources, their consumption & Protection:** Natural resources, their consumption & Protection: Water, Land Energy (Renewable, non-renewable, wind, solar, hydro, Biomass), Mineral, Forest, & Food resources, Role of an individual in conservation of natural resources, Equitable use of resources. Implications of energy use on the environment. Introduction to sustainable development: Sustainable Development Goals (SDGs)- targets and indicators, challenges and strategies for SDGs.	5
3	**Unit 3: Pollution- a threat to environment:** Pollution- a threat to environment: Air, Water & Land pollution, sources & causes, Space pollution, causes & effects, toxicity limits of pollutants. Critical issues concerning global Environment (Urbanization, population growth, global warming, climate change, acid rain, ozone depletion etc.) and the Roots in: Cultural, Social, Political, Commercial, industrial, territorial domains	5
4	**Unit 4: Environmental standards & Quality:** Environmental standards & Quality: Air, Water & Soil Quality, Pollutant sampling, pollution control systems. Green Chemistry and its applications	4
5	**Unit 5: Biodiversity and its conservation:** Biodiversity loss: Diversity of flora and fauna, species and wild life diversity, Biodiversity hotspots, threats to biodiversity	4
6	**Unit 6: Social Issues and the Environment:** Waste land reclamation, consumerism and waste products, eco-consumerism, dematerialization, green technologies, eco-tourism. Water conservation, rain water harvesting, watershed management. Major International organizations and initiatives: United Nations Environment Programme (UNEP), International Union for Conservation of Nature (IUCN),World Commission on Environment and Development (WCED), United Nations Educational, Scientific and Cultural Organization (UNESCO), Intergovernmental Panel on Climate Change (IPCC)	4
7	**Unit 7: Environmental Management:** Environment protection act, Air (prevention and control of population) act; Water (prevention and control of pollution) act, Wildlife protection act, Forest conservation act, Issues involved in the enforcement of environmental legislation National Environmental Policy; Function of pollution control boards (SPCB and CPCB), their roles and responsibilities Environmental management system. Life cycle analysis; Cost-benefit analysis, Environmental audit and impact assessment; Environmental risk assessment. Pollution control and management; Waste Management- Concept of 3R (Reduce, Recycle and Reuse) and sustainability;	4

8	**Case studies and fieldwork based upon projects**: The students are expected to be engaged in some of the following or similar identified activities: • Discussion on one national and one international case study related to the environment and sustainable development. • Field visits to identify local/regional environmental issues, make observations including data collection and prepare a brief report. • Documentation of campus biodiversity/Documentation of local biodiversity. • Campus environmental management activities such as solid waste disposal, water management, and sewage treatment.	**Self study hours (recommended 2 hours /week)***
Total lectures		**30**

*** Formal instructions /Guidance related to the project topics**

Suggested Text Book(s):

1. Environmental Studies By: M. P. Poonia and S.C. Sharma, Khanna Publishers
2. Textbook of Environmental Studies for UG Courses - Erach Bharucha, University Press
3. Joseph, B., 2005, Environmental Studies, Tata McGraw Hill, India.

Suggested Reference Book(s):

1. Nebel, B.J. & Wright, R.T., 1993, Environmental Science, 8th Edition, Prentice Hall, USA.
2. Chiras D D.(Ed.). 2001. Environmental Science – Creating a sustainable future. 6th ed. Jones & Barlett Publishers.
3. David Laurance. 2003. Environment Impact assessment, Wiley publications.
4. Chhokar KB, Pandya M & Raghunathan M. 2004. Understanding Environment. Sage publications, NewDelhi .

Other useful resource(s):

1. Issues of the journal: Down to Earth, published by Centre for Science and Environment.
2. Audio visuals from: Discovery, National Geographic etc.
3. https://nptel.ac.in/courses/120108002/
4. https://nptel.ac.in/courses/120108005
5.https://www.ugc.ac.in/pdfnews/1084504_Draft-Guidelines-and-Curriculum-Framework-for-Environment- Education-at-UG-level.pdf

MICROBIAL GENETICS AND PHYSIOLOGY COURSE CODE: 23MS1MB211 L-T-P: 3-0-0 CREDITS: 3	**Course objective** The objectives of this course are to take students through genetics and physiology covering prokaryotic/phage genetics to yeast and higher eukaryotic/ archea domains. Students will be exposed to concepts of complex traits encompassing, genetics and microbial metabolic regulation.	**Students Learning Outcomes** On successful completion of this course, student will be able to: ▪ Describe fundamental molecular principles of genetics. ▪ Describe the basics of genetic mapping. ▪ Understand the principles microbial genetic regulation. ▪ Various tools of the culturing and growth measurement of microorganisms. ▪ Acquaint with mechanisms of survival of various microorganisms.

Unit	Topics Covered
Unit I: **Genetics of bacteria, bacteriophages, and Yeast** 10 lectures	Concept of a gene in pre-DNA era; mapping of genes in bacterial and phage chromosomes by classical genetic crosses; fine structure analysis of a gene; genetic complementation and other genetic crosses using phenotypic markers; Yeast mating type switch; dominant and recessive genes/mutations, complementation groups
Unit II: **Mutants and Mutation** 7 lectures	Mutator genes, screening of mutations based on phenotypes and mapping the same, Loss of function mutants: null, leaky, and conditional mutations. Gain of function mutants, Are mutations random events or adaptive? Mutation rates, probability, and target theory, Uses of mutants
Unit III: **Genetic Exchange and restrictions** 5 lectures	Mechanisms of genetic exchange: Genotype vs phenotype, Genetic exchange in nature, Genetic exchange in the lab, Barriers to genetic exchange: host restriction and modification, Plasmids, Properties of some bacterial plasmids, Plasmid replication, Phage, General properties of phages, Lytic growth, Host specificity, Lysogenic phage, Phage Lambda

Unit IV: Microbial growth and metabolic regulations 10 lectures	Introduction, thermodynamics principles/ Eh-pH diagrams, Mitchell hypothesis and energetic, The Monod and Pirt models for microbial growth, Chemostats as an indispensible tool for physiological studies, Diversity of metabolism and selective enrichments, Mixed Cultures in the chemostat/selection, Metabolic genetic regulation, Regulatory systems during aerobic- anaerobic shifts.
Unit V: Growth and cell physiology of extremophilic microorganisms Lectures 10	Growth curve and diauxic growth curve and calculation of generation time and classification of microorganisms based upon nutrient and water activity. Determination of cell count by various methods. Cellular physiology of extremophilic microorganisms. Extremophilic physiological adaptations Methanotrophs, Thermophiles, Acidophiles , Sulfur reduction and SRBs, Mechanisms of survivals of various extremophiles.

Recommended Textbooks and References:

1. Hartl, D. L., & Jones, E. W. Genetics: Principles and Analysis. Sudbury, MA: Jones and Bartlett.
2. Pierce, B. A. Genetics: a Conceptual Approach. New York: W.H. Freeman.
3. Tamarin, R. H., & Leavitt, R. W. Principles of Genetics. Dubuque, IA: Wm. C. Brown.
4. Smith, J. M. Evolutionary Genetics. Oxford: Oxford University Press.
5. Klug, W.S., Cummings, R., Spencer, C. A., & Michael A. P., Concepts of Genetics. Pearson Publications
6. Albert G. M., & John W. F., Microbial Physiology, Wiley-Liss, A John Wiley& Sons, Inc. Publications.
7. Trudy T. A, Endang P. et al, Microbial Physiology and Genetics. Intelliz Press
8. Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press.
   Brock Biology of Microorganisms, Michael T. Madigan, Kelly S. Bender, Daniel H. Buckley, David Stahl, W. Matthew Sattley.
9. Prescott's Microbiology, By Joanne Willey and Kathleen Sandman and Dorothy Wood

MINUTES OF MEETING OF ACADEMIC COUNCIL HELD ON 28 JUNE 2023

General

Academic Council meeting of Jaypee University of Information Technology, Waknaghat was held on 28 June, 2023 at 11.00 a.m.

The Chairman, Academic Council extended warm welcome to all the members present in the meeting and expressed thanks to outstation members Sh. Sunil Sharma, Prof. S.C. Saxena, and Prof. Lalit Kumar Awasthi for their presence in the meeting.

He also appreciated the contributions made by Prof. Karanjeet Singh, HoD Mathematics Deptt., Dr. Anupriya Kaur, HoD HSS Deptt., and Prof. Rajiv Ganguly, Deptt. of CE, the outgoing members of the Council, and welcomed the newly inducted members Prof. Rakesh Kumar Bajaj, HoD Mathematics Deptt., Dr. Amit Srivastava, HoD HSS Deptt. and Prof. Vineet Sharma, Deptt. of PMS.

Attendance

The following members were present:-

Chairman

Prof. Rajendra Kumar Sharma	Vice Chancellor, JUIT, Waknaghat

Head of the Other Institution of the Trust

Prof. S.C. Saxena	Pro-Chancellor, JIIT, Noida

Distinguished Academicians nominated by the Pro-Chancellor

Prof. Lalit Kumar Awasthi	Professor, NIT, Hamirpur, Ex-Director, NIT-Jalandhar

Industry Professionals nominated by the Pro-Chancellor

Sh. Sunil Sharma	Executive Vice Chairman, Jaiprakash Associates Ltd.

The Dean of all Faculty of the University

Prof. Ashok Kumar Gupta	Dean (Academics& Research)

Heads of the Departments / Centres of the University

Prof. P. B. Barman	HoD PMS
Prof. Sudhir Kumar	HoD BT&BI
Prof. Ashish Kumar	HoD CE
Prof. Vivek Sehgal	HoD CSE/IT
Dr. Rajiv Kumar	HoD ECE
Prof. Rakesh Kumar Bajaj	HoD Mathematics
Dr. Amit Srivastava	HoD HSS

Professors other than Heads of Departments

Prof. Sunil Kumar Khah	CoE
Prof. Vineet Sharma	Deptt. of PMS

Non-Member Secretary

Maj Gen Rakesh Bassi, SM (Retd.)	Registrar and Dean of Students

Leave of Absence, if any

The Chairman, Academic Council granted leave of absence to the following members of the Academic Council as they were not able to attend the meeting of the council due to their pre-engagements:-

Dr. Satish Kumar	Ex-Director, NIT Kurukshetra
Lt Gen Ravindra Mohan Chadha, PVSM,ABSM (Retd)	Director, Jaiprakash Power Ventures Ltd

Agenda Items

ITEM NO.1/2023-1 **CONFIRMATION OF MINUTES OF LAST MEETING OF THE ACADEMIC COUNCIL**

Minutes of the meeting of the last ACM held on 29 November 2021 were forwarded to the members and one comment on item No. 8.2 was received from Head – Civil Engineering Department regarding reconsidering title of the course. As per the comment received from Head Civil Engineering Department, title of the Professional Elective – VI Course "Machine Learning Engineering for Production" (L-T-P: 3-0-0) changed to "Machine Learning Engineering for Production Systems" (L-T-P: 3-0-0). The minutes of the last ACM as per **Annexure-1** with correction in title of the course listed at item No. 8.2 were confirmed.

ITEM NO. 2/2023-1 **ACTION TAKEN REPORT ON THE MINUTES OF THE MEETING OF THE LAST ACADEMIC COUNCIL HELD ON 29 NOVEMBER 2021**

The actions taken on the items approved in the last ACM dated 29 November 2021 were noted by the members.

ITEM NO. 3/2023-1 **APPROVAL FOR DEGREE IN ADVANCE UNDER EXTRAORDINARY CIRCUMSTANCES**

As per the earlier approved policy, Degree Scroll is prepared for students every year who have completed the award of Degree requirement as on 30 September of the year and degrees are being prepared / printed as per the Degree Scroll for the year. Names of the students who have completed the award of Degree requirement after 30 September of the year are being considered for inclusion in the Degree Scroll of next year and subsequent award of degree to the eligible students.

However, in some extraordinary circumstances, the requirement for the award of degree prior to Degree Scroll of next year has been observed under very special circumstances, *i.e.*, to pursue higher studies abroad, to take up PR abroad and to join services.

The proposed item was considered and deliberated by the Council. The Council approved the item and authorized the Chairman, Academic Council (Vice Chancellor) to process such cases following the defined procedure under very special circumstances.
The detailed procedure for processing such cases is as per **Annexure-2**.

ITEM NO. 4/2023-1 **APPROVAL FOR INCLUSION OF FATHER'S NAME AND MOTHER'S NAME IN DEGREE CERTIFICATE**

UGC vide D.O. No. 1-38/97 (CPP-II) dated 06/06/2014 notified the need of inclusion of Mother's Name and Father's Name in all the application forms / Degrees / Certificates issued by Universities and Colleges. Copy of the relevant letter of UGC is at **Annexure–3** for reference.

However, the existing approved degree formats issued by the University does not have provisions of Mother's Name and Father's name in the Degree Certificate. It was proposed to include Mother's Name and Father's Name in the Degree Certificate to be issued from 01/07/2023 onwards.

The item was considered and deliberated by the Council and inclusion of Mother's Name and Father's Name in the Degree Certificate to be issued from 01/07/2023 onwards was approved by the Council.

Considering the inclusion of Mother's Name and Father's Name in the Degree Certificates, formats of Degree Certificates be amended accordingly.

ITEM NO. 5/2023-1 **APPROVAL FOR PURSUING TWO ACADEMIC PROGRAMMES SIMULTANEOUSLY**

UGC vide D.O. No. 1-6/2007(CPP-II)(New) dated 13/04/2022 has published the guidelines for pursuing two academic programmes simultaneously. Copy of the letter and guidelines are at **Annexure–4**.
Later through D.O. No. 1-6/2007(CPP-II)(New) pt. II dated 10/01/2023 requested to implement these guidelines for the benefit of the students and to devise a mechanism through their Statutory bodies to facilitate the students to pursue two academic programmes simultaneously, as per these guidelines.

The item was considered by the Council and after deliberation; the item was approved with a condition to follow the UGC guidelines for pursuing two academic programmes simultaneously.

ITEM NO. 6/2023-1 **APPROVAL FOR ENGAGING PROFESSOR OF PRACTICE IN THE UNIVERSITIES**

UGC vide D.O. No. 9-1/2010(PS/Misc) PT-I dated 14/11/2022 conveyed the guidelines for engaging Professor of Practice in Universities to bring the industry and other professional expertise into the academic institutions through a new category of positions called "Professor of Practice". This new initiative will help to take real world practices and experiences into the class rooms and also augment the faculty resources in higher education institutions. In turn, the industry and society will benefit from trained graduates equipped with the relevant skills. The detailed guidelines for engaging Professor of Practice is at **Annexure–5.**

The Objectives, Duties and Responsibilities, General Conditions, Categories of engagement, Procedure for selecting Professor of Practice, Tenure guidelines are illustrated in the detailed guidelines.

The proposed item was considered by the Council and in principal approval for the same was accorded by the Council.

ITEM NO. 7/2023-1 **APPROVAL FOR CREATION OF SUPERNUMERARY SEATS TO ACCOMMODATE PM CARES FOR CHILDREN SCHEME IN HIGHER EDUCATION**

Secretary, UGC vide D.O. Letter No. F.2-39/2022 (CPP-II) dated 30/03/2022 conveyed regarding creation of supernumerary seats to accommodate children who have lost both their parents during the COVID pandemic to facilitate them to pursue higher education. Copy of the letter is at **Annexure–6**. Govt. of India has launched PM CARES for children scheme for such children and Ministry of women & Child Development with support from the District Magistrates of all the States / UTs are identifying such children. Such identified children will be issued PM CARES for Children Scheme 2021 certificate by the Ministry of Woman & Child Development.

In order to accommodate such children to pursue their higher education whenever they become eligible for admission to the programs, supernumerary seats equal to number of applications received of such candidates in all UG, PG & PhD programs has to be created from the Academic Session 2023-24 onwards.

The item was considered by the Council and Council approved creation of supernumerary seats equal to number of applications received under the category in all UG, PG & PhD Programs from the Academic Session – 2023-24.

ITEM NO. 8/2023-1 **APPROVAL OF RECOMMENDATIONS OF BOARD OF STUDIES (BoS) OF DEPARTMENT OF CIVIL ENGINEERING**

a) **BOARD OF STUDIES (BoS) OF DEPARTMENT OF CIVIL ENGINEERING HELD ON 21/05/2022**

Department of Civil Engineering conducted its Board of Studies (BoS) on 21/05/2022 and recommended the following for approval by the Academic Council:

I. To consider and approve the course structure and syllabus of the newly introduced BTech Program: BTech in Civil Engineering with Computer Application

The minutes of the BoS of department of Civil Engineering are at **Annexure-7**.

The proposed item was considered by the Council and council approved the same. The approved Course Structure and detailed syllabus of the courses is as per **Annexure-BoS-CE-1 dated 21/05/2022.**

b) **BOARD OF STUDIES (BoS) OF DEPARTMENT OF CIVIL ENGINEERING HELD ON 15/06/2023**

Department of Civil Engineering conducted its Board of Studies (BoS) on 15/06/2023 and recommended the following for approval by the Academic Council:

I. To consider and approve the minor revision in the course structure of

BTech in Civil Engineering.

II. To consider and approve the minor revision in the course syllabus of Building Materials and Construction (18B11CE313), Fluid Mechanics (18B11CE412), Surveying (18B11CE312), Water Resources Engineering (18B11CE414) and Design of Steel Structures (18B11CE612).

III. To consider and approve the addition of a new Professional Elective (Geoinformatics; 3-0-0-3) for BTech Civil Engineering.

The minutes of the BoS of department of Civil Engineering are at **Annexure-8**.

The proposed items were considered by the Council and Council approved the same.

The approved revised course structure of BTech in Civil Engineering is at **Annexure-BoS-CE-1 dated 15/06/2023.**

The approved minor revisions in the syllabus of Building Materials and Construction (18B11CE313), Fluid Mechanics (18B11CE412), Surveying (18B11CE312), Water Resources Engineering (18B11CE414) and Design of Steel Structures (18B11CE612) are at **Annnexure-BoS-CE-2 dated 15/06/2023**.

The approved syllabus of newly introduced Professional Elective (Geoinformatics; 3-0-0) is at **Annexure-BoS-CE-3 dated 15/06/2023**.

ITEM NO. 9/2023-1 **APPROVAL OF RECOMMENDATIONS OF BOARD OF STUDIES (BoS) OF DEPARTMENT OF BIOTECHNOLOGY / BIOINFORMATICS**

a) **BOARD OF STUDIES (BoS) OF DEPARTMENT OF BIOTECHNOLOGY / BIOINFORMATICS HELD ON 21/05/2022**

Department of Biotechnology / Bioinformatics conducted its Board of Studies (BoS) on 21/05/2022 and recommended the following for approval by the Academic Council:

I. To consider and approve of detailed syllabus of courses to be offered in 2nd year of M.Sc. Microbiology Program.

II. To consider and approve modifications in the syllabus of "Microbial Genetics and Physiology" (21MS1MB212), a course in the 2nd semester of MSc Microbiology.

III. To consider and approve interchange of elective courses; Computational Systems Biology (Course Code 21MS2MB313; Credits 3) from 3rd to 4th semester, and Microbial Toxicology (Course Code 21MS2MB411, Credits 3) from 4th to 3rd semester in MSc Microbiology second year curriculum.

IV. To consider and approve inclusion of two new courses on Artificial Intelligence and Data Analytics from the Department of Computer Science in the VII and VIII semester of B. Tech. Bioinformatics Program, in the existing Elective baskets.

The minutes of the BoS of department of Biotechnology / Bioinformatics are at **Annexure-9.**

The proposed items were considered by the Council and council approved the same.

The approved syllabus of courses of 2nd year of M.Sc. Microbiology Program are

at **Annexure-BoS-BT-BI-1 dated 21/05/2022.**

The approved syllabus of "Microbial Genetics and Physiology" (21MS1MB212) is at **Annexure-BoS-BT-BI-2 dated 21/05/2022.**

The approved restructuring of Elective Courses of MSc Microbiology Program is at **Annexure-BoS-BT-BI-3 dated 21/05/2022.**

The approved inclusion of new courses in 7th & 8th Semester of BTech Bioinformatics Program and approved syllabus of the courses are at **Annexure-BoS-BT-BI-4 dated 21/05/2022.**

b) BOARD OF STUDIES (BoS) OF DEPARTMENT OF BIOTECHNOLOGY / BIOINFORMATICS HELD ON 03/03/2023

Department of Biotechnology / Bioinformatics conducted its Board of Studies (BoS) on 03/03/2023 and recommended the following for approval by the Academic Council:

I. To approve the modification in the course "Environmental studies" taught in second year of BTech program of all Branches as per UGC, NEP.
II. To consider and approve initiating a Certificate course on "Industrial Plant Tissue Culture" and its contents.

The minutes of the BoS of department of Biotechnology / Bioinformatics are at **Annexure-10**.

The proposed items were considered by the Council and council approved the same.

The approved syllabus of "Environmental Studies" is at **Annexure-BoS-BT-BI-1 dated 03/03/2023.**

The approved Certificate course on "Industrial Plant Tissue Culture" and its contents are at **Annexure-BoS-BT-BI-2 dated 03/03/2023.**

ITEM NO. 10/2023-1 APPROVAL OF RECOMMENDATIONS OF BOARD OF STUDIES (BoS) OF DEPARTMENT OF PHYSICS AND MATERIALS SCIENCE

Department of Physics and Materials Science conducted its Board of Studies (BoS) on 16/06/2023 and recommended the following for approval by the Academic Council:

I. To consider the revision in the course syllabus of six (06) courses offered by Department of Physics & Materials Science.
II. To consider and approve the three new Open Electives (Biomaterials, Biosensors and Computational Nanotechnology) during 8th Semester.

The minutes of the BoS of department of Physics & Materials Science are at **Annexure-11.**

The proposed items were considered by the Council and council approved the same.

The approved revised syllabus of six (06) courses offered by Department of Physics & Materials Science are at **Annexure-BoS-PMS-1 dated 16/06/2023.**

The approved three new Open Electives (Biomaterials, Biosensors and Computational Nanotechnology) and syllabus of the new courses are at **Annexure-BoS-PMS-2 dated 16/06/2023**.

ITEM NO. 11/2023-1 **APPROVAL OF RECOMMENDATIONS OF BOARD OF STUDIES (BoS) OF DEPARTMENT OF HUMANITIES & SOCIAL SCIENCES**

a) **BOARD OF STUDIES (BoS) OF DEPARTMENT OF HUMANITIES & SOCIAL SCIENCES HELD ON 15/02/2023**

Department of Humanities & Social Science conducted its Board of Studies (BoS) on 15/02/2023 and recommended the following for approval by the Academic Council:

I. BTech Minor (20 Credits) in Finance and Marketing.
II. Introduction of Mandatory UHV II Course (3 Credit) in second semester along with BTech minor in UHV

The minutes of the BoS of department of Humanities & Social Science are at **Annexure-12.**

The proposed items were considered by the Council and council approved the same.

The approved Course Structure of Minor in Finance and Marketing to be offered by department of HSS are at **Annexure-BoS-HSS-1 dated 15/02/2023**.

The approved syllabus of mandatory course of Universal Human Values – II (03 Credits) to be offered in BTech 2nd Semester is at **Annexure-BoS-HSS-2 dated 15/02/2023.**

b) **BOARD OF STUDIES (BoS) OF DEPARTMENT OF HUMANITIES & SOCIAL SCIENCES HELD ON 19/06/2023**

Department of Humanities & Social Science conducted its Board of Studies (BoS) on 19/06/2023 and recommended the following for approval by the Academic Council:

I. To review and approve the Course Structure of newly introduced BBA Program.
II. To review and approval of detailed syllabi of BBA 1st year courses.
III. Restructuring of 04 courses offered by HSS department for all branches of BTech 2nd & 3rd Semester, as core courses.
IV. To consider "Centre for Management Studies" under the Department of Humanities and Social Sciences.
V. Minor revision in course contents of 02 courses (I Sem – Core Courses) and 2 Open Elective Courses (VIII Sem) for BTech, offered by HSS Department

The minutes of the BoS of department of Humanities & Social Science are at **Annexure-13.**

The proposed items were considered by the Council and council approved the same.

The approved Course Structure of newly introduced BBA Program is at

Annexure-BoS-HSS-1 dated 19/06/2023.

The approved syllabus of BBA 1st Year Courses are at **Annexure-BoS-HSS-2 dated 19/06/2023**.

The approved restructuring of 04 courses offered by HSS department for BTech 2nd & 3rd Semester is at **Annexure-BoS-HSS-3 dated 19/06/2023**.

Centre for Management Studies under the Department of Humanities and Social Sciences approved by the Council.

The approved revised syllabus of 02 Core Courses of 1st Semester and 02 Open Elective Courses of 8th Semester offered by HSS Department are at **Annexure-BoS-HSS-4 dated 19/06/2023**.

ITEM NO. 12/2023-1 **SEAT RATIFICATION FOR ACADEMIC SESSION 2023-24**

Seat intake for various courses for the Academic Session – 2023-24 was proposed for approval of the Academic Council. The Council considered the proposal and approved the following for the Academic Session – 2023-24:

Undergraduate Programs (BTech)

Program	**Approved Intake for AS-2023-24**
Computer Science & Engineering (CSE)	390#
Information Technology (IT)	60*
Civil Engineering (CE)	30
Civil Engineering with specialization in Computer Science (CECS)	30
Biotechnology (BT)	30
Bioinformatics (BI)	30
Electronics & Communication Engineering (ECE)	30
Electronics & Communication Engineering with specialization in Computer Science (ECS)	30
Total	**630**

#Including 03 new specializations: (i) CSE with specialization in Artificial Intelligence & Machine Learning(CSE-AI&ML), (ii) CSE with specialization in Artificial Intelligence and Data Science(CSE-AI&DS),and (iii) CSE with specialization in Cyber Security(CSE-CS).

**Including 02 new specializations: (i) IT with specialization in Artificial Intelligence & Machine Learning(IT-AI&ML),and (ii) IT with specialization in Artificial Intelligence & Data Science(IT-AI&DS).*

Undergraduate Programs

Program	**Proposed Intake for AS-2023-24**
BSc (Hons.) in Mathematics & Computing	30
BBA	**30**

Post Graduate Programs (MSc)

Program	Approved Intake for AS-2023-24
Biotechnology	30
Microbiology	30
Physics	**30**
Total	**90**

Post Graduate Programs (MTech)

Program	Approved Intake for AS-2023-24
Computer Science & Engineering (CSE)	18
CSE with specialisation in Information Security	
CSE with specialisation in Data Science	
Electronics & Communication Engineering (ECE)	18
ECE with specialisation in Internet of Things	
Biotechnology	18
Construction Management	18
Structural Engineering	
Environmental Engineering	
Total	**72**

Note: *PG Program (MTech) seat intake for each department will be 18 seats. A program will run with 5 or more students only.*

Doctoral Programs (PhD)

Program	Approved Intake for AS-2023-24
Computer Science & Engineering	Seats subject to availability of Supervisor in each department.
Civil Engineering	
Biotechnology	
Bioinformatics	
Electronics & Communication Engg	
Mathematics	
Physics & Materials Science	
Humanities & Social Sciences	

The proposal for introduction of new academic programs and increase in the sanctioned intake of the existing programs were approved by the Chairman – Academic Council vide approval dated 23/02/2023. Copy of the approval is appended at **Annexure–14**

However, Academic Council approved the item with small modifications as listed above in deferment to earlier approval by the Chairman – Academic Council.

ITEM NO. 13/2023-1 **TO REVIEW AND EXTEND THE RESERVATION OF SEATS AND TUITION FEE CONCESSION FOR WARDSOF ARMED FORCES / PARAMILITARY FORCES PERSONNEL / PERSONS WITH DISABILITY AND WARD WIDOWS**

Reservation of 10% seats and concession in Tuition Fee was allowed for the wards of serving / retired armed forces / Paramilitary forces personnel (@30% of tuition fee) and for persons with disability and war widows (@35% of tuition fee) commencing from AY-2019-20 for the duration of 05 years, *i.e.,* upto AY-2023-

24.

The item for allowing further extension to the Reservation Policy and Tuition Fee concession under the policy beyond AY-2023-24 was proposed for review and decision by the Council. The proposed item was deferred by the Council and review of the same shall be done next year after analysing the admissions in this category.

ITEM NO. 14/2023-1 **REPORTING ITEMS**

The following Reporting Items were noted by the Academic Council:-

14.1 REVISION IN PARENT'S INCOME SLAB FOR AWARD OF WILLIAM WEBSTER MERIT-CUM-MEANS SCHOLARSHIP FROM 2022-23 ADMITTED BATCH

Chairman Academic Council apprised the members about the decision taken towards the revision in Parent's Annual Income Slab for award of William Webster Merit-Cum-Means Scholarship from 2022-23 (Fresh cases) admitted batch from 1.5 Lacs per annum to 8.0 Lacs per annum considering the revised income slab for the Economically Weaker Section (EWS) category notified by Central Govt. However, there is no change in the annual income slab for the Parent's of the students continuing award of scholarship for the subsequent years.

Copy of the approval dated 27/02/2023 by Chairman – Academic Council is as per **Annexure – 15**.

14.2 TUITION FEE AND HOSTEL CHARGES FOR INTERNATIONAL STUDENTS

Chairman Academic Council apprised the members about the Tuition Fees and Hostel Charges for International students. The issue of Tuition Fees and Hostel Charges for international students was also deliberated in the Heads meeting held on 28/12/2022, chaired by the Vice Chancellor. It was unanimously agreed to adopt the Tuition Fees and Hostel charges for International students as approved for JIIT Noida. The adopted Tuition Fee and Hostel charges for international students is as under:

Programs	Tuition Fees (per annum) (in USD)	Hostel Charges (per annum) (in USD)
BTech Programs	11600 USD	3000 USD
MTech Programs	5000 USD	3000 USD
MSc Programs	3000 USD	3000 USD
PhD Programs	3000 USD	3000 USD

50% Discount in Tuition Fee amount for students of SAARC Nations.

14.3 REGISTRATION OF UNIVERSITY AND STUDENTS ON ACADEMIC BANK OF CREDITS – AN INITIATIVE TOWARDS IMPLEMENTATION OF NATIONAL EDUCATION POLICY-2020

Chairman Academic Council apprised the members about the Registration of University and Students on Academic Bank of Credits – an initiative towards implementation of National Education Policy-2020 in compliance to UGC (Establishment and Operation of Academic Bank of Credits in Higher Education) Regulations, 2021 published

in Gazette of India on 28/07/2021 – **Annexure-16**.

JUIT has registered with the Academic Bank of Credits and students admitted in Academic Year 2021-22 onwards have been asked to create ABC ID through the Portal. Out of total 927 Nos. of students, 904 Nos. of students have registered themselves on the portal as on 08/06/2023. This has been done post approval dated 26/12/2022 by the Chairman – Academic Council. Copy of the approval is at **Annexure-17**.

14.4 ADMISSION STATUS – ACADEMIC SESSION 2022-23

Members were apprised of the admission status for the Academic Session 2022-23 as on 30/11/2022. The sanctioned strength vis-a-vis admission status as on 30/11/2022 is as under:-

UG Programs (BTech)	Sanctioned	Admitted
Computer Sc. & Engg.	360	357
Information Technology	60	45
Electronics & Comm. Engg.	30	04
Electronics & Computer Engg.	30	-
Civil Engineering	30	04
Civil Engineering with Computer Application	30	02
Biotechnology	30	31
Bioinformatics	30	13
Total	**600**	**456**

PG Programs (MTech)	Sanctioned	Admitted
Computer Science & Engineering CSE (Information Security) CSE (Data Science)	18	04
Electronics & Communication Engineering ECE (Internet of Things)	18	02
Biotechnology	18	02
Civil (Construction Management) Civil (Structural Engineering) Civil (Environmental Engineering)	18	07
Total	**72**	**15**

PG Programs (MSc)	Sanctioned	Admitted
Biotechnology	30	21
Microbiology	30	04
Total	**60**	**25**

Doctoral Programs (PhD)	Sanctioned	Admitted (till date)
Computer Science & Engineering	-	02
Civil Engineering	-	04
Biotechnology	-	01
Bioinformatics	-	-
Electronics & Communication Engg	-	02
Mathematics	-	02
Physics & Materials Science	-	01

Humanities & Social Sciences	-	-
Total	-	12

14.5 LIST OF SUBJECT EXPERTS FOR FACULTY SELECTION

Members were apprised about the approved list of subject experts for Faculty selection. Departments identified the subject experts for the selection of the faculty in their respective department and the list was proposed to the Chairman – Academic Council for approval. The proposed list was considered by the Chairman – Academic Council and same was approved vide approval dated 13/12/2022.

Copy of the approval and approved list of the subject experts is at **Annexure–18**.

14.6 POLICY DOCUMENTS

Chairman apprised the members about the approval of some policy documents in order to streamline the process of the various activities and considering requirements of various Regulatory bodies. The prepared 11 Policy Documents are as under:

1. Code of Ethics for Research
2. Consultancy Policy
3. Divyangjan Policy & Initiatives
4. e-Governance Policy
5. IT Policy
6. Library Policy (Manual)
7. Policy for Promotion of Research
8. Policy on Class Rooms
9. Policy on Guest Room
10. Policy on Laboratory Maintenance
11. Sports Policy

All the above policy documents have been approved by the Chairman – Academic Council. Copy of the approval **Annexure-19** and approved Policy Documents are appended as **Annexure–20 to 30**

14.7 AWARD OF PROFICIENCY CERTIFICATE FOR 2022 PASSED OUT BATCH

Chairman apprised the members about the award of Proficiency Certificate for 2022 passed out batch students.

The provisions of Proficiency Certification was introduced / floated from the 2018 Admission batch. First batch to which proficiency was offered completed the degree requirements in June 2022 along with the opted proficiency in the chosen filed.

Students who have opted for the proficiency and met the award of proficiency conditions have been awarded with the Proficiency Certificate. Sample of the awarded Proficiency Certificate is attached at **Annexure–31**.

14.8 MODIFICATION IN COURSE STRUCTURE OF MSc (BIOTECHNOLOGY)

PROGRAM

Chairman apprised the members about the modifications in Course Structure of MSc (Biotechnology) Program.

The said modifications were proposed in the MSc 3rd Semester as under:

- Clubbing of Courses "Critical Review of Classical Papers" and "Project Proposal Presentation" as a one course "Review of Classical Paper & Project Proposal Presentation (02 Credits) (22MS1BT311)

- Introduction of one new course "Food Biotechnology (02 Credits) (22MS1BT311)

The proposed modifications have been approved by the Chairman – Academic Council vide approval dated 21/04/2023. Copy of BoS Minutes, approval and detailed syllabus of newly introduced course "Food Biotechnology" (22MS1BT311) is as per **Annexure–32**.

14.9 APPROVAL FOR COURSE STRUCTURE (1ST & 2ND SEMESTER) AND DETAILED SYLLABI COURSES OF 1ST & 2ND SEMESTER OF BSc (HONS.) IN MATHEMATICS & COMPUTING

Chairman – Academic Council apprised the members about the approval of the Course Structure (1st & 2nd Semester) and detailed syllabi of courses of 1st & 2nd Semester – BSc (Hons.) in Mathematics & Computing.

The proposed Course Structure and detailed syllabi of the courses were proposed through the Board of Studies (BoS) meeting held on 08/06/2022. (Minutes of BoS at **Annexure-33**).

The approved Course Structure is at **Annexure–34** and detailed syllabi of the courses are at **Annexure–35**.

Recommendations of the BoS of the department were considered by the Chairman – Academic Council and same were approved vide approval dated 04/10/2022. Copy of the approval by Chairman – Academic Council is at **Annexure–36**.

14.10 FLOATING OF NEW COURSE "APPLIED SOFT COMPUTING TECHNIQUES" (22P1WMA231) TOWARDS PhD COURSE WORK – DEPTT. OF MATHEMATICS

Chairman – Academic Council apprised the members about the introduction of new course towards the course work for the PhD Program.

Department of Mathematics through its Board of Studies held on 30/12/2022 (Minutes of BoS at **Annexure-37**) proposed for introduction of new course towards the course work for the PhD Program. The newly proposed course is as under:
Applied Soft Computing Techniques (22P1WMA231) (L-T-P) (3-0-0) (03 Credits)

The proposal of introduction of new course was approved by the Chairman – Academic Council vide approval dated 02/03/2023. Copy of approval and detailed syllabus of newly introduced course "Applied Soft Computing Techniques" (22P1WMA231) are at **Annexure–38**.

14.11 FLOATING OF NEW OPEN ELECTIVE COURSES BY DEPARTMENT OF CIVIL ENGINEERING

Chairman – Academic Council apprised the members about the introduction of two (02) new Open Elective Courses offered by Department of Civil Engineering Department.
Department of Civil Engineering through its Board of Studies held on 21/05/2022 (Minutes of BoS at **Annexure-39**) proposed for introduction of new Open Elective Course for BTech Program. The newly proposed courses are as under:

- Perennial Power Structures (22B1WCE731) (L-T-P) (3-0-0) (03 Credits)
- Disaster Risk Analysis and Management (22B1WCE831) (L-T-P) (3-0-0) (03 Credits)

The proposed introduction of Open Elective Courses was approved by the Chairman – Academic Council vide approval dated 22/10/2022. Copy of approval and detailed syllabus of newly introduced courses are as per **Annexure–40**.

14.12 REPRINTING OF DEGREE CERTIFICATES DUE TO SPELLING ERROR IN NAME

Chairman – Academic Council apprised the members about the reprinting of two (02) Degree Certificates due to spelling error in name printed on the Degree certificate in respect of below mentioned students:-
Ms. Suchi Johari, Enrolment No. 132208 – MTech (CSE)
Ms. Shivani Sood, Enrolment No. 106558 – PhD (Biotechnology)

Noting for change in the name and reprinting of the degree was moved to the Chairman – Academic Council and upon approval by the Chairman – Academic Council, reprinting of the degrees was done with correct name. The earlier printed Degree certificate having spelling error in name were called back and cancelled. Copy of the approval Chairman – Academic Council and reprinted Degree certificates are appended at **Annexure–41**.

ITEM NO. 15/2023-1 ANY OTHER ITEM WITH THE PERMISSION OF THE CHAIR

15.1 APPROVAL FOR POST DOCTORATE FELLOWSHIP RULES

In order to improvise and enhance the academic standards of the Institution, it was proposed to devise the mechanism for induction of Post Doctorate Fellows and implementation of Post Doctorate Fellowship Programmes for induction of such Post Doctorate Fellows. Such induction will translate to better research environment, perception of the institution and may bring higher accolades to the

Institution under NIRF rankings.

In order to attain the above objective, it was proposed to frame proper rules and regulations for offering post doctorate fellowship to the prospective candidates.

The item was considered by the Council and after deliberation item was approved.

The approved Post Doctorate Fellowship Rules are as per **Annexure-42**.

There being no other point, meeting ended with a vote of thanks to the Chair.

(Maj Gen Rakesh Bassi, SM (Retd))
Registrar & Non-Member Secretary

Confirmed

(Prof Rajendra Kumar Sharma)
Chairman, Academic Council&
Vice-Chancellor, JUIT, W

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY

(Established by H.P. State Legislature vide Act No. 14 of 2002)

Date:

Department of Biotechnology and Bioinformatics

A meeting of Board of Studies (BoS) of the **Department of Biotechnology and Bioinformatics** was held as per the following schedule :

Meeting Name:	Board of Studies –Department of Biotechnology and Bioinformatics		
Date of Meeting:	17.06.2024	**Time:9:15-10 AM**	
Chairman:	Prof. (Dr.) Sudhir Kumar	**Location: Board Room and Online**	

1. Meeting Objective: BoS meeting of Deptt of Biotechnology and Bioinformatics

2(a). Meeting Attendees: The following members were present	
Prof. Sudhir Kumar, HOD, Department of Biotechnology and Bioinformatics	Chairman
Dr. Anil Kant, Associate Prof, Department of Biotechnology and Bioinformatics	Member Secretary/Coordinator
Prof. T.C. Bhalla Ex-Professor Emeritus Department of Biotechnology HPU Shimla	External Member (Academic)
Prof. G.P.S. Raghava, Prof and Head, Deptt of Computational Biology, IIIT-Dehli	External Member (Academic)
Prof. Sunil Kumar Khah, Incharge IQAC, JUIT	Member
Dr Tiratha Raj Singh, Professor, Department of Biotechnology and Bioinformatics	Member
Dr Jata Shankar, Professor, Department of Biotechnology and Bioinformatics	Member
Dr Rahul Shrivastava, Associate Prof, Department of Biotechnology and Bioinformatics	Member
Dr Udaybanu M, Associate Prof, Department of Biotechnology and Bioinformatics	Member
Dr Poonam Sharma, Associate Prof, Department of Biotechnology and Bioinformatics	Member
Dr Jitendraa Vashistt, Associate Prof, Department of Biotechnology and Bioinformatics	Member
Dr Hemant Sood, Associate Prof, Department of Biotechnology and Bioinformatics	Member

Dr Saurabh Bansal,Associate Prof, Department of Biotechnology and Bioinformatics	Member
Dr Gopal Bisht,Associate Prof, Department of Biotechnology and Bioinformatics	Member
Dr V. Garlapati Vijay Kumar, Associate Prof, Department of Biotechnology and Bioinformatics	Member
Dr Ashok Kumar Nadda, Assistant Prof., Department of Biotechnology and Bioinformatics	Member
Mr. Aditya Sahni, JUIT Alumni, Founder of ELEM, India (Industry Expert)	External Member (JUIT Alumni)
HOD, Department of Electronics & Communication Engineering	Member
HOD, Department of Physics and Material Science	Member
HOD, Department of Civil Engineering	Member
2 (b). Leave of Absence: The following members were granted leave of absence by the Chairman, BOS	
HOD, Department of Computer Science & Engineering	Member
HOD, Department of Humanities and Social Sciences	Member
HOD, Department of Mathematics	Member
Dr. Shruti Jain	Member

Dr Anil Kant offered a welcome note to the members, Prof. Sudhir Kumar addressed the house and welcomed all the members of BoS. Dr. Anil Kant invited Dr Udayabanu, B.Tech. Program coordinator, Dr Rahul Shrivstava M.Sc. Microbiology Program coordinator to present the agenda pertaining to their respective program. Dr Anil Kant presented agenda details regarding the M.Sc Biotechnology program. Dr. Udayabanu M. presented details regarding B.Tech. Biotechnology & B.Tech. Bioinformatics course structure.

3. Action Items / Instructions: Following decisions were taken/approved by the members of BoS.

Agenda Item 3(a) To consider and approve modification and restructuring of the course curriculum of B.Tech Biotechnology.

Existing Courses in B.Tech Biotechnology Semester I

SEMESTER - 1								
S. No.	**Course Category**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
				L	**T**	**P**		
1	Humanities & Social Sciences	21B11HS111	English	2	0	0	2	**2**
		21B17HS171	English Lab	0	0	2	1	**2**
2	Basic Science		Basic Mathematics I (3-1-0) - 4 Credits/ Fundamental Biology & Fundamental Biology Lab				4	4 or 5
3	Basic Sciences	18B11PH112	Basic Engineering Physics-I	3	1	0	**4**	**4**
4	Engg Science	19B11CI111	Programming for Problem Solving-2	2	0	0	**2**	**2**
5	Engg Science	18B17GE173	Engineering Graphics	0	0	3	**1.5**	**3**
6	Basic Sciences	18B17PH172	Basic Engineering Physics Lab-I	0	0	2	**1**	**2**
7	Engg Science	19B17CI171	Programming for Problem Solving Lab-2	0	0	4	**2**	**4**
			TOTAL				**17.5**	**23 or 24**

Existing Courses in B.Tech Biotechnology Semester 1

Modified & Approved by BoS
B.Tech Biotechnology Semester I

S. No.	**Course Category**	**New / Revised**	**Subject Code**	**Name of the Subjects**	**Course Hours**				**Credits**	**Total Hours**
					L	**T**	**P**	**S**		
1	Humanities & Social Sciences			English	2	0	0		**2**	**2**
2	Humanities & Social Sciences			English Lab	0	0	2		**1**	**2**
3	Basic Sciences	New		Mathematics for Life Sciences I **OR**	3	1	0		**4**	**4**
4	Basic Sciences			Fundamental Biology	3	0	0		**3**	**3**
5	Basic Sciences			Fundamental Biology Lab	0	0	2		**1**	**2**
6	Basic Sciences			Basic Engineering Physics	3	1	0		**4**	**4**
7	Engg Science	Revised		Problem Solving and Programming	3	0	0		**3**	**3**
8	Engg Science			Engineering Graphics	0	0	3		**1.5**	**3**
9	Basic Sciences			Basic Engineering Physics Lab	0	0	2		**1**	**2**
10	Engg Science	Revised		Problem Solving and Programming Lab	0	0	2		**1**	**2**
11	Project			Project	0	0	2	2	**1**	**2**
12	Mandatory Course			Mandatory Induction Program (including UHV-1)						**2 Weeks**
				TOTAL					**18.5**	**24/25**

Existing Courses in B.Tech Biotechnology Semester II

S. No.	Course Category	Subject Code	Name of the Subjects	Course Hours			Credits	Total Hours
				L	T	P		
1	Humanities & Social Sciences	23B11HS211	Universal Human Values II: Understanding Harmony	2	1	0	3	**3**
2	Humanities & Social Sciences	23B11HS212	Professional Communication Practice	0	0	2	Audit	**2**
3	Basic Science	18B11MA212	Basic Mathematics II	3	1	0	4	4
4	Basic Sciences	18B11PH212	Bioinstrumentation Techniques	3	1	0	4	4
5	Engg Science	18B11EC212	Basic Electrical Sciences	3	1	0	4	4
6	Engg Science	18B17EC272	Basic Electrical Sciences lab	0	0	2	1	2
7	Engg Science	18B11CI211	Data Structure & Algorithms	3	1	0	4	4
8	Engg Science	18B17CI271	Data Structure & Algorithms Lab	0	0	4	2	4
9	Engg Science	18BI7GE171	Workshop Practices	0	0	3	1.5	3
			TOTAL				**23.5**	**30**

Modified & Approved by BoS
B.Tech Biotechnology Semester II

SEMESTER - II

S. No.	Course Category	New / Revised	Subject Code	Name of the Subjects	Course Hours				Credits	Total Hours
					L	T	P	S		
1	Humanities & Social Sciences			UHV II: Understanding Harmony	2	1	0		**3**	**3**
2	Humanities & Social Sciences			Professional Communication Practice (AUDIT)	0	1	0		**0**	**1**
3	Basic Sciences	New		Mathematics for Life Sciences II	3	1	0		**4**	**4**
4	Basic Sciences			Bioinstrumentation Techniques	3	1	0		**4**	**4**
5	Engg Science			Basic Electrical Sciences	3	1	0		**4**	**4**
6	Engg Science			Basic Electrical Sciences lab	0	0	2		**1**	**2**
7	Engg Science			Data Structure & Algorithms	3	0	0		**3**	**3**
8	Engg Science			Data Structure & Algorithms Lab	0	0	4		**2**	**4**
9	Engg Science			Workshop Practices	0	0	3		**1.5**	**3**
10	Project			Project	0	0	2	2	**1**	**2**
				TOTAL					**23.5**	**30**

Existing Courses in B.Tech Biotechnology Semester III

SEMESTER-III

S. No.	Course Category	Subject Code	Name of the Subjects	Course Hours			Credits	Total Hours
				L	T	P		
1	Humanities & Social Sciences	23B11HS311	Life Skills and Interpersonal Dynamics	2	1	0	3	**3**
2	Basic Sciences	18B11MA312	Probability & Statistical Techniques	3	1	0	4	4
3	Professional Core		Genetics	3	1	0	4	4
4	Professional Core	18B11BT312	Biochemistry	3	0	0	3	3
5	Engg Science	18B11BT313	Thermodynamics & Chemical Processes	3	1	0	4	4
6	Basic Sciences	18B11BT314	General Chemistry	3	0	0	3	3
7	Professional Core	18B17BT371	Genetics Lab.	0	0	2	1	2
8	Professional Core	18B17BT372	Biochemistry Lab	0	0	2	1	2
9	Engg Science	18B17BT373	Thermodynamics & Chemical Processes lab	0	0	2	1	2
10	Basic Sciences	18B17BT374	General Chemistry Lab	0	0	2	1	2
			TOTAL				**25**	**29**

Modified & Approved by BoS
B.Tech Biotechnology Semester III

SEMESTER -III

S. No.	Course Category	New / Revised	Subject Code	Name of the Subjects	Course Hours				Credits	Total Hours
					L	T	P	S		
1	Humanities & Social Sciences			Life Skills and Interpersonal Dynamics	2	1	0		**3**	**3**
2	Basic Sciences	New		Probability & Statistical Methods	2	0	0		**2**	**2**
3	Basic Sciences	New		Probability & Statistical Methods Lab	0	0	2		**1**	**2**
4	Professional Core Course			Genetics	3	0	0		**3**	**3**
5	Professional Core Course	Revised		Biochemistry	3	0	0		**3**	**3**
6	Engg Science	Revised		Thermodynamics & Chemical Processes	3	0	0		**3**	**3**
7	Professional Core Course	New		Chemistry for Life Sciences	3	0	0		**3**	**3**
8	Professional Core Course			Genetics Lab.	0	0	2		**1**	**2**
9	Professional Core Course	Revised		Biochemistry Lab	0	0	2		**1**	**2**
10	Engg Science	Revised		Thermodynamics & Chemical Processes lab	0	0	2		**1**	**2**
11	Professional Core Course	New		Chemistry for Life Sciences Lab	0	0	2		**1**	**2**
12	Project			Project	0	0	2	2	**1**	**2**
				TOTAL					**23**	**29**

Existing Courses in B.Tech Biotechnology Semester IV

SEMESTER- IV

Sr. No	Course Category	Subject Code	Name of the Subjects	Course Hours			Credits	Total Hours
				L	T	P		
1	Humanities & Social Sciences	18B11HS411	Finance and Accounts	3	0	0	3	**3**
2	Professional Core	18B11BT411	Cell Biology and Culture Technologies	3	1	0	4	4
3	Professional Core	18B11BT412	Molecular Biology	3	0	0	3	3
4	Professional Core	18B11BT413	Introduction to Bioinformatics	3	1	0	4	4
5	Professional Core	18B11BT414	Microbiology	3	1	0	4	4
6	Professional Core	18B17BT471	Cell Biology and Culture Technologies lab	0	0	2	1	2
7	Professional Core	18B17BT472	Molecular Biology Lab	0	0	2	1	2
8	Professional Core	18B17BT473	Introduction to Bioinformatics lab	0	0	2	1	2
9	Professional Core	18B17BT474	Microbiology Lab	0	0	2	1	2
10	Mandatory Course	18B11GE411	Environmental Studies	2	0	0	2	2
			TOTAL				**24**	**28**

Modified & Approved by BoS
B.Tech Biotechnology Semester IV

SEMESTER - IV

S. No.	Course Category	New / Revised	Subject Code	Name of the Subjects	Course Hours				Credits	Total Hours
					L	T	P	S		
1	Humanities & Social Sciences			Finance and Accounts	3	0	0		**3**	**3**
2	Professional Core Course	Revised		Cell Biology and Culture Technologies	3	0	0		**3**	**3**
3	Professional Core Course	Revised		Molecular Biology	3	0	0		**3**	**3**
4	Professional Core Course			Introduction to Bioinformatics	3	1	0		**4**	**4**
5	Professional Core Course	Revised		Microbiology	3	0	0		**3**	**3**
6	Professional Core Course	Revised		Cell Biology and Culture Technologies lab	0	0	2		**1**	**2**
7	Professional Core Course	Revised		Molecular Biology Lab	0	0	2		**1**	**2**
8	Professional Core Course			Introduction to Bioinformatics lab	0	0	2		**1**	**2**
9	Professional Core Course			Microbiology Lab	0	0	2		**1**	**2**
10	Engg Science			Environmental Studies	2	0	0		**2**	**2**
11	Project			Project	0	0	2	2	**1**	**2**
				TOTAL					**23**	**28**

Existing Courses in B.Tech Biotechnology Semester V

SEMESTER-V								
S. Nno	**Course Category**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
				L	**T**	**P**		
1	Humanities & Social Sciences	18B11HS511	Project Management and Entrepreneurship	3	0	0	3	**3**
2	Professional Core	18B11BT511	Bioprocess Engineering	3	1	0	4	4
3	Professional Core	18B11BT512	Genetic Engineering	3	1	0	4	4
4	Professional Core	18B11BT513	Immunology	3	1	0	4	4
5	Professional Core	18B17BT571	Bioprocess Engineering Lab	0	0	2	1	2
6	Professional Core	18B17BT572	Genetic Engineering Lab	0	0	2	1	2
7	Professional Core	18B17BT573	Immunology Lab	0	0	2	1	2
8	Professional Elective		Departmental Elective-I	3	0	0	3	3
9	Project	18B19BT591	Minor Project Part-I	0	0	2	1	2
			TOTAL				**22**	**26**

Modified & Approved by BoS
B.Tech Biotechnology Semester V

SEMESTER - V										
S. No .	**Course Category**	**New / Revised**	**Subject Code**	**Name of the Subjects**	**Course Hours**				**Credits**	**Total Hours**
					L	**T**	**P**	**S**		
1	Humanities & Social Sciences			Project Management and Entrepreneurship	3	0	0		**3**	**3**
2	Professional Core Course	Revised		Bioprocess Engineering	3	1	0		**4**	**4**
3	Professional Core Course	Revised		Genetic Engineering	3	1	0		**4**	**4**
4	Professional Core Course	Revised		Immunology	3	1	0		**4**	**4**
5	Professional Core Course	Revised		Bioprocess Engineering Lab	0	0	2		**1**	**2**
6	Professional Core Course			Genetic Engineering Lab	0	0	2		**1**	**2**
7	Professional Core Course	Revised		Immunology Lab	0	0	2		**1**	**2**
8	professional Elective			PE-I	3	0	0		**3**	**3**
10	Project			Project	0	0	4	2	**2**	**4**
				TOTAL					**23**	**28**

Existing Courses in B.Tech Biotechnology Semester VI

SEMESTER-VI

S. No	Course Category	Subject Code	Name of the Subjects	Course Hours			Credits	Total Hours
				L	T	P		
1	Professional Core	18B11BT611	Downstream Processing	3	1	0	4	**4**
2	Professional Core	18B11BT612	Food and Agricultural Biotechnology	3	0	0	3	3
3	Professional Core	18B17BT671	Downstream Processing Lab.	0	0	2	1	2
4	Professional Core	18B17BT672	Food and Agricultural Biotechnology Lab	0	0	2	1	2
5	Professional Elective		Departmental Elective- II	3	0	0	3	3
6	Professional Elective		Departmental Elective-III	3	0	0	3	3
7	Open Elective		Open Elective-I (HSS)	3	0	0	3	3
8	Open Elective		Open Elective-II	3	0	0	3	3
9	Project	18B19BT691	Minor Project Part-II	0	0	4	2	4
10	Mandatory Course		Industrial Training				Audit	
			TOTAL				**23**	**27**

Modified & Approved by BoS
B.Tech Biotechnology Semester VI

SEMESTER - VI

S. No.	Course Category	New / Revised	Subject Code	Name of the Subjects	Course Hours				Credits	Total Hours
					L	T	P	S		
1	Professional Core Course	Revised		Downstream Processing	3	0	0		**3**	**3**
2	Professional Core Course	New		Food Technology	3	0	0		**3**	**3**
3	Professional Core Course	Revised		Downstream Processing Lab.	0	0	2		**1**	**2**
4	Professional Core Course	New		Food Technology Lab	0	0	2		**1**	**2**
5	professional Elective			PE-II	3	0	0		**3**	**3**
6	professional Elective			PE-III	3	0	0		**3**	**3**
7	Open Elective			OE-I (HSS)	3	0	0		**3**	**3**
8	Open Elective			OE-II	3	0	0		**3**	**3**
9	Project			Project	0	0	4	2	**2**	**4**
10	Mandatory Course			Soft Skills for Professionals (Audit)	0	1	0		**0**	**1**
11	Mandatory Course			Industrial Training					**Audit**	
				TOTAL					**22**	**27**

Existing Courses in B.Tech Biotechnology Semester VII

SEMESTER-VII

Sr. No.	Course Category	Subject Code	Name of the Subjects	Course Hours			Credits	Total Hours
				L	T	P		
1	Professional Elective		Departmental Elective-I V	3	0	0	3	**3**
2	Open Elective		Open Elective - III	3	0	0	3	3
3	Open Elective		Open Elective - IV	3	0	0	3	3
4	Project	18B19BT791	Major Project Part I	0	0	10	5	10
5	HSS		Indian Constitution	1	0	0	Audit	1
			TOTAL				**14**	**20**

Approved by BoS
B.Tech Biotechnology Semester VII

SEMESTER - VII

S. No.	Course Category	New / Revised	Subject Code	Name of the Subjects	Course Hours				Credits	Total Hours
					L	T	P	S		
1	professional Elective			PE-IV	3	0	0		**3**	**3**
2	professional Elective			PE-V	3	0	0		**3**	**3**
3	Open Elective			OE-III	3	0	0		**3**	**3**
4	Open Elective			OE-IV	3	0	0		**3**	**3**
5	Project			Project	0	0	8		**4**	**8**
6	Mandatory Course			Indian Constitution	1	0	0		**Audit**	**1**
				TOTAL					**16**	**21**

Existing Courses in B.Tech Biotechnology Semester VIII

SEMESTER-VIII

Sr.No.	Course Category	Subject Code	Name of the Subjects	Course Hours			Credits	Total Hours
				L	T	P		
1	Professional Elective		Departmental Elective- V	3	0	0	3	**3**
2	Professional Elective		Departmental Elective- VI	3	0	0	3	3
3	Open Elective		Open Elective-V	3	0	0	3	3
4	Project	18B19BT891	Major Project Part II	0	0	14	7	14
			TOTAL				**16**	**23**

Modified & Approved by BoS
B.Tech Biotechnology Semester VIII

SEMESTER - VIII

S. No.	Course Category	New / Revised	Subject Code	Name of the Subjects	Course Hours				Credits	Total Hours
					L	T	P	S		
1	Professional Elective			PE-VI	3	0	0		**3**	**3**
2	Open Elective			OE-V	3	0	0		**3**	**3**
3	Open Elective			OE-VI	3	0	0		**3**	**3**
4	Project			Project	0	0	8		**4**	**8**
				TOTAL					**13**	**17**
				OR						
				Industrial Internship					**13**	

Item 1a.

Two New Electives were proposed and approved by the BoS

1. Omics Technologies & Data Analysis (3-0-0)
2. Biopharmaceutical Technology (3-0-0)

Agenda Item 2. To consider and approve modification and restructuring of the course curriculum of B.Tech Bioinformatics.

Existing Courses in B.Tech Bioinformatics Semester I

SEMESTER - 1								
S. No.	**Course Category**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
				L	**T**	**P**		
1	Humanities & Social Sciences	21B11HS111	English	2	0	0	2	**2**
		21B17HS171	English Lab	0	0	2	1	**2**
2	Basic Science		Basic Mathematics I (3-1-0) - 4 Credits/ Fundamental Biology & Fundamental Biology Lab				4	4 or 5
3	Basic Sciences	18B11PH112	Basic Engineering Physics-I	3	1	0	**4**	**4**
4	Engg Science	19B11CI111	Programming for Problem Solving-2	2	0	0	**2**	**2**
5	Engg Science	18B17GE173	Engineering Graphics	0	0	3	**1.5**	**3**
6	Basic Sciences	18B17PH172	Basic Engineering Physics Lab-I	0	0	2	**1**	**2**
7	Engg Science	19B17CI171	Programming for Problem Solving Lab-2	0	0	4	**2**	**4**
			TOTAL				**17.5**	**23 or 24**

Existing Courses in B.Tech Bioinformatics Semester 1
Modified & Approved by BoS
B.Tech Bioinformatics Semester I

S. No.	**Course Category**	**New / Revised**	**Subject Code**	**Name of the Subjects**	**Course Hours**				**Credits**	**Total Hours**
					L	**T**	**P**	**S**		
1	Humanities & Social Sciences			English	2	0	0		**2**	**2**
2	Humanities & Social Sciences			English Lab	0	0	2		**1**	**2**
3	Basic Sciences	New		Mathematics for Life Sciences I **OR**	3	1	0		**4**	**4**
4	Basic Sciences			Fundamental Biology	3	0	0		**3**	**3**
5	Basic Sciences			Fundamental Biology Lab	0	0	2		**1**	**2**
6	Basic Sciences			Basic Engineering Physics	3	1	0		**4**	**4**
7	Engg Science	Revised		Problem Solving and Programming	3	0	0		**3**	**3**
8	Engg Science			Engineering Graphics	0	0	3		**1.5**	**3**
9	Basic Sciences			Basic Engineering Physics Lab	0	0	2		**1**	**2**
10	Engg Science	Revised		Problem Solving and Programming Lab	0	0	2		**1**	**2**
11	Project			Project	0	0	2	2	**1**	**2**
12	Mandatory Course			Mandatory Induction Program (including UHV-1)						**2 Weeks**
				TOTAL					**18.5**	**24/25**

Existing Semester II

S. No.	Course Category	Subject Code	Name of the Subjects	Course Hours			Credits	Total Hours
				L	T	P		
1	Humanities & Social Sciences	23B11HS211	Universal Human Values II: Understanding Harmony	2	1	0	3	**3**
2	Humanities & Social Sciences	23B11HS212	Professional Communication Practice	0	0	2	Audit	**2**
3	Basic Science	18B11MA212	Basic Mathematics II	3	1	0	4	4
4	Basic Sciences	18B11PH212	Bioinstrumentation Techniques	3	1	0	4	4
5	Engg Science	18B11EC212	Basic Electrical Sciences	3	1	0	4	4
6	Engg Science	18B17EC272	Basic Electrical Sciences lab	0	0	2	1	2
7	Engg Science	18B11CI211	Data Structure & Algorithms	3	1	0	4	4
8	Engg Science	18B17CI271	Data Structure & Algorithms Lab	0	0	4	2	4
9	Engg Science	18BI7GE171	Workshop Practices	0	0	3	1.5	3
			TOTAL				**23.5**	**30**

Approved & Modified by Bos Semester II

SEMESTER - II

S. No.	Course Category	New / Revised	Subject Code	Name of the Subjects	Course Hours				Credits	Total Hours
					L	T	P	S		
1	Humanities & Social Sciences			UHV II: Understanding Harmony	2	1	0		**3**	**3**
2	Humanities & Social Sciences			Professional Communication Practice (AUDIT)	0	1	0		**0**	**1**
3	Basic Sciences	New		Mathematics for Life Sciences II	3	1	0		**4**	**4**
4	Basic Sciences			Bioinstrumentation Techniques	3	1	0		**4**	**4**
5	Engg Science			Basic Electrical Sciences	3	1	0		**4**	**4**
6	Engg Science			Basic Electrical Sciences lab	0	0	2		**1**	**2**
7	Engg Science			Data Structure & Algorithms	3	0	0		**3**	**3**
8	Engg Science			Data Structure & Algorithms Lab	0	0	4		**2**	**4**
9	Engg Science			Workshop Practices	0	0	3		**1.5**	**3**
10	Project			Project	0	0	2	2	**1**	**2**
				TOTAL					**23.5**	**30**

Existing Semester III

SEMESTER-III

S. No.	Course Category	Subject Code	Name of the Subjects	Course Hours			Credits	Total Hours
				L	T	P		
1	Humanities & Social Sciences	23B11HS311	Life Skills and Interpersonal Dynamics	2	1	0	3	**3**
2	Basic Sciences	18B11BI311	Cell and Molecular Biology	3	0	0	**3**	**3**
3	Engg Science	20B11BI311	Bioinformatics Data Management	3	1	0	**4**	**4**
4	Professional Core	18B11BI312	Microbiology & Immune System	3	1	0	**4**	**4**
5	Professional Core	18B11BI313	Biological Computation	3	1	0	**4**	**4**
6	Engg Science	20B17BI371	Bioinformatics Data Management Lab	0	0	2	**1**	**2**
7	Basic Sciences	18B17BI371	Cell and Molecular Biology Lab	0	0	2	**1**	**2**
8	Professional Core	18B17BI372	Microbiology & Immune System Lab	0	0	2	**1**	**2**
9	Professional Core	18B17BI373	Biological Computation Lab	0	0	2	**1**	**2**
10	Professional Core	18B17BI374	Linux Lab	0	0	2	**1**	**2**
			TOTAL				**23**	**28**

Modified & Approved by Bos Semester III

SEMESTER - 3

S. No.	Course Category	New / Revised	Subject Code	Name of the Subjects	Course Hours				Credits	Total Hours
					L	T	P	S		
1	Humanities & Social Sciences			Life Skills and Interpersonal Dynamics	2	1	0		**3**	**3**
2	Basic Sciences	New		Probability & Statistical Methods	2	0	0		**2**	**2**
3	Basic Sciences	New		Probability & Statistical Methods Lab	0	0	2		**1**	**2**
4	Professional Core Course	New		Structural Bioinformatics	3	0	0		**3**	**3**
5	Engg Science			Object Oriented Systems and Programming	3	0	0		**3**	**3**
6	Professional Core Course			Microbiology & Immune System	3	0	0		**3**	**3**
7	Professional Core Course			Biological Computation	3	0	0		**3**	**3**
8	Engg Science			Object Oriented Systems and Programming Lab	0	0	2		**1**	**2**
9	Professional Core Course	New		Structural Bioinformatics Lab	0	0	2		**1**	**2**
10	Professional Core Course			Biological Computation Lab	0	0	2		**1**	**2**
11	Professional Core Course			Linux Lab	0	0	2		**1**	**2**
12	Project			Project			2	2	**1**	**2**
				TOTAL					**23**	**29**

Existing Semester IV

SEMESTER-IV

Sr.No.	Course Category	Subject Code	Name of the Subjects	Course Hours			Credits	Total Hours
				L	T	P		
1	HSS	18B11HS411	Finance and Accounts	3	0	0	**3**	**3**
2	Basic Sciences	18B11MA411	Bio-Statistics	3	0	0	**3**	**3**
3	Professional Core	18B11BI412	Genetic Engineering and Genomics	3	0	0	**3**	**3**
4	Engg Science	18B11CI415	Object Oriented Programming	3	1	0	**4**	**4**
5	Professional Core	18B11BI413	Structural Biology	3	0	0	**3**	**3**
6	Professional Core	18B11BI414	Programming Languages for Bioinformatics	3	0	0	**3**	**3**
7	Engg Science	18B11CI474	Object Oriented Programming Lab	0	0	2	**1**	**2**
8	Basic Sciences	18B11MA412	Bio-Statistics Lab	0	0	2	**1**	**2**
9	Professional Core	18B17BI472	Genetic Engineering and Genomics Lab	0	0	2	**1**	**2**
10	Professional Core	18B17BI473	Structural Biology Lab	0	0	2	**1**	**2**
11	Professional Core	18B17BI474	Programming Languages for Bioinformatics Lab	0	0	2	**1**	**2**
12	Mandatory Course	23B11GE411	Environmental Studies	2	0	0	Audit	2
			TOTAL				**26**	**31**

Modified & Approved by Bos Semester IV

SEMESTER - IV

S. No.	Course Category	New / Revised	Subject Code	Name of the Subjects	Course Hours				Credits	Total Hours
					L	T	P	S		
1	Humanities & Social Sciences			Finance and Accounts	3	0	0		**3**	**3**
2	Professional Core Course	New		Python for Bioinformatics	3	0	0		**3**	**3**
3	Professional Core Course	New		Web development for Bioinformatics	3	0	0		**3**	**3**
4	Professional Core Course			Design and Analysis of Algorithms	3	0	0		**3**	**3**
5	Professional Core Course			Cell and Molecular Biology	3	0	0		**3**	**3**
6	Professional Core Course	New		Web Development for Bioinformatics Lab	0	0	2		**1**	**2**
7	Professional Core Course			Design and Analysis of Algorithms Lab	0	0	4		**2**	**4**
8	Professional Core Course	New		Python for Bioinformatics Lab	0	0	2		**1**	**2**
9	Professional Core Course			Cell and Molecular Biology Lab	0	0	2		**1**	**2**
10	Engg Science			Environmental Studies	2	0	0		**2**	**2**
11	Project			Project			2	2	**1**	**2**
				TOTAL					**23**	**29**

Existing Semester V

SEMESTER-5

Sr. No.	Course Category	Subject Code	Name of the Subjects	Course Hours			Credits	Total Hours
				L	T	P		
1	Humanities & Social Sciences	18B11HS511	Project Management and Entrepreneurship	3	0	0	3	**3**
2	Professional Core	18B11BI511	Design and Analysis of Algorithms	3	0	0	3	3
3	Professional Core	18B11BT511	Bioprocess Engineering	3	1	0	4	4
4	Professional Core	18B11BI512	Scripting Languages for Bioinformatics	3	0	0	3	3
5	Professional Core	18B17BI571	Design and Analysis of Algorithms Lab	0	0	2	1	2
6	Professional Core	18B17BT571	Bioprocess Engineering Lab	0	0	2	1	2
7	Professional Core	18B17BI572	Scripting Languages for Bioinformatics Lab	0	0	2	1	2
8	Professional Core	18B17BI573	Structural Bioinformatics Lab	**0**	0	2	1	2
9	Professional Elective		Departmental Elective-I	3	0	0	3	3
10	Open Elective		Open Elective-I	3	0	0	3	3
11	Project	18B19BI591	Minor Project Part-I	0	0	2	1	2
			TOTAL				**24**	**29**

Modified & Approved by Bos Semester V

SEMESTER - V

S. No.	Course Category	New / Revised	Subject Code	Name of the Subjects	Course Hours				Credits	Total Hours
					L	T	P	S		
1	Humanities & Social Sciences			Project Management and Entrepreneurship	3	0	0		**3**	**3**
2	Professional Core Course			Genetic Engineering and Genomics	3	0	0		**4**	**4**
3	Professional Core Course	Revised		Bioprocess Engineering	3	1	0		**4**	**4**
4	Professional Core Course			Bioinformatics Data Management	3	0	0		**3**	**3**
5	Professional Core Course			Genetic Engineering and Genomics Lab	0	0	2		**1**	**2**
6	Professional Core Course	Revised		Bioprocess Engineering Lab	0	0	2		**1**	**2**
7	Professional Core Course			Bioinformatics Data Management Lab	0	0	2		**1**	**2**
8	Professional Core Course			R Language Lab	0	0	2		**1**	**2**
9	professional Elective			PE-I	3	0	0		**3**	**3**
11	Project			Project	0	0	4	2	**2**	**4**
				TOTAL					**23**	**29**

Existing Semester VI

SEMESTER-VI

S. No.	Course Category	Subject Code	Name of the Subjects	Course Hours			Credits	Total Hours
				L	T	P		
1	Professional Core	18B11BI611	Machine Learning for Bioinformatics	3	0	0	3	3
2	Professional Core	18B11BI612	Computer Aided Drug Design	3	0	0	3	3
3	Professional Core	18B17BI671	Machine Learning for Bioinformatics lab	0	0	2	1	2
4	Professional Core	18B17BI672	Computer Aided Drug Design Lab	0	0	2	1	2
5	Professional Elective	18B17BI673	Advanced Algorithms for Bioinformatics Lab	0	0	2	1	2
6	Professional Elective	18B17BI674	R Language Lab	0	0	2	1	2
7	Professional Elective		Departmental Elective-II	3	0	0	3	3
8	Professional Elective		Departmental Elective-III	3	0	0	3	3
9	Open Elective		Open Elective-II	3	0	0	3	3
10	Project	18B19BI691	Minor Project Part-II	0	0	4	2	4
11	Mandatory Course		Industrial Training				Audit	
			TOTAL				**21**	**27**

Modified & Approved by Bos Semester VI

SEMESTER - VI

S. No.	Course Category	New / Revised	Subject Code	Name of the Subjects	Course Hours				Credits	Total Hours
					L	T	P	S		
1	Professional Core Course	Revised		Machine Learning for Bioinformatics	2	0	0		**2**	**2**
2	Professional Core Course	Revised		Computer Aided Drug Design	2	0	0		**2**	**2**
3	Professional Core Course	Revised		Machine Learning for Bioinformatics lab	0	0	2		**1**	**2**
4	Professional Core Course	Revised		Computer Aided Drug Design Lab	0	0	2		**1**	**2**
5	Professional Core Course	Revised		Advanced Algorithms for Bioinformatics Lab	0	0	2		**1**	**2**
6	Professional Core Course	New		NGS Data Analysis Lab	0	0	2		**1**	**2**
7	professional Elective			PE-II	3	0	0		**3**	**3**
8	professional Elective			PE-III	3	0	0		**3**	**3**
9	Open Elective			OE-I (HSS)	3	0	0		**3**	**3**
10	Open Elective			OE-II	3	0	0		**3**	**3**
11	Project			Project	0	0	4	2	**2**	**4**
12	Mandatory Course			Soft Skills for Professionals (Audit)	0	1	0		**0**	**1**
13	Mandatory Course			Industrial Training					**Audit**	
				TOTAL					**22**	**29**

Existing SemesterVII

SEMESTER-VII

S. No.	Course Category	Subject Code	Name of the Subjects	Course Hours			Credits	Total Hours
				L	**T**	**P**		
1	Professional Elective		Departmental Elective-I V	3	0	0	3	**3**
2	Open Elective		Open Elective - III	3	0	0	3	3
3	Open Elective		Open Elective - IV	3	0	0	3	3
4	Project	18B19BI791	Major Project Part I	0	0	10	5	10
5	HSS		Indian Constitution	1	0	0	Audit	1
			TOTAL				**14**	**20**

Modified & Approved by Bos SemesteVII

SEMESTER -VII

S. No.	Course Category	New / Revised	Subject Code	Name of the Subjects	Course Hours				Credits	Total Hours
					L	**T**	**P**	**S**		
1	Professional Elective			PE-IV	3	0	0		**3**	**3**
2	Professional Elective			PE-V	3	0	0		**3**	**3**
3	Open Elective			OE-III	3	0	0		**3**	**3**
4	Open Elective			OE-IV	3	0	0		**3**	**3**
5	Project			Project	0	0	8		**4**	**8**
6	Mandatory Course			Indian Constitution	1	0	0		**Audit**	**1**
				TOTAL					**16**	**21**

Existing Semester VIII

SEMESTER-VIII

S. No.	Course Category	Subject Code	Name of the Subjects	Course Hours			Credits	Total Hours
				L	T	P		
1	Professional Elective		Departmental Elective- V	3	0	0	3	**3**
2	Professional Elective		Departmental Elective- VI	3	0	0	3	3
3	Open Elective		Open Elective-V	3	0	0	3	3
4	Project	18B19BI891	Major Project Part II	0	0	14	7	14
			TOTAL				**16**	**23**

Modified & Approved by Bos SemesterVIII

SEMESTER - VIII

S. No.	Course Category	New / Revised	Subject Code	Name of the Subjects	Course Hours				Credits	Total Hours
					L	T	P	S		
1	Professional Elective			PE-VI	3	0	0		**3**	**3**
2	Open Elective			OE-V	3	0	0		**3**	**3**
3	Open Elective			OE-VI	3	0	0		**3**	**3**
4	Project			Project	0	0	8		**4**	**8**
				TOTAL					**13**	**17**
				OR						
				Industrial Internship					**13**	

Agenda Item 3. To consider and approve modification in M.Sc. Biotechnology Course curriculum.

- Dr Anil Kant presented the proposed changes in M.Sc. Biotechnology Course curriculum, for introduction of new modified course Molecular Diagnostics and Forensic Biology 3-0-0 in second semester and dropping of Course Seminar-I, 0-0-1
- Dr Anil Kant explained the rationale of including some topics of Forensic Biology and remaining of course as "Molecular Diagnostics and Forensic Biology". He also presented the detailed syllabus of the modified course.
- Dr TC Bhalla suggested adding electives related to Forensic Sciences in future for some interested students.
- Dr Saurabh suggested that name should be "Molecular Diagnostics and Forensic Sciences". It was clarified by Dr Anil Kant that only few topics of Forensic Biology are being added in the existing course rather than including the topics of forensic science like computational forensics, documentation, application of Physics and Chemistry. So it will be more appropriate to name it "Molecular Diagnostics and Forensic Biology"
- Dr. G.P.S.Raghava enquired about the need of adding content of Forensic Biology. Prof. Sudhir explained that jobs related to Forensic Sciences are on demand and these skills will help in students' progression.
- Dr. Udayabanu proposed two electives Omics Technologies & Data Analysis and Biopharmaceutical Technology in B.Tech Biotechnology VIII Semester
- Prof Sunil Khah suggested changing the name of Seminar-II in 3rd semester now to Seminar only as Seminar -I is dropped now, which was accepted by all the members.
- All the members including Prof TC Bhalla, Dr. GPS Raghav and Mr Aditya Sahni supported the proposal as well as content of the course and the proposal was approved as presented.

Existing Courses in M.Sc Biotechnology II semester
SEMESTER -II

S.No.	New Code	Subject	L-T-P	Credits
1	20MS1BT211	Genetic Engineering	3-0-0	3
2	20MS1BT212	Immunology	3-0-0	3
3	20MS1BT213	Bioinformatics	2-0-0	2
4	20MS1BT214	Genomics and Proteomics	2-0-0	2
5	20MS1BT215	Molecular Diagnostics	2-0-0	2
6	20MS1BT216	Research Methodology and Scientific Communication Skills	2-0-0	2
7		Elective I	2-0-0	2
8	20MS9BT211	Seminar-I	-	1
9	20MS7BT271	Molecular Biology and Genetic Engineering Lab	0-0-8	4
10	20MS7BT272	Immunology Lab	0-0-6	3
		Total	**30**	**24**

Modified & Approved by BoS
M.Sc Biotechnology II semester
SEMESTER -II

S.No.	New Code	Subject	L-T-P	Credits
1	20MS1BT211	Genetic Engineering	3-0-0	3
2	20MS1BT212	Immunology	3-0-0	3
3	20MS1BT213	Bioinformatics	2-0-0	2
4	20MS1BT214	Genomics and Proteomics	2-0-0	2
5	XXXXXXXX	Molecular Diagnostics and Forensic Biology	3-0-0	3
6	20MS1BT216	Research Methodology and Scientific Communication Skills	2-0-0	2
7		Elective I	2-0-0	2
8	20MS7BT271	Molecular Biology and Genetic Engineering Lab	0-0-8	4
9	20MS7BT272	Immunology Lab	0-0-6	3
		Total	**30**	**24**

Existing Courses in M.Sc Biotechnology IIIsemester
SEMESTER -III

S.No.	Code	Subject	L-T-P	Credits
1	20MS1BT311	Bioprocess Engineering and Technology	3-0-0	3
2	20MS1BT312	Emerging Technologies	2-0-0	2
3	20MS9BT313	Review of Classical papers & Project Proposal Presentation	2-0-0	2
4	20MS1BT314	Bioentrepreneurship	2-0-0	2
5	20MS1BT315	Intellectual Property Rights, Biosafety and Bioethics	2-0-0	2
6	22MS1BT311	Food Biotechnology	2-0-0	2
7	20MS9BT311	Seminar-II	-	1
8	20MS7BT371	Bioprocess Engineering and Technology Lab	0-0-8	4
9	20MS7BT372	Bioinformatics Lab	0-0-4	2
10	20MS9BT391	Dissertation	-	4
		Total	**21**	**24**

Modified & Approved by BoS
M.Sc Biotechnology III semester
SEMESTER -III

S.No.	Code	Subject	L-T-P	Credits
1	20MS1BT311	Bioprocess Engineering and Technology	3-0-0	3
2	20MS1BT312	Emerging Technologies	2-0-0	2
3	20MS9BT313	Review of Classical papers & Project Proposal Presentation	2-0-0	2
4	20MS1BT314	Bioentrepreneurship	2-0-0	2
5	20MS1BT315	Intellectual Property Rights, Biosafety and Bioethics	2-0-0	2
6	22MS1BT311	Food Biotechnology	2-0-0	2
7	20MS9BT311	Seminar	0-0-2	1
8	20MS7BT371	Bioprocess Engineering and Technology Lab	0-0-8	4
9	20MS7BT372	Bioinformatics Lab	0-0-4	2
10	20MS9BT391	Dissertation	-	4
		Total	**21**	**24**

Agenda Item 4. To consider and approve modification in M.Sc. Microbiology Course curriculum

- Dr. Rahul Shrivastava presented the proposed changes in M.Sc. Microbiology Course curriculum, for introduction of new course 'Molecular Diagnostics and Forensic Biology' in the Second Semester and dropping of the Course - (21MS1MB312) Diagnostic Microbiology and Vaccines being currently taught in the third semester..

- Dr. Rahul Shrivastava explained the rationale of including some topics of Forensic Biology to the Diagnostics Course, and removal of the Vaccine part which is already covered in the course - (18MS1BT211) Immunology and Immunotechnology.

- Dr. Shrivastava proposed that the new course 'Molecular Diagnostics and Forensic Biology' would be taught to M.Sc. Microbiology and M.Sc. Biotechnology students together in the Second semester of the program, the course (21MS1MB212) Microbial Genetics and Physiology is being shifted to the Third Semester of M.Sc. Microbiology Program to balance the number of credits.

- All the members including Prof TC Bhalla, Dr. GPS Raghav and Mr Aditya Sahni supported the proposal as well as content of the course and the proposal was approved as presented.

Existing Courses in M.Sc Microbiology - II SEMESTER

S.No.	New Code	Subject	L-T-P	Credits
1	18MS1BT211	Immunology and Immunotechnology	3-0-0	3
2	21MS1MB211	Enzymes and Bioprocess Technology	3-0-0	3
3	21MS1MB212	Microbial Genetics and Physiology	3-0-0	3
4	18MS1BT313	Recombinant DNA Technology	3-0-0	3
5	20MS1BT213	Bioinformatics	2-0-0	2
6	18MS7BT211	Immunology and Immunotechnology Lab	0-0-2	1
7	21MS7MB271	Enzymes and Bioprocess Technology Lab	0-0-2	1
8	18MS7BI214	Basic Bioinformatics Lab	0-0-2	1
9	18MS7BT373	Recombinant DNA Technology lab	0-0-4	2
10	18MS9BI211	Masters Research Review seminar	0-0-2	1
		Total	**26**	**20**

Existing Courses in M.Sc Microbiology - III SEMESTER

S.No.	Code	Subject	L-T-P	Credits
1	21MS1MB311	Environmental Microbiology	3-0-0	3
2	21MS1MB312	Diagnostic Microbiology and vaccines	3-0-0	3
3		Elective-I	3-0-0	3
4	21MS9MB311	Master's Dissertation & Thesis Part-I	0-0-16	8
		Total	**25**	**17**

Modified & Approved by BoS

Modified Courses in M.Sc Microbiology - II SEMESTER

S.No.	New Code	Subject	L-T-P	Credits
1	18MS1BT211	Immunology and Immunotechnology	3-0-0	3
2	21MS1MB211	Enzymes and Bioprocess Technology	3-0-0	3
3	XXXXXXXX	Molecular Diagnostics and Forensic Biology	3-0-0	3
4	18MS1BT313	Recombinant DNA Technology	3-0-0	3
5	20MS1BT213	Bioinformatics	2-0-0	2
6	18MS7BT211	Immunology and Immunotechnology Lab	0-0-2	1
7	21MS7MB271	Enzymes and Bioprocess Technology Lab	0-0-2	1
8	18MS7BI214	Basic Bioinformatics Lab	0-0-2	1
9	18MS7BT373	Recombinant DNA Technology lab	0-0-4	2
10	18MS9BI211	Masters Research Review seminar	0-0-2	1
		Total	**26**	**20**

Modified Courses in M.Sc Microbiology - IIIrd SEMESTER

S.No.	Code	Subject	L-T-P	Credits
1	21MS1MB311	Environmental Microbiology	3-0-0	3
2	21MS1MB212	Microbial Genetics and Physiology	3-0-0	3
3		Elective-I	3-0-0	3
4	21MS9MB311	Master's Dissertation &Thesis Part-I	0-0-16	8
		Total	**25**	**17**

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY

(Established by H.P. State Legislature vide Act No. 14 of 2002)

ATTENDANCE SHEET: BoS meeting of Deptt of Biotechnology and Bioinformatics held on 17.06.2024

Name and Designation		Signature or consent by email
Prof. Sudhir Kumar, HOD, Department of BT and BI	Chairman	17/06/2024
Dr. Anil Kant, Associate Prof, Deptt of BT and BI	Member Secretary	17/6/2024
Prof. T.C. Bhalla Ex, Professor Emeritus Department of Biotechnology HPU Shimla	External Member BoS	Consent via Email
Prof. G .P. S. Raghava, Prof and Head, Deptt of Computational Biology, IIIT-Dehli, (External Member BoS)	External Member BoS	Consent via Email
Dr Jata Shankar, Professor, Deptt of BT and BI	Member	17/6/2024
Prof. Sunil Kunmar Khatri, Incharge IQAC, JUIT	Member	17.6.2024
Dr Tiratha Raj Singh, Professor, Deptt of BT and BI	Member	17/06/24
Dr Udaybanu M, Associate Prof, Deptt of BT and BI	Member	17/6/24
Dr Poonam Sharma, Associate Prof, Deptt of BT and BI	Member	17/6/24
Dr Jiendra Vashistt, Associate Prof, Deptt of BT and BI	Member	
Mr. Aditya Sahni, JUIT Alumni, Founder of ELEM, India (JUIT alumni Member BoS)	External Member-3 (Alumni)	Consent via Email

Dr. Rahul Shrivastava — Member
Dept. of BT & BI

17/6/24

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Dr Hemant, Associate Prof, Deptt of BT and BI	Member	17/6/24
HOD, Deptt of ECE	Member	17/6/2024
HOD, Deptt of Physics and Material Science	Member	17.6.2024
Dr Saurabh Bansal,Associate Prof, Deptt of BT and BI	Member	17/06/2024
Dr V. Garlapati,Associate Prof, Deptt of BT and BI	Member	17/06/24
Dr Ashok Nadda, Assistant Prof. Deptt of BT and BI	Member	17.6.24
HOD, Deptt. of Civil Engineering	Member	17.6.24

26/06/2024

Dr. Anil Kant Associate Professor
Member Secretary, BoS
Department of Biotechnology
JUIT Waknaghat

21/06/2024

Prof. Sudhir Kumar
Chairman BoS, HOD Department of Biotechnology, JUIT Waknaghat

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Ref.:**JUIT/CED/2022-23/31** Date: 20-06-2023

Department of Civil Engineering

A meeting of Board of Studies (BoS) of the **Department of Civil Engineering** was held as per the following schedule :

Meeting Name:	Board of Studies –Department of Civil Engineering		
Date of Meeting:	15-06-2023	**Time:**	3:00 PM
Chairman:	Dr. Ashish Kumar	**Location:**	online

1. Meeting Objective:
Board of Studies (BoS) meeting

2(a). Meeting Attendees: The following members were present	
Prof. Ashish Kumar (Professor & HOD, CE)	Chairman
Dr. Amardeep (Assistant Professor, CE, JUIT)	Member Secretary / Coordinator
Prof. Ashok Kumar Gupta (Professor, CE, Dean (Academics & Research), JUIT)	Member-1
Dr. Hemant Sood (Associate Professor, BT &BI, JUIT)	Member-2
Dr. Saurabh Rawat (Associate Professor, CE, JUIT)	Member-3
Prof. Sunil Kumar Khah (Professor, PMS, JUIT)	Member-4 (IQAC Representative, JUIT)
Prof. B.R. Gurjar (Director, NITTTR Chandigarh)	External Member-1 (Academic)
Prof. Arun Goel (Professor & HOD, CE, NIT Kurukshetra)	External Member-2 (Academic)
Er. Rijul Bajaj (Asst. Manager, L&T, Gurugram)	External Member-3 (Industry/R&D)
Er. Kapil Dutt Sharma (Sr. Manager-Civil, HPPCL, HP)	External Member-4 (Alumni)
Prof. Rajiv Kumar (Professor & HOD, ECE, JUIT)	Co-opted member-1
Prof. Vivek Sehgal (Professor & HOD,CS&IT, JUIT)	Co-opted member-2
Prof. P B Barman (Professor & HOD, PMS, JUIT)	Co-opted member-3

Prof. R K Bajaj (Professor & HOD, Mathematics, JUIT)	Co-opted member-4
Dr. Amit Srivastava (Associate Professor & HOD, HSS, JUIT)	Co-opted member-5
Dr. Anil Kant (Representative, HOD, BT&BI, JUIT)	Co-opted member-6
Dr. Sugandha Singh (Assistant Professor, CE, JUIT)	Special Invitee
2(b). Leave of Absence: The following members were granted leave of absence by the Chairman, BOS	
Dr. Ashish Dhamaniya (Associate Professor, CE, SVNIT, Surat	Special Invitee

The Chairman welcomed all the members who were present for the meeting. The meeting was thereafter deliberated by Chairman on agenda items.

3. Action Items / Instructions: Following decisions were taken/approved by the members of BoS.

Item No. 1 : To approve the minutes of the last meeting of the BoS held on 21-05-2022.

No objection was received from any BoS member for the earlier BoS held on 21-05-2022 therefore all the items proposed were considered to be approved.

Item No. 2 : To consider and approve the minor revision in the course structure of BTech in Civil Engineering.

The following changes in the course structure of BTech in Civil Engineering were discussed and approved.

Proposed Change -1
Existing Structure
Semester 3rd

S. No.	Category Code	Subject Code	Name of the Subjects	Course Hours			Credits	Total Hours
				L	**T**	**P**		
1	Professional Core Courses	18B11CE314	Water Supply Engineering	3	0	0	3	3
2	Professional Core Courses	18B17CE373	Concrete Technology Lab	3	0	0	3	3

Approved by BoS
Semester -4th

S. No.	Category Code	Subject Code	Name of the Subjects	Course Hours			Credits	Total Hours
				L	**T**	**P**		
1	Professional Core Courses		Water Supply Engineering	3	0	0	3	3
2	Professional Core Courses		Concrete Technology Lab	3	0	0	3	3

Proposed Change -2

Existing Structure
Semester 4th

S. No.	Category Code	Subject Code	Name of the Subjects	Course Hours			Credits	Total Hours
				L	**T**	**P**		
1	Professional Core Courses	18B11CE412	Fluid Mechanics	3	0	0	3	3
2	Professional Core Courses	18B17CE472	Fluid Mechanics Lab	3	0	0	3	3

Approved by BoS
Semester - 3rd

S. No.	Category Code	Subject Code	Name of the Subjects	Course Hours			Credits	Total Hours
				L	**T**	**P**		
1	Professional Core Courses		Fluid Mechanics	3	0	0	3	3
2	Professional Core Courses		Fluid Mechanics Lab	3	0	0	3	3

Proposed Change -3

Existing Structure
Semester 4th

S. No.	Category Code	Subject Code	Name of the Subjects	Course Hours			Credits	Total Hours
				L	**T**	**P**		
1	Professional Core Courses	18B11CE414	Water Resources Engineering	3	0	0	3	3

Approved by BoS
Semester - 6th

S. No.	Category Code	Subject Code	Name of the Subjects	Course Hours			Credits	Total Hours
				L	**T**	**P**		
1	Professional Core Courses		Water Resources Engineering	3	0	0	**3**	**3**

Proposed Change -4

Existing Structure
Semester 6th

S. No.	Category Code	Subject Code	Name of the Subjects	Course Hours			Credits	Total Hours
				L	**T**	**P**		
1	Professional Core Courses	18B11CE611	Concrete Technology	3	0	0	3	3

Approved by BoS
Semester - 4th

S. No.	Category Code	Subject Code	Name of the Subjects	Course Hours			Credits	Total Hours
				L	**T**	**P**		
1	Professional Core Courses		Concrete Technology	3	0	0	**3**	**3**

The revised course structure is attached as Annexure 1.

Item No. 3 : To consider and approve the minor revision in the course syllabus of Building Materials and Construction (18B11CE313), Fluid Mechanics (18B11CE412), Surveying

(18B11CE312), Water Resources Engineering (18B11CE414) and Design of Steel Structures (18 B11CE612).

The revised syllabus of the subjects was discussed in the meeting and the same was approved by the members after the discussion. The revised syllabus is attached as Annexure 2.

Item No. 4 : To consider and approve the addition of a new Professional elective (Geoinformatics; 3-0-0-3) for BTech Civil Engineering.

Prof. Ashish Kumar and Mr. Akash Bhardwaj suggested to add a Professional elective titled as "Geoinformatics" due to its importance for the students of Civil Engineering Department.

Prof. Arun Goel and Prof. Sunil Kumar Khah suggested to remove some topics/portions of the syllabus in order to cover the entire syllabus within a given time period. After discussion, the syllabus of the proposed course was revised as per the suggestion of the BOS committee members and the same was approved. The subject is added in the 5th semester as Elective1.

Proposed Change

Existing Structure
Semester 5th Elective 1 (Bucket)

S. No.	Category Code	Subject Code	Name of the Subjects	Course Hours			Credits	Total Hours
				L	**T**	**P**		
1	Professional Elective	18B1WCE531	Construction Technology and Management	3	0	0	3	3
2	Professional Elective	18B1WCE532	Solid Waste Management	3	0	0	3	3
3	Professional Elective	18B1WCE533	Air and Noise Pollution and Control	3	0	0	3	3

Approved by BoS
Semester - 5th Elective 1 (Bucket)

S. No.	Category Code	Subject Code	Name of the Subjects	Course Hours			Credits	Total Hours
				L	**T**	**P**		
1	Professional Elective	18B1WCE531	Construction Technology and Management	3	0	0	3	3
2	Professional Elective	18B1WCE532	Solid Waste Management	3	0	0	3	3
3	Professional Elective	18B1WCE533	Air and Noise Pollution and Control	3	0	0	3	3
4	Professional Elective	Newly proposed	Geoinformatics	3	0	0	3	3

The syllabus of the proposed course Geoinformatics is attached as Annexure 3.

The meeting ended with a vote of thanks.

ATTACH SIGNED ATTENDANCE SHEET

Member-1 Member-2 Member-3

Approved / Not Approved

Vice Chancellor

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY
WAKNAGHAT, P.O. – WAKNAGHAT,
TEHSIL – KANDAGHAT, DISTRICT – SOLAN (H.P.)
PIN – 173234 (INDIA) Phone Number- +91-1792-257999
(Established by H.P. State Legislature vide Act No. 14 of 2002)

Department of Electronics and Communication Engineering

JUIT Waknaghat

A meeting of Board of Studies of the Department of Electronics and Communication Engineering was held on 14-06-2024 at 11:00 AM in Board Room.

The following members were present

1.	Prof. Rajiv Kumar	Chairman
2.	Prof. D. Ghosh	External Member
3.	Dr. Balwinder Singh	External Member
4.	Mr. Sanjay Kumar Singh	External Member
5.	Prof. Shruti Jain	Member
6.	Prof. Vineet Sharma	Member
7.	Prof. R.S. Raja Durai	Member
8.	Dr. Harsh Sohal	Member
9.	Dr. Emjee Puthooran	Member
10.	Dr. Naveen Jaglan	Member
11.	Dr. Salman Raju Talluri	Member
12.	Dr. Vikas Baghel	Co-opted member
13.	Dr. Shweta Pandit	Co-opted member
14.	Dr. Alok Kumar	ECE Department
15.	Mr. Pardeep Garg	ECE Department
16.	Mr. Munish Sood	ECE Department
17.	Prof. P.B. Barman	HoD, Physics and Material Science
18.	Mr. Kamlesh Shrivastava	Co-opted Member for online issue

The Chairman welcomed all the members who were present for the meeting. With the permission of the Chairman, Prof. D. Ghosh and Mr. Sanjay Kumar Singh have joined online. The meeting was thereafter deliberated by Dr. Shweta Pandit on agenda items as had been approved by the Chairman.

Item No. 1: **To approve the minutes of last meeting of the BoS held on Nov. 18, 2021.**

Dr. Shweta Pandit has presented the last minutes of meeting.

Approved as presented.

Item No. 2: **To approve the following two new Bachelor Degree Programs in the Department of Electronics and Communication Engineering in its UG Program starting from the academic session 2024-2025**

1. **Electronics and Computer Science (ECS)**

2. **Electronics Engineering (VLSI Design and Technology)**

Chairman Prof. Rajiv Kumar presented the proposal of introduction of two new undergraduate programs in the department:

1. Electronics and Computer Science (ECS)
2. Electronics Engineering (VLSI Design and Technology)

Dr. Balwinder Singh supported the initiation of a VLSI-related degree program, citing the GoI initiates and increasing demand for this field in the near future. Dr. Balwinder Singh inquired about the current status of the Electronics and Computer Engineering (ECM) program. Prof. Rajiv Kumar informed the members that the ECM program students have completed their 6th semester and this is the only batch currently enrolled in this degree program. The new ECS and VLSI programs are proposed to commence from the academic session 2024-25. Prof. P.B. Barman asked about the further clarification of this point that whether the proposed ECS course is a renaming of the existing ECM course or a completely new program. Prof. Rajiv Kumar clarified that the ECS program is a completely new degree program. Prof. P.B. Barman and Prof. Vineet Sharma suggested that the discontinuation of the ECM program should be formally proposed as an agenda item, potentially after the graduation of current ECM students.

During the discussion on the second proposed degree program, the question was raised by Prof. Vineet Sharma and Prof. P.B. Barman whether the degree is a specialization degree in ECE? If not so, it may be titled "VLSI Design and Technology" rather than Electronics Engineering (VLSI Design and Technology). In response to this point, the department's Board of Studies members mentioned that the proposed degree program is a full degree program and not specialization. It also aligns with the AICTE model curriculum, which has been reviewed by the department's curriculum committee. The AICTE model curriculum of Electrics Engineering (VLSI Design and Technology) degree program was also shared with the meeting attendees by Mr. Sanjay Kumar Singh.

Prof. Balwinder Singh further added that for some government competitive examinations, candidates must demonstrate the equivalency of their degree with a core branch. Having "Electronics" included in the degree title would prevent potential rejections in such examinations.

After thorough deliberation, the proposed two new undergraduate degree programs were **approved**.

Item No. 3: **To consider the review, assessment and approval of the modifications carried out in the course curriculum of Electronics and Communication Engineering (ECE) for the batch starting from the session 2024-2025**

Dr. Shweta Pandit informed the members that the department has restructured the ECE curriculum in accordance with new guidelines from higher authorities. Dr. Salman Raju Talluri was invited to present the proposed ECE curriculum. The proposed ECE semester-wise curriculum is attached in ***Annexure I.*** Dr. Salman Raju Talluri explained that the first two semesters are common for all university students. There was discussion regarding the implementation of project components in each semester. Since the semester-wise project activities yet to be finalized in consultation with other core departments of university, it was decided to work out on it first at the department and seek approval in the next Board of Studies meeting. Prof. Balwinder Singh emphasized that project should be more relevant to the branch. He also expressed concerns about the feasibility of a single department managing projects for all university students in a semester.

After thorough discussion, it was decided to eliminate one credit Verilog HDL Lab from 3rd semester of ECE curriculum. Prof. Vineet Sharma supported the addition of a Verilog-related course for CSE students, potentially as an open elective, to provide them with an understanding of VLSI concepts.

It was decided to add tutorial of Electromagnetic Waves along with lecture in the 5th semester of ECE curriculum. Prof. Barman highlighted that increasing credits beyond 162 in a degree program could impose an undue burden on students. Additionally, Prof. Barman emphasized the importance of capping the total weekly hours at 30 to ensure a manageable workload for students. The suggestion to incorporate the Material Sciences subject in the curriculum of ECE by Prof. Barman was proposed. After careful consideration and reviewing the credit restrictions for basic sciences courses, the decision was made to include the Probability, Statistics, and Stochastic Processes course in the ECE curriculum under the basic sciences category, as initially planned due to necessity of this course for an ECE engineer. Simultaneously, the Semiconductor Physics course was decided to be incorporated into the Electronics Engineering (VLSI Design and Technology) degree program, replacing the Probability, Statistics, and Stochastic Processes course in the third semester of this proposed second degree program.

Embedded Systems Course and its lab were decided to be replaced with Antenna Theory and Wave Propagation subject and its lab in the 6th Semester of the proposed ECE curriculum. This decision was influenced by the inclusion of the Microprocessor and Microcontrollers subject in the 5th semester, which is expected to cover the basics of embedded systems. Embedded system subject was suggested to be included in the professional electives, covering advanced topics like ARM processors etc.

After presenting the semester wise course structure by Dr. Salman Raju Talluri, the tentative list of professional electives and open electives were presented. It was intimated that the list is still under preparation and will be put in next BoS. External department members of BoS suggested the inclusion of robotics and drone courses in the open electives.

After thorough discussion, the final semester-wise changes suggested are as follows:
From Semster-3, Verilog HDL Lab is dropped.

In Semester-5, Electromagnetic Waves subject tutorial is added.

In Semester-6, Embedded Systems theory course and its Lab is replaced with Antenna Theory and Wave Propagation subject and its Lab.

These changes are **approved** and the updated curriculum with the asked changes is attached as ***Annexure II*** with highlighted changes**.**

Item No. 4: **To consider the approval of the new course curriculum scheme of Electronics and Computer Science (ECS) for the batch starting from the session 2024-2025**

Dr. Shweta Pandit presented the next agenda item with the consent of Chairman to approve the new course curriculum scheme of Electronics and Computer Science (ECS) degree starting from the session 2024-2025. Dr. Vikas Baghel was invited to present the proposed ECS curriculum. The proposed ECS semester-wise curriculum is attached in ***Annexure III***. It was informed by Dr. Vikas Baghel that he has made the structure with reference to the proposed ECE curriculum in *Item No. 3* and CSE department's recently proposed curriculum. He mentioned inclusion of nearly equal distribution of courses, from ECE and CSE, reflecting the interdisciplinary nature of this branch, which incorporate the portions from both fields. There was discussion on addition of Python subject in the proposed ECS curriculum and was decided to put this course in Profession Electives bucket. The external members have asked for the list of professional and open electives for ECS course. It was intimated to them that the list is still under preparation and will be put in next BoS. It was the suggestion of all the external expert BoS members to put course on cyber security, cloud etc. in electives. It was communicated to the members that once the electives list is finalized by the ECE and CSE branches, the plan is to select a few courses from those lists for the ECS elective offerings. There was no change suggested in the proposed ECS curriculum attached as ***Annexure III*** and is **approved** in its current form.

Item No. 5: **To consider the approval of the new course curriculum scheme of Electronics Engineering (VLSI Design and Technology) for the batch starting from the session 2024-2025**

Dr. Shweta Pandit presented the next agenda item with the consent of Chairman to approve the new course curriculum scheme of Electronics Engineering (VLSI Design and Technology) degree starting from the session 2024-2025. Dr. Harsh Sohal was invited to present the proposed degree program curriculum. The proposed Electronics Engineering (VLSI Design and Technology) semester-wise curriculum is attached in ***Annexure IV***. It was recommended to remove the Verilog HDL lab from the 3rd semester, aligning with suggestions made during the finalization of the ECE curriculum. There is proposal to rename the "FPGA based System Design" course in the 4th semester to "FPGA Design using Verilog" and to schedule its lab with the same name in the 4th semester. All members agreed to this proposal. Semiconductor Physics course was proposed to be incorporated in the third semester by replacing Probability, Statistics and Stochastic Processes course. It was discussed that knowledge of different materials used is design, fabrication, and performance optimization of integrated circuits is required for a VLSI engineer. A list of few electives was suggested by Dr. Balwinder Singh. He suggested to include courses like DSP for VLSI, Sensors and MEMS design, Packaging and Reliability, Hardware security, AI for VLSI circuits, VLSI for biomedical applications, RF circuits in electives.

After thorough discussion, the final semester-wise changes suggested are as follows:
From Semster-3, Verilog HDL Lab is dropped.

In Semester-3, Probability, Statistics and Stochastic Processes course is replaced with Semiconductor Physics Course.

In Semester-4, the course name FPGA based System Design is renamed as FPGA Design using Verilog.

In Semester-4, FPGA Design using Verilog Lab is included.

These changes are **approved** and the updated curriculum with the asked changes is attached as ***Annexure V*** with highlighted changes.

Item No. 6: **Any other with permission of the Chair.**

Prof. Shruti Jain requested suggestions from the external members to improve admissions and placements in the ECE department. In response, Dr. Balwinder Singh emphasized the importance of providing students with more practical exposure to laboratories, software, and industry. He invited the department students for an industrial visit to SCL, Mohali.
Mr. Sanjay Singh, an ECE alumnus of JUIT offered to organize online meetings between students and professionals at TSMC (Taiwan Semiconductor Manufacturing Company).
Both Mr. Sanjay Kumar and Dr. Balwinder Singh suggested inviting guest faculty from the industry to collaborate on courses. They recommended involving industry professionals to teach two to three chapters of selected courses, which would add significant value. Dr. Balwinder proposed to prepare a plan for industry experts to teach some VLSI electives. He also advised to seek consultancy projects from external agencies and suggested to organize workshops on project proposal writing. He informed the faculty about his ongoing projects with different agencies. Furthermore, he recommended reducing the load on research faculty and establishing a Center of Excellence for packaging and testing.
Department faculty thanked external members for their suggestions.

Prof. Rajiv Kumar concluded the meeting at 1:45PM with vote of thanks to all the curriculum committee members Dr. Harsh Sohal, Dr. Emjee Puthooran, Dr. Salman Raju Talluri, Dr. Vikas Baghel, and Dr. Shweta Pandit for finalizing the proposal of different programs and planning of the BoS meeting. He also thanked Dr. Balwinder Singh, Prof. D. Ghosh, and Mr. Sanjay Kumar Singh and all the BoS members for their suggestions.

Dr. Shweta Pandit
(BoS Coordinator)

Prof. Rajiv Kumar
(Chairman, HoD ECE)

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY
(Established by H.P. State Legislature vide Act No. 14 of 2002)

JAYPEE
IGNITED MINDS INSPIRED SOULS

Attendance Sheet of BoS held on 14.6.24

(Dr. Balwinder Singh)

(Prof. Debasshish Ghosh)

14/06/2024

(Mr. Sanjay Kumar Singh)

17/06/2024

(Prof. Rajiv Kumar)

14/6/24

(Prof. Shruti Jain)

14/06/2024

(Prof. Vineet Sharma,
Prof, Dept. of PMS, IQAC representative)

R.S. Raja (14.06.2024)

(Prof. R S Raja Kumai,
Prof., Dept. of Mathematics)

14/06/2024

(Dr. Harsh Sohal)

19/6/2024.

(Dr. Emjee Puthooran)

14/6/2024

(Dr. Naveen Jaglan)

(Dr. Salman Raju Talluri) 14/6/2024

14/6/24

(Dr. Vikas Baghel)

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY
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Attendance Sheet of BoS held on 14.6.24

(Dr. Shweta Pandit)

(Dr. Pardeep Garg)

(Dr. Alok Kumar)

(Mr. Munish Sood)

(Prof. P.B. Barman)

Annexure I

Proposed Electronics and Communication Engineering (ECE) Degree Curriculum presented in BoS Meeting held on 14 June, 2024

PROPOSED CATEGORY & SEMESTER WISE CREDIT DISTRIBUTION (FINALIZED)ECED

CATEGORY / SEM	HSS	BASIC SC.	ENGG. SC.	PROF. CORE	PROF. ELECTIVE	OPEN ELECTIVE	PROJECT	TOTAL Credits (Hours)
1 SEM	3	9	5.5				1	18.5(24)
2 SEM	3	8	11.5				1	23.5(31)
3 SEM	3	3	4	11			1	22(27)
4 SEM	3		2	18			1	24(28)
5 SEM	3			13	3		2	21(26)
6 SEM				8	6	6	2	22(27)
7 SEM				3	6	6	4	19(24)
8 SEM					3	6	4	13(17)
Total	**15**	**20**	**23**	**53**	**18**	**18**	**16**	**163 (204)**

Basic Sc. – Mathematics, Physics & Chemistry.
Engg. Sc. – Engg. Courses offered by one particular department and mandatory to all students irrespective to department.
Note:- Only Credits have been defined under the category / semester. However, No. of Courses in each department should be kept Uniform. If deemed fit, liberty of introduction of Theory Courses / Lab courses within the specified credit limit should be given to the departments.

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, SOLAN

Course Structure of BTech in Electronics and Communications Engineering

(TOTAL CREDITS - 163) – APPLICABLE FROM- 2024 ADMISSION BATCH

SEMESTER - 1

S. No.	Course Category	R/N	Subject Code	Name of the Subjects	Course Hours			Credits	Total Hours
					L	T	P		
1	HSMC			English	2	0	0	2	2
2	HSMC			English Lab	0	0	2	1	2
3	BSC			Engineering Mathematics-I	3	1	0	4	4
4	BSC			Engineering Physics-I	3	1	0	4	4
5	BSC			Engineering Physics Lab-I	0	0	2	1	2
6	ESC			Engineering Graphics/Workshop Practices	0	0	3	1.5	3
7	ESC			Problem Solving and Programming	3	0	0	3	3
8	ESC			Problem Solving and Programming Lab	0	0	2	1	2
9	PR			Project-I BSC	0	0	2	1	2
10	MNC			UHV-I Mandatory Induction Program	2 Weeks			0	
				TOTAL				**18.5**	**24**

	Credits	Hours
HSMC	3	4
BSC	9	10
ESC	5.5	8
PCC		
PEC		
OEC		
PR	1	2
Total	18.5	24

SEMESTER - 2									
S. No.	**Course Category**	**R/N**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
					L	**T**	**P**		
1	HSMC			Universal Human Values- II: Understanding Harmony	2	1	0	3	**3**
2	BSC			Engineering Mathematics-II	3	1	0	4	4
3	BSC			Engineering Physics-II	3	0	0	3	3
4	BSC			Engineering Physics-II Lab	0	0	2	1	2
5	ESC	N		Electrical Engineering/Basic Electrical Engineering(BT an	3	1	0	4	4
6	ESC	N		Electrical Engineering Lab/Basic Electrical Engineering Lab(BT and BI)	0	0	2	1	2
7	ESC			Workshop Practices/Engineering Graphics	0	0	3	1.5	3
8	ESC			Data Structures and Algorithms	3	0	0	3	3
9	ESC			Data Structures and Algorithms Lab	0	0	4	2	4
10	PR			Project-II BI/BT	0	0	2	1	2
11	HSMC			Professional Communication Practice (AUDIT)	0	1	0	0	1
				TOTAL				**23.5**	**31**

	Credits	Hours
HSMC	3	4
BSC	8	9
ESC	11.5	16
PCC		
PEC		
OEC		
PR	1	2
Total	23.5	31

Summer Term

Exit option with UG certificate of Level 5 on successful completion of 40 credits from 2 semesters and additional 6 credits from an Internship or Skill-based courses in the summer term.

SEMESTER - 3									
S. No.	**Course Category**	**R/N**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
					L	**T**	**P**		
1	HSMC			Life Skills and Interpersonal Dynamics	2	1	0	3	**3**
2	BSC			Probability, Statistics and Stochastic Processes	3	0	0	3	3
3	ESC	N		Digital System Design	3	0	0	3	3
4	ESC	N		Digital System Design Lab	0	0	2	1	2
5	PCC	N		Electronic Devices	3	1	0	4	4
6	PCC	N		Electronic Devices Lab	0	0	2	1	2
7	PCC	N		Signals and Systems	3	1	0	4	4
8	PCC	N		Signals and Systems Lab	0	0	2	1	2
9	PCC	N		Verilog HDL Lab	0	0	2	1	2
10	PR			Project-III ESC	0	0	2	1	2
				TOTAL				**22**	**27**

	Credits	Hours
HSMC	3	3
BSC	3	3
ESC	4	5
PCC	11	14
PEC		
OEC		
PR	1	2
Total	22	27

SEMESTER - 4									
S. No.	**Course Category**	**R/N**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
					L	**T**	**P**		
1	HSMC			Finance and Accounts	3	0	0	3	**3**
2	ESC			Environmental Studies	2	0	0	2	**2**
3	PCC	N		Analog Circuits	3	1	0	4	4
4	PCC	N		Analog Circuits Lab	0	0	2	1	2
5	PCC	N		Control Systems	3	1	0	4	4
6	PCC	R		Analog and Digital Communication	3	1	0	4	4
7	PCC	R		Analog and Digital Communication Lab	0	0	2	1	2
8	PCC	R		Microprocessors and Microcontrollers	3	0	0	3	3
9	PCC	R		Microprocessors and Microcontrollers Lab	0	0	2	1	2
10	PR			Project-IV	0	0	2	1	2
				TOTAL				**24**	**28**

	Credits	Hours
HSMC	3	3
BSC		
ESC	2	2
PCC	18	21
PEC		
OEC		
PR	1	2
Total	24	28

Summer Term
Exit option with UG Diploma of Level 6 on successful completion of 80 credits from 4 semesters and additional 6 credits from an Internship or Skill-based courses in the summer term.

SEMESTER - 5									
S. No.	**Course Category**	**R/N**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
					L	**T**	**P**		
1	HSMC			PR Management and Entrepreneurship	3	0	0	3	**3**
2	PCC	R		Electromagnetic Waves	3	0	0	3	3
3	PCC	N		Electromagnetic Waves Lab	0	0	2	1	2
4	PCC	R		Digital Signal Processing	3	0	0	3	3
5	PCC	R		Digital Signal Processing Lab	0	0	2	1	2
6	PCC	R		VLSI Design	3	1	0	4	4
7	PCC	N		VLSI Design Lab	0	0	2	1	2
8	PEC			PE-I	3	0	0	3	3
9	PR			Project-V	0	0	4	2	4
				TOTAL				**21**	**26**

	Credits	Hours
HSMC	3	3
BSC		
ESC		
PCC	13	16
PEC	3	3
OEC		
PR	2	4
Total	21	26

SEMESTER - 6									
S. No.	**Course Category**	**R/N**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
					L	**T**	**P**		
1	PCC	N		Embedded Systems	3	0	0	3	**3**
2	PCC	N		Embedded Systems Lab	0	0	2	1	**2**
3	PCC	R		Wireless and Data Communication	3	0	0	3	3
4	PCC	N		Wireless and Data Communication Lab	0	0	2	1	2
5	PEC			PE-II	3	0	0	3	**3**
6	PEC			PE-III	3	0	0	3	3
7	OEC			OE-I - SE	3	0	0	3	3
8	OEC			OE-II - HSS	3	0	0	3	3
9	PR			Project-VI	0	0	4	2	4
10	MNC			Soft Skills for Professionals	0	1	0	0	1
				TOTAL				**22**	**27**

	Credits	Hours
HSMC	0	1
BSC		
ESC		
PCC	8	10
PEC	6	6
OEC	6	6
PR	2	4
Total	22	27

Summer Term

Exit option with B.Sc. of Level 7 on successful completion of 120 credits from 6 semesters and additional 6 credits from an Internship or Skill-based courses in the summer term.

SEMESTER - 7									
S. No.	**Course Category**	**R/N**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
					L	**T**	**P**		
1	PCC	**N**		Computer Architecture	3	0	0	3	3
2	PEC			PE-IV	3	0	0	3	**3**
3	PEC			PE-V	3	0	0	3	**3**
4	OEC			OE-III	3	0	0	3	3
5	OEC			OE-IV	3	0	0	3	3
6	PR			Project-VII	0	0	8	4	8
7	HSMC			Indian Constitution	1	0	0	Audit	1
				TOTAL				**19**	**24**

	Credits	Hours
HSMC	0	1
BSC		
ESC		
PCC	3	3
PEC	6	6
OEC	6	6
PR	4	8
Total	19	24

SEMESTER - 8									
S. No.	**Course Category**	**R/N**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
	Option-1				**L**	**T**	**P**		
1	PEC			PE-VI	3	0	0	3	**3**
2	OEC			OE-V	3	0	0	3	3
3	OEC			OE-VI	3	0	0	3	3
4	PR			Project-VIII	0	0	8	4	8
				TOTAL				**13**	**17**
	OR								
	Option-2				**L**	**T**	**P**		
1	PR			**Industrial Internship**				11	
				TOTAL				**11**	
	OR								
	Option-3				**L**	**T**	**P**		
1	PEC			PE-VI	3	0	0	3	**3**
2	OEC			OE-V	3	0	0	3	3
3	OEC			OE-VI	3	0	0	3	3
4	INT			Industrial	0	0	8	4	8
				TOTAL				**13**	**17**

	Credits	Hours
HSMC		
BSC		
ESC		
PCC		
PEC	3	3
OEC	6	6
PR	4	8
Total	13	17

COURSE CATEGORY-WISE CREDIT BREAKUP			
		Total Credits	**Total Hours**
Humanities & Social Sciences	HSMC	15	19
Basic Science	BSC	20	22
Engineering Science	ESC	23	31
Professional Core	PCC	53	64
Professional Elective	PEC	18	18
Open Elective	OEC	18	18
Project	PR	16	32
TOTAL		**163**	**204**

Annexure II

Modified Electronics and Communication Engineering (ECE) Degree Curriculum as per suggestions during BoS Meeting

PROPOSED CATEGORY & SEMESTER WISE CREDIT DISTRIBUTION (FINALIZED)ECED

CATEGORY / SEM	HSS	BASIC SC.	ENGG. SC.	PROF. CORE	PROF. ELECTIVE	OPEN ELECTIVE	PROJECT	TOTAL Credits (Hours)
1 SEM	3	9	5.5				1	18.5(24)
2 SEM	3	8	11.5				1	23.5(31)
3 SEM	3	3	4	10			1	21(25)
4 SEM	3		2	18			1	24(28)
5 SEM	3			13	3		2	22(27)
6 SEM				8	6	6	2	22(27)
7 SEM				3	6	6	4	19(24)
8 SEM					3	6	4	13(17)
Total	**15**	**20**	**23**	**53**	**18**	**18**	**16**	**163 (203)**

Basic Sc. – Mathematics, Physics & Chemistry.
Engg. Sc. – Engg. Courses offered by one particular department and mandatory to all students irrespective to department.
Note:- Only Credits have been defined under the category / semester. However, No. of Courses in each department should be kept Uniform. If deemed fit, liberty of introduction of Theory Courses / Lab courses within the specified credit limit should be given to the departments.

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Course Structure of BTech in Electronics and Communications Engineering

(TOTAL CREDITS - 168) – APPLICABLE FROM- 2024 ADMISSION BATCH

SEMESTER - 1

S. No.	Course Category	R/N	Subject Code	Name of the Subjects	Course Hours			Credits	Total Hours
					L	T	P		
1	HSMC			English	2	0	0	**2**	2
2	HSMC			English Lab	0	0	2	**1**	2
3	BSC			Engineering Mathematics-I	3	1	0	**4**	4
4	BSC			Engineering Physics-I	3	1	0	**4**	4
5	BSC			Engineering Physics Lab-I	0	0	2	**1**	2
6	ESC			Engineering Graphics/Workshop Practices	0	0	3	**1.5**	3
7	ESC			Problem Solving and Programming	3	0	0	**3**	3
8	ESC			Problem Solving and Programming Lab	0	0	2	**1**	2
9	PR			Project-I BSC	0	0	2	**1**	2
10	MNC			UHV-I Mandatory Induction Program	2 Weeks			**0**	
				TOTAL				**18.5**	**24**

	Credits	Hours
HSMC	3	4
BSC	9	10
ESC	5.5	8
PCC		
PEC		
OEC		
PR	1	2
Total	18.5	24

SEMESTER - 2									
S. No.	**Course Category**	**R/N**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
					L	**T**	**P**		
1	HSMC			Universal Human Values- II: Understanding Harmony	2	1	0	3	**3**
2	BSC			Engineering Mathematics-II	3	1	0	4	4
3	BSC			Engineering Physics-II	3	0	0	3	3
4	BSC			Engineering Physics-II Lab	0	0	2	1	2
5	ESC	N		Electrical Engineering/Basic Electrical Engineering(BT an	3	1	0	4	4
6	ESC	N		Electrical Engineering Lab/Basic Electrical Engineering Lab(BT and BI)	0	0	2	1	2
7	ESC			Workshop Practices/Engineering Graphics	0	0	3	1.5	3
8	ESC			Data Structures and Algorithms	3	0	0	3	3
9	ESC			Data Structures and Algorithms Lab	0	0	4	2	4
10	PR			Project-II BI/BT	0	0	2	1	2
11	HSMC			Professional Communication Practice (AUDIT)	0	1	0	0	1
				TOTAL				**23.5**	**31**

	Credits	Hours
HSMC	3	4
BSC	8	9
ESC	11.5	16
PCC		
PEC		
OEC		
PR	1	2
Total	23.5	31

Summer Term

Exit option with UG certificate of Level 5 on successful completion of 40 credits from 2 semesters and additional 6 credits from an Internship or Skill-based courses in the summer term.

SEMESTER - 3										
S. No.	**Course Category**	**R/N**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
					L	**T**	**P**		
1	HSMC			Life Skills and Interpersonal Dynamics	2	1	0	3	**3**
2	BSC			Probability, Statistics and Stochastic Processes	3	0	0	3	3
3	ESC	N		Digital System Design	3	0	0	3	3
4	ESC	N		Digital System Design Lab	0	0	2	1	2
5	PCC	N		Electronic Devices	3	1	0	4	4
6	PCC	N		Electronic Devices Lab	0	0	2	1	2
7	PCC	N		Signals and Systems	3	1	0	4	4
8	PCC	N		Signals and Systems Lab	0	0	2	1	2
9	PR			Project-III ESC	0	0	2	1	2
				TOTAL				**21**	**25**

	Credits	Hours
HSMC	3	3
BSC	3	3
ESC	4	5
PCC	10	12
PEC		
OEC		
PR	1	2
Total	21	25

SEMESTER - 4									
S. No.	**Course Category**	**R/N**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
					L	**T**	**P**		
1	HSMC			Finance and Accounts	3	0	0	3	**3**
2	ESC			Environmental Studies	2	0	0	2	**2**
3	PCC	N		Analog Circuits	3	1	0	4	4
4	PCC	N		Analog Circuits Lab	0	0	2	1	2
5	PCC	N		Control Systems	3	1	0	4	4
6	PCC	R		Analog and Digital Communication	3	1	0	4	4
7	PCC	R		Analog and Digital Communication Lab	0	0	2	1	2
8	PCC	R		Microprocessors and Microcontrollers	3	0	0	3	3
9	PCC	R		Microprocessors and Microcontrollers Lab	0	0	2	1	2
10	PR			Project-IV	0	0	2	1	2
				TOTAL				**24**	**28**

	Credits	Hours
HSMC	3	3
BSC		
ESC	2	2
PCC	18	21
PEC		
OEC		
PR	1	2
Total	24	28

Summer Term

Exit option with UG Diploma of Level 6 on successful completion of 80 credits from 4 semesters and additional 6 credits from an Internship or Skill-based courses in the summer term.

SEMESTER - 5									
S. No.	**Course Category**	**R/N**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
					L	**T**	**P**		
1	HSMC			PR Management and Entrepreneurship	3	0	0	3	**3**
2	PCC	R		Electromagnetic Waves	3	1	0	4	4
3	PCC	N		Electromagnetic Waves Lab	0	0	2	1	2
4	PCC	R		Digital Signal Processing	3	0	0	3	3
5	PCC	R		Digital Signal Processing Lab	0	0	2	1	2
6	PCC	R		VLSI Design	3	1	0	4	4
7	PCC	N		VLSI Design Lab	0	0	2	1	2
8	PEC			PE-I	3	0	0	3	3
9	PR			Project-V	0	0	4	2	4
				TOTAL				**22**	**27**

	Credits	Hours
HSMC	3	3
BSC		
ESC		
PCC	14	17
PEC	3	3
OEC		
PR	2	4
Total	22	27

SEMESTER - 6									
S. No.	**Course Category**	**R/N**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
					L	**T**	**P**		
1	PCC	N		Antenna theory and Wave Propagation	3	0	0	3	**3**
2	PCC	N		Antenna theory and Wave Propagation Lab	0	0	2	1	**2**
3	PCC	R		Wireless and Data Communication	3	0	0	3	3
4	PCC	N		Wireless and Data Communication Lab	0	0	2	1	2
5	PEC			PE-II	3	0	0	3	**3**
6	PEC			PE-III	3	0	0	3	3
7	OEC			OE-I - SE	3	0	0	3	3
8	OEC			OE-II - HSS	3	0	0	3	3
9	PR			Project-VI	0	0	4	2	4
10	MNC			Soft Skills for Professionals	0	1	0	0	1
				TOTAL				**22**	**27**

	Credits	Hours
HSMC	0	1
BSC		
ESC		
PCC	8	10
PEC	6	6
OEC	6	6
PR	2	4
Total	22	27

Summer Term
Exit option with B.Sc. of Level 7 on successful completion of 120 credits from 6 semesters and additional 6 credits from an Internship or Skill-based courses in the summer term.

SEMESTER - 7									
S. No.	**Course Category**	**R/N**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
					L	**T**	**P**		
1	PCC	**N**		Computer Architecture	3	0	0	3	3
2	PEC			PE-IV	3	0	0	3	**3**
3	PEC			PE-V	3	0	0	3	**3**
4	OEC			OE-III	3	0	0	3	3
5	OEC			OE-IV	3	0	0	3	3
6	PR			Project-VII	0	0	8	4	8
7	HSMC			Indian Constitution	1	0	0	Audit	1
				TOTAL				**19**	**24**

	Credits	Hours
HSMC	0	1
BSC		
ESC		
PCC	3	3
PEC	6	6
OEC	6	6
PR	4	8
Total	19	24

SEMESTER - 8									
S. No.	**Course Category**	**R/N**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
	Option-1				**L**	**T**	**P**		
1	PEC			PE-VI	3	0	0	3	**3**
2	OEC			OE-V	3	0	0	3	3
3	OEC			OE-VI	3	0	0	3	3
4	PR			Project-VIII	0	0	8	4	8
				TOTAL				**13**	**17**
	OR								
	Option-2				**L**	**T**	**P**		
1	PR			**Industrial Internship**				11	
				TOTAL				**11**	
	OR								
	Option-3				**L**	**T**	**P**		
1	PEC			PE-VI	3	0	0	3	**3**
2	OEC			OE-V	3	0	0	3	3
3	OEC			OE-VI	3	0	0	3	3
4	INT			Industrial	0	0	8	4	8
				TOTAL				**13**	**17**

	Credits	Hours
HSMC		
BSC		
ESC		
PCC		
PEC	3	3
OEC	6	6
PR	4	8
Total	13	17

COURSE CATEGORY-WISE CREDIT BREAKUP			
		Total Credits	**Total Hours**
Humanities & Social Sciences	HSMC	15	19
Basic Science	BSC	20	22
Engineering Science	ESC	23	31
Professional Core	PCC	53	63
Professional Elective	PEC	18	18
Open Elective	OEC	18	18
Project	PR	16	32
TOTAL		**163**	**203**

Annexure III

Proposed and Approved Electronics and Computer Science (ECS) Curriculum during BoS Meeting

PROPOSED CATEGORY & SEMESTER WISE CREDIT DISTRIBUTION (FINALIZED) ECS

CATEGORY / SEM	HSS	BASIC SC.	ENGG. SC.	PROF. CORE	PROF. ELECTIVE	OPEN ELECTIVE	PROJECT	TOTAL Credits (Hours)
1 SEM	3	9	5.5				1	18.5 (24)
2 SEM	3	8	11.5				1	23.5 (31)
3 SEM	3	3	9	10			1	26 (32)
4 SEM	3		2	18			1	24 (30)
5 SEM	3			12	3		2	20 (24)
6 SEM				4	6	6	2	18 (22)
7 SEM				3	6	6	4	19 (24)
8 SEM					3	6	4	13 (17)
Total	**15**	**20**	**28**	**47**	**18**	**18**	**16**	**162 (204)**

Basic Sc. – Mathematics, Physics & Chemistry.
Engg. Sc. – Engg. Courses offered by one particular department and mandatory to all students irrespective to department.
Note:- Only Credits have been defined under the category / semester. However, No. of Courses in each department should be kept Uniform. If deemed fit, liberty of introduction of Theory Courses / Lab courses within the specified credit limit should be given to the departments.

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, SOLAN

Course Structure of BTech in Electronics & Computer Science

(TOTAL CREDITS – 162) – APPLICABLE FROM 2024 ADMISSION BATCH

SEMESTER - 1

S. No.	Course Category	New / Revised	Subject Code	Name of the Subjects	Course Hours			Credits	Total Hours
					L	T	P		
1	HSMC			English	2	0	0	2	2
2	HSMC			English Lab	0	0	2	1	2
3	BSC			Engineering Mathematics-I	3	1	0	4	4
4	BSC			Engineering Physics-I	3	1	0	4	4
5	BSC			Engineering Physics Lab-I	0	0	2	1	2
6	ESC	N		Problem Solving and Programming	3	0	0	3	3
7	ESC	N		Problem Solving and Programming Lab	0	0	2	1	2
8	ESC			Workshop Practices **OR**	0	0	3	1.5	3
				Engineering Graphics	0	0	3		
9	PR			Project-I C	0	0	2	1	2
10	MNC			UHV-I Mandatory Induction	2 weeks			0	
				TOTAL				**18.5**	**24**

	Credits	Hours
HSMC	3	4
BSC	9	10
ESC	5.5	8
PCC	0	0
PEC	0	0
OEC	0	0
PR	1	2
Total	**18.5**	**24**

SEMESTER - 2

S. No.	Course Category	New / Revised	Subject Code	Name of the Subjects	Course Hours			Credits	Total Hours
					L	T	P		
1	HSMC			Universal Human Values- II:	2	1	0	3	3
2	BSC			Engineering Mathematics-II	3	1	0	4	4
3	BSC			Engineering Physics-II	3	0	0	3	3
4	BSC			Engineering Physics-II Lab	0	0	2	1	2
5	ESC	N		Electrical Engineering	3	1	0	4	4
6	ESC	N		Electrical Engineering Lab	0	0	2	1	2
7	ESC			Data Structures and Algorithms	3	0	0	3	3
8	ESC			Data Structures and Algorithms Lab	0	0	4	2	4
9	ESC			Workshop Practices **OR**	0	0	3	1.5	3
				Engineering Graphics	0	0	3		
10	PR			Project-II BI/BT	0	0	2	1	2
11	HSMC			Professional Communication Practice (AUDIT)	0	1	0	0	1
				TOTAL				**23.5**	**31**

	Credits	Hours
HSMC	3	4
BSC	8	9
ESC	11.5	16
PCC	0	0
PEC	0	0
OEC	0	0
PR	1	2
Total	**23.5**	**31**

Summer Term

Exit option with UG certificate of Level 5 on successful completion of 40 credits from 2 semesters and additional 6 credits from an Internship or Skill-based courses in the summer term.

SEMESTER - 3

S. No.	Course Category	New / Revised	Subject Code	Name of the Subjects	Course Hours			Credits	Total Hours
					L	T	P		
1	HSMC			Life Skills and Interpersonal	2	1	0	3	3
2	BSC			Probability, Statistics and Stochastic Processes	3	0	0	3	3
3	ESC			Object Oriented Systems and Programming	3	0	0	3	3
4	ESC			Object Oriented Systems and Programming Lab	0	0	4	2	4
5	ESC	N		Digital System Design	3	0	0	3	3
6	ESC	N		Digital System Design Lab	0	0	2	1	2
7	PCC	N		Electronic Devices	3	1	0	4	4
8	PCC	N		Electronic Devices Lab	0	0	2	1	2
9	PCC	N		Signals and Systems	3	1	0	4	4
10	PCC	N		Signals and Systems Lab	0	0	2	1	2
11	PR			Project III ESC	0	0	2	1	2
				TOTAL				**26**	**32**

	Credits	Hours
HSMC	3	3
BSC	3	3
ESC	9	12
PCC	10	12
PEC	0	0
OEC	0	0
PR	1	2
Total	**26**	**32**

SEMESTER - 4

S. No.	Course Category	New / Revised	Subject Code	Name of the Subjects	Course Hours			Credits	Total Hours
					L	T	P		
1	HSMC			Finance and Accounts	3	0	0	3	3
2	ESC			Environmental Studies	2	0	0	2	2
3	PCC	R		Analog and Digital Communication	3	1	0	4	4
4	PCC	R		Analog and Digital Communication Lab	0	0	2	1	2
5	PCC	R		Microprocessors and Microcontrollers	3	0	0	3	3
6	PCC	R		Microprocessors and Microcontrollers Lab	0	0	2	1	2
7	PCC			Operating Systems	3	0	0	3	3
8	PCC			Operating System Lab	0	0	2	1	2
9	PCC			Design & Analysis of Algorithms	3	0	0	3	3
10	PCC			Design and Analysis of Algorithms Lab	0	0	4	2	4
11	PR			Project-IV	0	0	2	1	2
				TOTAL				**24**	**30**

Summer Term

Exit option with UG Diploma of Level 6 on successful completion of 80 credits from 4 semesters and additional 6 credits from an Internship or Skill-based courses in the summer term.

	Credits	Hours
HSMC	3	3
BSC	0	0
ESC	2	2
PCC	18	23
PEC	0	0
OEC	0	0
PR	1	2
Total	**24**	**30**

SEMESTER - 5									
S. No.	**Course Category**	**New / Revised**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
					L	**T**	**P**		
1	HSMC			Project Management and Entrepreneurship	3	0	0	3	3
2	PCC	R		VLSI Design	3	1	0	4	4
3	PCC	N		VLSI Design Lab	0	0	2	1	2
4	PCC			Theory of Computaion	3	0	0	3	3
5	PCC			Database Management systems	3	0	0	3	3
6	PCC			Database Management systems Lab	0	0	2	1	2
7	PEC			PE-I	3	0	0	3	3
8	PR			Project-V	0	0	4	2	4
				TOTAL				**20**	**24**

	Credits	Hours
HSMC	3	3
BSC	0	0
ESC	0	0
PCC	12	14
PEC	3	3
OEC	0	0
PR	2	4
Total	**20**	**24**

SEMESTER - 6

S. No.	Course Category	New / Revised	Subject Code	Name of the Subjects	Course Hours			Credits	Total Hours
					L	T	P		
1	PCC			Computer Networks	3	0	0	3	3
2	PCC			Computer Networks lab	0	0	2	1	2
3	PEC			PE-II	3	0	0	3	3
4	PEC			PE-III	3	0	0	3	3
5	OEC			OE-I (SE)	3	0	0	3	3
6	OEC			OE-II (HSS)	3	0	0	3	3
7	PR			Project-VI	0	0	4	2	4
8	HSMC			Soft Skills for Professionals (AUDIT)	0	1	0	0	1
				TOTAL				**18**	**22**

Summer Term

Exit option with B.Sc. of Level 7 on successful completion of 120 credits from 6 semesters and additional 6 credits from an Internship or Skill-based courses in the summer term.

	Credits	Hours
HSMC	0	1
BSC	0	0
ESC	0	0
PCC	4	5
PEC	6	6
OEC	6	6
PR	2	4
Total	**18**	**22**

SEMESTER - 7									
S. No.	**Course Category**	**New / Revised**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
					L	**T**	**P**		
1	PCC	N		Computer Architecture	3	0	0	3	3
2	PEC			PE-IV	3	0	0	3	3
3	PEC			PE-V	3	0	0	3	3
4	OEC			OE-III	3	0	0	3	3
5	OEC			OE-IV	3	0	0	3	3
6	PR			Project-VII	0	0	8	4	8
7	HSMC			Indian Constitution (AUDIT)	1	0	0	0	1
				TOTAL				**19**	**24**

	Credits	Hours
HSMC	0	1
BSC	0	0
ESC	0	0
PCC	3	3
PEC	6	6
OEC	6	6
PR	4	8
Total	**19**	**24**

SEMESTER - 8

S. No.	Course Category	New / Revised	Subject Code	Name of the Subjects	Course Hours			Credits	Total Hours
					L	T	P		
Option 1									
1	PEC			PE-VI	3	0	0	3	3
2	OEC			OE-V	3	0	0	3	3
3	OEC			OE-VI	3	0	0	3	3
4	PR			Project-VIII	0	0	8	4	8
				TOTAL				**13**	**17**
OR									
Option 2									
1	PEC			PE-VI	3	0	0	3	3
2	OEC			OE-V	3	0	0	3	3
3	OEC			OE-VI	3	0	0	3	3
4	INT			Industrial	0	0	8	4	8
				TOTAL				**13**	**17**
OR									
Option 3									
1	PR			Industrial Internship				13	
				TOTAL				**13**	

	Credits	Hours
HSMC	0	0
BSC	0	0
ESC	0	0
PCC	0	0
PEC	3	3
OEC	6	6
PR	4	8
Total	**13**	**17**

COURSE CATEGORY-WISE CREDIT BREAKUP

Humanities & Social Sciences	HSMC	15
Basic Science	BSC	20
Engineering Science	ESC	28
Professional Core	PCC	47
Professional Elective	PEC	18
Open Elective	OEC	18
Project	PR	16
TOTAL CREDITS		**162**
TOTAL HOURS		**204**

Annexure IV

Proposed Electronics Engineering (VLSI Design and Technology) Degree Curriculum presented in BoS Meeting held on 14 June, 2024

PROPOSED CATEGORY & SEMESTER WISE CREDIT DISTRIBUTION (FINALIZED)ECED (VLSI)

CATEGORY / SEM	HSS	BASIC SC.	ENGG. SC.	PROF. CORE	PROF. ELECTIVE	OPEN ELECTIVE	PROJECT	TOTAL Credits (Hours)
1 SEM	3	9	5.5				1	**18.5(24)**
2 SEM	3	8	11.5				1	**23.5(31)**
3 SEM	3	3	4	11			1	**22(27)**
4 SEM	3		2	17			1	**23(27)**
5 SEM	3			13	3		2	**21(26)**
6 SEM				9	6	6	2	**23(28)**
7 SEM				3	6	6	4	**19(24)**
8 SEM					3	6	4	**13(17)**
Total	**15**	**20**	**23**	**53**	**18**	**18**	**16**	**163 (204)**

Basic Sc. – Mathematics, Physics & Chemistry.
Engg. Sc. – Engg. Courses offered by one particular department and mandatory to all students irrespective to department.
Note:- Only Credits have been defined under the category / semester. However, No. of Courses in each department should be kept Uniform. If deemed fit, liberty of introduction of Theory Courses / Lab courses within the specified credit limit should be given to the departments.

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, SOLAN

Course Structure of B.Tech. in Electronics Engineering (VLSI Design & Technology)

(TOTAL CREDITS - 163) – APPLICABLE FROM- 2024 ADMISSION BATCH

SEMESTER - 1

S. No.	Course Category	R/N	Subject Code	Name of the Subjects	Course Hours			Credits	Total Hours
					L	T	P		
1	HSMC			English	2	0	0	**2**	2
2	HSMC			English Lab	0	0	2	**1**	2
3	BSC			Engineering Mathematics-I	3	1	0	**4**	4
4	BSC			Engineering Physics-I	3	1	0	**4**	4
5	BSC			Engineering Physics Lab-I	0	0	2	**1**	2
6	ESC			Engineering Graphics/Workshop Practices	0	0	3	**1.5**	3
7	ESC			Problem Solving and Programming	3	0	0	**3**	3
8	ESC			Problem Solving and Programming Lab	0	0	2	**1**	2
9	PR			Project-I	1	0	2	**1**	2
10	MNC			UHV-I Mandatory Induction Program	2 Weeks			**0**	
				TOTAL				**18.5**	**24**

	Credits	Hours
HSMC	3	4
BSC	9	10
ESC	5.5	8
PCC		
PEC		
OEC		
PR	1	2
Total	18.5	24

SEMESTER - 2									
S. No.	**Course Category**	**R/N**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
					L	**T**	**P**		
1	HSMC			Universal Human Values- II: Understanding Harmony	2	1	0	3	**3**
2	BSC			Engineering Mathematics-II	3	1	0	4	4
3	BSC			Engineering Physics-II	3	0	0	3	3
4	BSC			Engineering Physics-II Lab	0	0	2	1	2
5	ESC	N		Electrical Engineering	3	1	0	4	4
6	ESC	N		Electrical Engineering Lab	0	0	2	1	2
7	ESC			Workshop Practices/Engineering Graphics	0	0	3	1.5	3
8	ESC			Data Structures and Algorithms	3	0	0	3	3
9	ESC			Data Structures and Algorithms Lab	0	0	4	2	4
10	PR			Project-II	0	0	2	1	2
11	HSMC			Professional Communication Practice (AUDIT	0	1	0	0	1
				TOTAL				**23.5**	**31**
Summer Term									
Exit option with UG certificate of Level 5 on successful completion of 40 credits from 2 semesters and additional 6 credits from an Internship or Skill-based courses in the summer term.									

	Credits	Hours
HSMC	3	4
BSC	8	9
ESC	11.5	16
PCC		
PEC		
OEC		
PR	1	2
Total	23.5	31

SEMESTER - 3									
S. No.	**Course Category**	**R/N**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
					L	**T**	**P**		
1	HSMC			Life Skills and Interpersonal Dynamics	2	1	0	3	**3**
2	BSC			Probability, Statistics and Stochastic Processe	3	0	0	3	3
3	ESC	N		Digital System Design	3	0	0	3	3
4	ESC	N		Digital System Design Lab	0	0	2	1	2
5	PCC	N		Electronic Devices	3	1	0	4	4
6	PCC	N		Electronic Devices Lab	0	0	2	1	2
7	PCC	N		Signals and Systems	3	1	0	4	4
8	PCC	N		Signals and Systems Lab	0	0	2	1	2
9	PCC	N		Verilog HDL Lab	0	0	2	1	2
10	PR			Project-III	0	0	2	1	2
				TOTAL				**22**	**27**

	Credits	Hours
HSMC	3	3
BSC	3	3
ESC	4	5
PCC	11	14
PEC		
OEC		
PR	1	2
Total	22	27

SEMESTER - 4									
S. No.	**Course Category**	**R/N**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
					L	**T**	**P**		
1	HSMC			Finance and Accounts	3	0	0	3	**3**
2	ESC			Environmental Studies	2	0	0	2	**2**
3	PCC	N		Analog Circuits	3	1	0	4	4
4	PCC	N		Analog Circuits Lab	0	0	2	1	2
5	PCC	N		FPGA based System Design	3	0	0	3	3
7	PCC	R		Analog and Digital Communication	3	1	0	4	4
8	PCC	R		Analog and Digital Communication Lab	0	0	2	1	2
9	PCC	R		Microprocessors and Microcontrollers	3	0	0	3	3
10	PCC	R		Microprocessors and Microcontrollers Lab	0	0	2	1	2
11	PR			Project-IV	0	0	2	1	2
				TOTAL				**23**	**27**

	Credits	Hours
HSMC	3	3
BSC		
ESC	2	2
PCC	17	20
PEC		
OEC		
PR	1	2
Total	23	27

Summer Term
Exit option with UG Diploma of Level 6 on successful completion of 80 credits from 4 semesters and additional 6 credits from an Internship or Skill-based courses in the summer term.

SEMESTER - 5									
S. No.	**Course Category**	**R/N**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
					L	**T**	**P**		
1	HSMC			PR Management and Entrepreneurship	3	0	0	3	**3**
2	PCC	N		Linux Lab	0	0	2	1	2
3	PCC	N		Introduction to Microfabrication Technology	3	0	0	3	3
4	PCC	R		Digital Signal Processing	3	0	0	3	3
5	PCC	R		Digital Signal Processing Lab	0	0	2	1	2
6	PCC	R		VLSI Design	3	1	0	4	4
7	PCC	N		VLSI Design Lab	0	0	2	1	2
8	PEC			PE-1	3	0	0	3	3
9	PR			Project-V	0	0	4	2	4
				TOTAL				**21**	**26**

	Credits	Hours
HSMC	3	3
BSC		
ESC		
PCC	13	16
PEC	3	3
OEC		
PR	2	4
Total	21	26

SEMESTER - 6									
	Course Category	**R/N**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
S. No.					**L**	**T**	**P**		
1	PCC	N		Analog IC Design	3	1	0	4	4
2	PCC	N		Analog IC Design Lab	0	0	2	1	2
3	PCC	N		VLSI Verification &Testing	3	0	0	3	3
4	PCC	N		VLSI Verification &Testing Lab	0	0	2	1	2
5	PEC			PE-2	3	0	0	3	3
6	PEC			PE-3	3	0	0	3	3
7	OEC			OE-1	3	0	0	3	3
8	OEC			OE-2	3	0	0	3	3
9	PR			Project-VI	0	0	4	2	4
10	HSMC			Soft Skills for Professionals (Audit)	0	1	0	Audit	1
				TOTAL				**23**	**28**
Summer Term									
Exit option with B.Sc. of Level 7 on successful completion of 120 credits from 6 semesters and additional 6 credits from an Internship or Skill-based courses in the summer term.									

	Credits	Hours
HSMC		
BSC		
ESC		
PCC	9	11
PEC	6	6
OEC	6	6
PR	2	4
MNC	0	1
Total	23	28

SEMESTER - 7									
	Course Category	**R/N**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
S. No.					**L**	**T**	**P**		
1	PCC	N		Computer Architecture	3	0	0	3	3
2	PEC			PE-4	3	0	0	3	**3**
3	PEC			PE-5	3	0	0	3	**3**
4	OEC			OE-3	3	0	0	3	3
5	OEC			OE-4	3	0	0	3	3
6	PR			Project-VII	0	0	8	4	8
7	HSMC			Indian Constitution	1	0	0	Audit	1
				TOTAL				**19**	**24**

	Credits	Hours
HSMC	0	1
BSC		
ESC		
PCC	3	3
PEC	6	6
OEC	6	6
PR	4	8
Total	19	24

SEMESTER - 8

S. No.	Course Category	R/N	Subject Code	Name of the Subjects	Course Hours			Credits	Total Hours
	Option-1				**L**	**T**	**P**		
	PEC			PE-6	3	0	0	3	**3**
1	OEC			OE-5	3	0	0	3	3
2	OEC			OE-6	3	0	0	3	3
3	PR			Project-VIII	0	0	8	4	8
4				**TOTAL**				**13**	**17**

OR

S.No	Course Category	R/N	Subject Code	Name of the Subjects	Course Hours			Credits	Total Hours
	Option-2				**L**	**T**	**P**		
	PR			**Industrial Internship**				13	
1				**TOTAL**				**13**	

OR

S. No.	Course Category	R/N	Subject Code	Name of the Subjects	Course Hours			Credits	Total Hours
	Option-3				**L**	**T**	**P**		
	PEC			PE-6	3	0	0	3	**3**
1	OEC			OE-5	3	0	0	3	3
2	OEC			OE-6	3	0	0	3	3
3	INT			Industrial	0	0	8	4	8
4				**TOTAL**				**13**	**17**

	Credits	Hours
HSMC		
BSC		
ESC		
PCC		
PEC	3	3
OEC	6	6
PR	4	8
Total	13	17

COURSE CATEGORY-WISE CREDIT BREAKUP		
		Total Credits
Humanities & Social Sciences	HSMC	15
Basic Science	BSC	20
Engineering Science	ESC	23
Professional Core	PCC	53
Professional Elective	PEC	18
Open Elective	OEC	18
Project	PR	16
TOTAL		**163**
Total Hours		204

Annexure V

Modified Electronics Engineering (VLSI Design and Technology) Degree Curriculum as per suggestions during BoS Meeting

PROPOSED CATEGORY & SEMESTER WISE CREDIT DISTRIBUTION (FINALIZED)ECED (VLSI)

CATEGORY / SEM	HSS	BASIC SC.	ENGG. SC.	PROF. CORE	PROF. ELECTIVE	OPEN ELECTIVE	PROJECT	TOTAL Credits (Hours)
1 SEM	3	9	5.5				1	**18.5(24)**
2 SEM	3	8	11.5				1	**23.5(31)**
3 SEM	3	3	4	11			1	**21(25)**
4 SEM	3		2	17			1	**24(29)**
5 SEM	3			13	3		2	**21(26)**
6 SEM				9	6	6	2	**23(28)**
7 SEM				3	6	6	4	**19(24)**
8 SEM					3	6	4	**13(17)**
Total	**15**	**20**	**23**	**53**	**18**	**18**	**16**	**163 (204)**

Basic Sc. – Mathematics, Physics & Chemistry.
Engg. Sc. – Engg. Courses offered by one particular department and mandatory to all students irrespective to department.
Note:- Only Credits have been defined under the category / semester. However, No. of Courses in each department should be kept Uniform. If deemed fit, liberty of introduction of Theory Courses / Lab courses within the specified credit limit should be given to the departments.

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, SOLAN

Course Structure of B.Tech. in Electronics Engineering (VLSI Design & Technology)

(TOTAL CREDITS - 163) – APPLICABLE FROM- 2024 ADMISSION BATCH

SEMESTER - 1

S. No.	Course Category	R/N	Subject Code	Name of the Subjects	Course Hours			Credits	Total Hours
					L	T	P		
1	HSMC			English	2	0	0	**2**	2
2	HSMC			English Lab	0	0	2	**1**	2
3	BSC			Engineering Mathematics-I	3	1	0	**4**	4
4	BSC			Engineering Physics-I	3	1	0	**4**	4
5	BSC			Engineering Physics Lab-I	0	0	2	**1**	2
6	ESC			Engineering Graphics/Workshop Practices	0	0	3	**1.5**	3
7	ESC			Problem Solving and Programming	3	0	0	**3**	3
8	ESC			Problem Solving and Programming Lab	0	0	2	**1**	2
9	PR			Project-I	1	0	2	**1**	2
10	MNC			UHV-I Mandatory Induction Program	2 Weeks			**0**	
				TOTAL				**18.5**	**24**

	Credits	Hours
HSMC	3	4
BSC	9	10
ESC	5.5	8
PCC		
PEC		
OEC		
PR	1	2
Total	18.5	24

SEMESTER - 2									
S. No.	**Course Category**	**R/N**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
					L	**T**	**P**		
1	HSMC			Universal Human Values- II: Understanding Harmony	2	1	0	3	**3**
2	BSC			Engineering Mathematics-II	3	1	0	4	4
3	BSC			Engineering Physics-II	3	0	0	3	3
4	BSC			Engineering Physics-II Lab	0	0	2	1	2
5	ESC	N		Electrical Engineering	3	1	0	4	4
6	ESC	N		Electrical Engineering Lab	0	0	2	1	2
7	ESC			Workshop Practices/Engineering Graphics	0	0	3	1.5	3
8	ESC			Data Structures and Algorithms	3	0	0	3	3
9	ESC			Data Structures and Algorithms Lab	0	0	4	2	4
10	PR			Project-II	0	0	2	1	2
11	HSMC			Professional Communication Practice (AUDIT	0	1	0	0	1
				TOTAL				**23.5**	**31**
Summer Term									
Exit option with UG certificate of Level 5 on successful completion of 40 credits from 2 semesters and additional 6 credits from an Internship or Skill-based courses in the summer term.									

	Credits	Hours
HSMC	3	4
BSC	8	9
ESC	11.5	16
PCC		
PEC		
OEC		
PR	1	2
Total	23.5	31

SEMESTER - 3									
S. No.	**Course Category**	**R/N**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
					L	**T**	**P**		
1	HSMC			Life Skills and Interpersonal Dynamics	2	1	0	3	**3**
2	BSC			Semiconductor Physics	3	0	0	3	3
3	ESC	N		Digital System Design	3	0	0	3	3
4	ESC	N		Digital System Design Lab	0	0	2	1	2
5	PCC	N		Electronic Devices	3	1	0	4	4
6	PCC	N		Electronic Devices Lab	0	0	2	1	2
7	PCC	N		Signals and Systems	3	1	0	4	4
8	PCC	N		Signals and Systems Lab	0	0	2	1	2
9	PR			Project-III	0	0	2	1	2
				TOTAL				**21**	**25**

	Credits	Hours
HSMC	3	3
BSC	3	3
ESC	4	5
PCC	10	12
PEC		
OEC		
PR	1	2
Total	21	25

SEMESTER - 4									
S. No.	**Course Category**	**R/N**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
					L	**T**	**P**		
1	HSMC			Finance and Accounts	3	0	0	3	**3**
2	ESC			Environmental Studies	2	0	0	2	**2**
3	PCC	N		Analog Circuits	3	1	0	4	4
4	PCC	N		Analog Circuits Lab	0	0	2	1	2
5	PCC	N		FPGA Design using Verilog	3	0	0	3	3
6	PCC	N		FPGA Design using Verilog Lab	0	0	2	1	2
7	PCC	R		Analog and Digital Communication	3	1	0	4	4
8	PCC	R		Analog and Digital Communication Lab	0	0	2	1	2
9	PCC	R		Microprocessors and Microcontrollers	3	0	0	3	3
10	PCC	R		Microprocessors and Microcontrollers Lab	0	0	2	1	2
11	PR			Project-IV	0	0	2	1	2
				TOTAL				**24**	**29**

	Credits	Hours
HSMC	3	3
BSC		
ESC	2	2
PCC	18	22
PEC		
OEC		
PR	1	2
Total	24	29

Summer Term
Exit option with UG Diploma of Level 6 on successful completion of 80 credits from 4 semesters and additional 6 credits from an Internship or Skill-based courses in the summer term.

SEMESTER - 5									
S. No.	**Course Category**	**R/N**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
					L	**T**	**P**		
1	HSMC			PR Management and Entrepreneurship	3	0	0	3	**3**
2	PCC	N		Linux Lab	0	0	2	1	2
3	PCC	N		Introduction to Microfabrication Technology	3	0	0	3	3
4	PCC	R		Digital Signal Processing	3	0	0	3	3
5	PCC	R		Digital Signal Processing Lab	0	0	2	1	2
6	PCC	R		VLSI Design	3	1	0	4	4
7	PCC	N		VLSI Design Lab	0	0	2	1	2
8	PEC			PE-1	3	0	0	3	3
9	PR			Project-V	0	0	4	2	4
				TOTAL				**21**	**26**

	Credits	Hours
HSMC	3	3
BSC		
ESC		
PCC	13	16
PEC	3	3
OEC		
PR	2	4
Total	21	26

SEMESTER - 6									
	Course Category	**R/N**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
S. No.					**L**	**T**	**P**		
1	PCC	N		Analog IC Design	3	1	0	4	**4**
2	PCC	N		Analog IC Design Lab	0	0	2	1	**2**
3	PCC	N		VLSI Verification &Testing	3	0	0	3	3
4	PCC	N		VLSI Verification &Testing Lab	0	0	2	1	2
5	PEC			PE-2	3	0	0	3	**3**
6	PEC			PE-3	3	0	0	3	3
7	OEC			OE-1	3	0	0	3	3
8	OEC			OE-2	3	0	0	3	3
9	PR			Project-VI	0	0	4	2	4
10	HSMC			Soft Skills for Professionals (Audit)	0	1	0	Audit	1
				TOTAL				**23**	**28**
Summer Term									
Exit option with B.Sc. of Level 7 on successful completion of 120 credits from 6 semesters and additional 6 credits from an Internship or Skill-based courses in the summer term.									

	Credits	Hours
HSMC		
BSC		
ESC		
PCC	9	11
PEC	6	6
OEC	6	6
PR	2	4
MNC	0	1
Total	23	28

SEMESTER - 7									
	Course Category	**R/N**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
S. No.					**L**	**T**	**P**		
1	PCC	N		Computer Architecture	3	0	0	3	3
2	PEC			PE-4	3	0	0	3	**3**
3	PEC			PE-5	3	0	0	3	**3**
4	OEC			OE-3	3	0	0	3	3
5	OEC			OE-4	3	0	0	3	3
6	PR			Project-VII	0	0	8	4	8
7	HSMC			Indian Constitution	1	0	0	Audit	1
				TOTAL				**19**	**24**

	Credits	Hours
HSMC	0	1
BSC		
ESC		
PCC	3	3
PEC	6	6
OEC	6	6
PR	4	8
Total	19	24

SEMESTER - 8									
	Course Category	**R/N**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
S. No.	**Option-1**				**L**	**T**	**P**		
	PEC			PE-6	3	0	0	3	**3**
1	OEC			OE-5	3	0	0	3	3
2	OEC			OE-6	3	0	0	3	3
3	PR			Project-VIII	0	0	8	4	8
4				**TOTAL**				**13**	**17**
	OR								
	Course Category	**R/N**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
S.No	**Option-2**				**L**	**T**	**P**		
	PR			**Industrial Internship**				13	
1				**TOTAL**				**13**	
	OR								
	Course Category	**R/N**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
S. No.	**Option-3**				**L**	**T**	**P**		
	PEC			PE-6	3	0	0	3	**3**
1	OEC			OE-5	3	0	0	3	3
2	OEC			OE-6	3	0	0	3	3
3	INT			Industrial	0	0	8	4	8
4				**TOTAL**				**13**	**17**

	Credits	Hours
HSMC		
BSC		
ESC		
PCC		
PEC	3	3
OEC	6	6
PR	4	8
Total	13	17

COURSE CATEGORY-WISE CREDIT BREAKUP		
		Total Credits
Humanities & Social Sciences	HSMC	15
Basic Science	BSC	20
Engineering Science	ESC	23
Professional Core	PCC	53
Professional Elective	PEC	18
Open Elective	OEC	18
Project	PR	16
TOTAL		**163**
Total Hours		204

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY

(Established by H.P. State Legislature vide Act No. 14 of 2002)

Ref.: JUIT/PMS/BOS/June_2023_1 Date: 16-06-2023

Department of Physics and Materials Science

A meeting of Board of Studies (BoS) of the **Department of Physics and Materials Science** was held as per the following schedule:

Meeting Name:	Board of Studies –Department of Physics and Materials Science		
Date of Meeting:	16-06-2023	**Time:**	04:00 pm
Chairman:	Prof.(Dr.) P. B. Barman	**Location:**	JUIT (Online mode)

1. Meeting Objective:
1. To introduce Open Electives for VIII Semester students of BTech in CSE, IT, BT, BI and ECE in view of new scheme of 160 credits for BTech programmes Biomaterials, Biosensors and Computational nanotechnology.
2. Syllabus bench marking and up-gradation for the core courses.

2(a). Meeting Attendees: **The following members were present**	
Prof.(Dr.) P. B. Barman (Professor and HOD, PMS)	Chairman
Dr. Ragini Raj Singh (Associate Professor, PMS)	Member Secretary / Coordinator
Prof.(Dr.) Vineet Sharma (Professor, PMS)	Member-2
Dr. Surajit Hazra (Associate Professor, PMS)	Member-3
Dr. Sanjiv Kumar Tiwari (Assistant Professor, PMS)	Member-4
Prof.(Dr.) Rajiv Kumar (Professor & HOD, ECE, JUIT)	Co-opted Member-1
Prof.(Dr.) Vivek Kumar Sehgal (Professor & HOD, CS&IT, JUIT)	Co-opted Member-2
Prof.(Dr.) Rakesh Kumar Bajaj (Professor & HOD, Mathematics, JUIT)	Co-opted Member-3
Dr. Amit Srivastava (Associate Professor & HOD, HSS, JUIT)	Co-opted Member-4
Dr. Anil Kant (Representative, HOD BT and BI, JUIT)	Co-opted Member-5
Dr. Saurabh Rawat (Representative, HOD, CE, JUIT)	Co-opted Member-6
Dr. Vikas Baghel (IQAC Representative, JUIT)	Member IQAC
Dr. Shovit Bhattacharya	External Member-3 (Industry/R&D)
Dr. Diksha Painuly	External Member-4 (Industry/R&D)
Dr. Santu Baidya	Special Invitee

2(b). Leave of Absence: **The following members were granted leave of absence by the Chairman, BOS**	
Prof.(Dr.) Sunil Kumar Khah (Professor, COE and IQAC head, PMS)	On Official Tour (Member 1)
Prof.(Dr.) K. L. Yadav	External Member-1 (Academic)
Dr. Pushpendra Singh	External Member-2 (Academic)

The Chairman welcomed all the members who were present for the meeting. The meeting was thereafter deliberated by Dr. Ragini Raj Singh on agenda items as had been approved by the Chairman.

3. Action Items / Instructions: **Following decisions were taken/approved by the members of BoS.**

Item No. 1 : To approve the minutes of last meeting of the BoS.

No objection was received from any BoS member for the earlier BoS therefore all the items proposed were considered to be approved.

Item No. 2 : To consider the revision in the course syllabus of the following courses offered by Department of Physics & Materials Science.

S. No.	Subject Code	Subject Name	Semester	Status	L	T	P	Credit	Hours
1	xxB11PH111	(a)Engineering Physics I	Semester-I (Core)	For BTech CSE, IT, ECE and CE	3	1	0	4	4
2	xxB11PH211	(b)Engineering Physics II	Semester-II (Core)	For BTech CSE, IT, ECE and CE	3	0	0	3	3
3	xxB11PH112	(c)Basic Engineering Physics I	Semester-I (Core)	For BTech Bioinformatics and BTech Biotechlogy	3	1	0	4	4
4	xxB1WPH212	(d) Bioinstrumentation Techniques	Semester-II (Core)	For BTech Bioinformatics and BTech Biotechnology	3	1	0	4	4
5	xxB1WPH531	(e) Science and Technology of Materials	Semester-III (Core)	For BTech ECE	3	0	0	3	3
6	xxB1WPH532	(f) Applied materials Science	Semester-III (Core)	For BTech CSE, IT	3	0	0	3	3

The BOS members advised some changes in the revised syllabus of the subjects in the meeting. The changes were made according to the suggestions. The revised syllabus after the modification suggested by BOS members is attached as ***Annexure 1***.

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY

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Item No. 3 : To consider and approve the three new open Electives (Biomaterials, Biosensors and Computational Nanotechnology) for 8th Semester.

a) Biomaterials
b) Biosensors
c) Computational Nanotechnology

S. No.	Subject Code	Subject Name	Semester	Status	L	T	P	Credit	Hours
1	xxB1WPHxxx	Biomaterials	Semester-VIII (OPEN)	Open Elective (Category: Non Departmental Electives)	3	0	0	3	3
2	20B1WPH831	Biosensors	Semester-VIII (OPEN)	Open Elective (Category: Non Departmental Electives)	3	0	0	3	3
3	xxB1WPHxxx	Computational Nanotechnology	Semester-VIII (OPEN)	Open Elective (Category: Non Departmental Electives)	3	0	0	3	3

The syllabus of the open electives is attached in ***Annexure II***. Biomaterial has been approved as it is. The syllabus of Biosensors has been reduced and modified as per the suggestions of the BOS members. Some minor modifications have been done in the Computational nanotechnology also.

ATTACH SIGNED ATTENDANCE SHEET *Annexure III.*

Chairperson
(P. B. Barman)
(HOD, PMS)

Member Secretary/ Coordinator
(Ragini Raj Singh)

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY

(Established by H.P. State Legislature vide Act No. 14 of 2002)

Board of Studies Meeting of the Department of Physics and Materials Science, Jaypee University of Information technology held on 16th June 2023 at 04:00 PM

Meeting Attendees: The following members were present		**Signatures**
Prof.(Dr.) P. B. Barman (Professor and HOD, PMS)	Chairman	
Dr. Ragini Raj Singh (Associate Professor, PMS)	Member Secretary / Coordinator	16.06.23
Prof.(Dr.) Vineet Sharma (Professor, PMS)	Member-2	16/06/23
Dr. Surajit Hazra (Associate Professor, PMS)	Member-3	16/06/2023
Dr. Sanjiv Kumar Tiwari (Assistant Professor, PMS)	Member-4	16/6/2023
Prof.(Dr.) Rajiv Kumar (Professor & HOD, ECE, JUIT)	Co-opted Member-1	16/06/2023
Prof.(Dr.) Vivek Kumar Sehgal (Professor & HOD, CS&IT, JUIT)	Co-opted Member-2	16/6/23
Prof.(Dr.) Rakesh Kumar Bajaj (Professor & HOD, Mathematics, JUIT)	Co-opted Member-3	for Kanan
Dr. Amit Srivastava (Associate Professor & HOD, HSS, JUIT)	Co-opted Member-4	16/06/2023
Dr. Anil Kant (Representative, HOD BT and BI, JUIT)	Co-opted Member-5	16/06/2023
Dr. Saurabh Rawat (Representative, HOD, CE, JUIT)	Co-opted Member-6	for Saurav 16/6/2023
Dr. Vikas Baghel (IQAC Representative, JUIT)	Member IQAC	for
Dr. Santu Baidya (Assistant Professor, PMS)	Special Invitee	16/06/2023

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY

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Prof.(Dr.) K. L. Yadav	External Member-1 (Academic)	Leave of absence
Dr. Pushpendra Singh	External Member-2 (Academic)	Leave of absence
Dr. Shovit Bhattacharya	External Member-3 (Industry/R&D)	
Dr. Diksha Painuly	External Member-4 (Industry/R&D)	

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY
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(Established by H.P. State Legislature vide Act No. 14 of 2002)

JAYPEE EDUSPHERE
IGNITED MINDS INSPIRED SOULS

GUIDELINES FOR REVISION OF COURSES

The curriculum review process is designed to ensure the integrity of curricula and credit-bearing courses offered by university. The major modifications can be done not before 3 years. Before doing the revisions the feedback from the following (atleast 5-6) should be considered:

1. Action taken on recommendations of previous BoS.
2. Feedback from students.
3. Feedback from Stake holders.
4. Syllabi of competitive exams like IES, GATE, and IAS.
5. Visits of faculty to industry.
6. Information from the company's campus interview.
7. Feedback / Suggestions from faculty.
8. Rules & regulations of governing, funding, accreditation and monitoring bodies.
9. Scheme of courses/curriculum prevalent in other university/universities of National & International repute.
10. Feedback from IQAC.

Later it was approved from the following bodies:

1. Discussing the feedback in faculty meeting and proposing the changes to be taken by Program Curriculum and Evaluation Committee.
2. Discussions in the meetings of Program Curriculum and Evaluation Committee.
3. Bench marking with IIT/NIT.
4. Board of Studies.
5. Academic Council.

Jaypee University of Information Technology IQAC Waknaghat

Prof. Ashok K. Gupta
(Dean A&R)

Jaypee University of Information Technology Dean (A&R) Waknaghat