GANDHI INSTITUTE OF TECHNOLOGY AND MANAGEMENT(GITAM)
(Deemed to be University)
VISAKHAPATNAM * HYDERABAD * BENGALURU

Accredited by NAAC with A^{++} Grade

CURRICULUM AND SYLLABUS

OF

UBCBI01: B.Sc. Biochemistry

w.e.f. 2021-22 admitted batch

(Updated upto May 2024)

Academic Regulations

Applicable for the Undergraduate Programme in the Schools of Technology,

Humanities & Social Sciences, Business and Sciences

https://www.gitam.edu/academic-regulations

VISION AND MISSION OF THE UNIVERSITY

VISION

To become a global leader in higher education.

MISSION

To impart futuristic and comprehensive education of global standards with a high sense of discipline and social relevance in a serene and invigorating environment.

UBCBI01: B.Sc. Biochemistry

VISION AND MISSION OF THE SCHOOL

VISION

To develop science education in an intellectually vibrant atmosphere

MISSION

1. To transmit, expand and apply knowledge of science through teaching, interaction, research, and societal service.
2. Realising the full potential of science and attaining new heights in Science & Technology to impart quality scientific education.
3. To provide a flexible curriculum with more elective courses and allow a choice-based credit system for the students in a research-oriented teaching and learning environment.
4. To inculcate and create an environment of research and academic excellence by propagating the knowledge and cater the needs of the industry and society
5. To create excellent prospects for emerging entrepreneurs by disseminating the knowledge and tapping their potential skills

UBCBI01: B.Sc. Biochemistry

(w.e.f. academic year 2021-22 admitted batch)

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO 1	Exhibit an ability to apply fundamental knowledge related to biochemical sciences in an interdisciplinary manner for providing solutions to need based problems.
PEO 2	Engross an ability to decisively analyse scientific data, draw objective inferences and apply this knowledge for human welfare.
PEO 3	Be able to demonstrate proficiency and ethical perception on areas relevant to Biochemistry.
PEO 4	Acquire communication skills and exhibit commitment towards teamwork which is necessary for functioning productively and professionally on multidisciplinary fields of Biochemistry.

the Mission of the School with the PEOs

	PEO1	**PEO2**	**PEO3**	**PEO4**
M1		**H**		**L**
M2	**M**		**H**	
M3				
M4				
M5				

PROGRAMME OUTCOMES(POs) AND PROGRAMME SPECIFIC OUTCOMES(PSOs):

At the end of the Programme the students would be able to:

PO1	Understand various aspects of biomolecules and an overview of their metabolic, cellular events, and genetic basis of life and gain knowledge in diagnosis, prognosis and management of various diseases and addressing clinical problems
PO2	Gain knowledge in conventional techniques, modern analytical techniques, omics, bioinformatic approaches and nanotechnologies to apply in biological research and in discovery of new products.
PO3	Gain knowledge in Information Technology and Communication skills in English and apply effectively in professional context.
PO4	Gain an overview of the organization of vital physiological systems, their function and abnormalities in both animal and plant systems
PO5	Gain theoretical and practical knowledge of genome, expression of genes and, their regulation, repair and application of rDNA technology for superior traits.
PO6	Gain knowledge of clinically and industrially important microorganisms and understand their role in elicitation of immune response and find their applications in bioprocess technology.
PO7	Acquire knowledge regarding ethical conduct of research, clinical trials, economic, political, ELSI of the HGP and apply intellectual property rights (IPR) principles to real problems and analyse the social impact
PSO1	Gain knowledge and insights on various aspects of Biochemistry
PSO2	Apply knowledge, tools, and techniques for solving biochemical problems
PSO3	Acquaint Central Dogma of life and understands the various facets of Molecular Biology
PSO4	Understand the cellular, molecular, immunological, biochemical and genetic basis of diseases.

Curriculum Structure

(Choice Based Credit System)

UNIVERSITY CORE (UC)									
Course code	**Level**	**Course title**	**L**	**T**	**P**	**S**	**J**	**C**
CSEN1001	1	IT Productivity Tools^	0	0	2	0	0	1*
CLAD1001	1	Emotional Intelligence & Reasoning Skills (Soft Skills 1)	0	0	2	0	0	1
CLAD1011	1	Leadership Skills & Quantitative Aptitude (Soft Skills 2)	0	0	2	0	0	1
CLAD1021	1	Verbal Ability & Quantitative Ability (Soft Skills 3)	0	0	2	0	0	1
CLAD1031	1	Practicing Verbal Ability & Quantitative Aptitude (Soft Skills 4)	0	0	2	0	0	1
CLAD20XX	2	Soft skills 5A/5B/5C	0	0	2	0	0	1
CLAD20XX	2	Soft skills 6A/6B/6C	0	0	2	0	0	1
DOSP10XX	1	Sports 1#	0	0	0	2	0	2*
DOSL10XX	1	Club Activity#	0	0	0	2	0	2*
DOSL10XX	1	Community Service#	0	0	0	0	2	2*
ENVS1001	1	Environmental Studies^	3	0	0	0	0	3*
FINA3001	3	Personal Financial Planning#	0	0	2	0	0	1*
LANG1001	1	Communication Skills in English - Beginners	0	0	4	0	0	2*
LANG1011	1	Communication Skills in English	0	0	4	0	0	2
LANG1021	1	Advanced Communication Skills in English	0	0	4	0	0	2
MFST1001	1	Health & Wellbeing	0	0	2	0	0	1*
POLS1001	1	Indian Constitution and History	2	0	0	0	0	2*
PHPY1001	1	Gandhi for the 21st Century	2	0	0	0	0	2*
VEDC1001	1	Venture Development	0	0	0	2	0	2

* Pass/Fail courses
# Opt any three courses among the five
^ Online/Swayam/NPTEL Courses

Soft skills courses 5 and 6								
Course code	**Level**	**Course title**	**L**	**T**	**P**	**S**	**J**	**C**
CLAD2001	2	Preparation for Campus Placement-1 (Soft skills 5A)	0	0	2	0	0	1
CLAD2011	2	Preparation for Higher Education (GRE/ GMAT)-1 (Soft skills 5B)	0	0	2	0	0	1
CLAD2021	2	Preparation for CAT/ MAT - 1 (Soft skills 5C)	0	0	2	0	0	1

CLAD2031	2	Preparation for Campus Placement-2 (Soft skills 6A)	0	0	2	0	0	1
CLAD2041	2	Preparation for Higher Education (GRE/ GMAT)-2 (Soft skills 6B)	0	0	2	0	0	1
CLAD2051	2	Preparation for CAT/ MAT - 2 (Soft skills 6C)	0	0	2	0	0	1

Sports Courses								
Course code	**Level**	**Course title**	**L**	**T**	**P**	**S**	**J**	**C**
DOSP1001	1	Badminton	0	0	0	2	0	2
DOSP1011	1	Chess	0	0	0	2	0	2
DOSP1021	1	Carrom	0	0	0	2	0	2
DOSP1031	1	Football	0	0	0	2	0	2
DOSP1041	1	Volleyball	0	0	0	2	0	2
DOSP1051	1	Kabaddi	0	0	0	2	0	2
DOSP1061	1	Kho Kho	0	0	0	2	0	2
DOSP1071	1	Table Tennis	0	0	0	2	0	2
DOSP1081	1	Handball	0	0	0	2	0	2
DOSP1091	1	Basketball	0	0	0	2	0	2
DOSP1101	1	Tennis	0	0	0	2	0	2
DOSP1111	1	Throwball	0	0	0	2	0	2

Club Activity Courses								
Course code	**Level**	**Course title**	**L**	**T**	**P**	**S**	**J**	**C**
DOSL1001	1	Club Activity (Participant)	0	0	0	2	0	2
DOSL1011	1	Club Activity (Member of the Club)	0	0	0	2	0	2
DOSL1021	1	Club Activity (Leader of the Club)	0	0	0	2	0	2
DOSL1031	1	Club Activity (Competitor)	0	0	0	2	0	2
Community Service courses								
Course code	**Level**	**Course title**	**L**	**T**	**P**	**S**	**J**	**C**
DOSL1041	1	Community Services - Volunteer	0	0	0	0	2	2
DOSL1051	1	Community Services - Mobilizer	0	0	0	0	2	2

FACULTY CORE (FC)								
Course code	**Level**	**Course title**	**L**	**T**	**P**	**S**	**J**	**C**
CHEM1011	1	Chemistry I	3	0	0	0	0	3
CHEM1031	1	Chemistry II	3	0	0	0	0	3
CSCI1001	1	Basics of Information Technology	3	0	0	0	0	3
CHEM1021	1	Chemistry Lab I	0	0	2	0	0	1
CHEM1051	1	Chemistry III	3	0	0	0	0	3
PHYS1091	1	Biophysics	3	0	0	0	0	3
CHEM1041	1	Chemistry II Lab	0	0	2	0	0	1
PHYS1101	1	Biophysics Lab	0	0	2	0	0	1

Program Core courses for B.Sc. Biochemistry

Course code	**Level**	**Course Title**	**L**	**T**	**P**	**J**	**S**	**C**
BCBI1001	1	Biomolecules	3	0	0	0	0	3
BCBI1011	1	Biochemistry Lab	0	0	0	0	2	1
BCBI1021	1	Protein Chemistry and Enzymology	3	0	0	0	0	3
BCBI1031	1	Protein Chemistry and Enzymology Lab	0	0	2	0	0	1
BCBI2001	2	Metabolism and Bioenergetics	3	0	0	0	0	3
BCBI2011	2	Metabolism and Bioenergetics Lab	0	0	2	0	0	1
BCBI2021	2	Biochemical Techniques	3	0	0	0	0	3
BCBI2031	2	Biochemical Techniques Lab	0	0	2	0	0	1
BCBI2041	2	Molecular Biology	3	0	0	0	0	3
BCBI2051	2	Molecular Biology Lab	0	0	2	0	0	1
BCBI3001	3	Concepts of Genetic Engineering	3	0	0	0	0	3
BCBI3011	3	Genetic Engineering Lab	0	0	2	0	0	1
BCBI3021	3	Clinical Biochemistry	3	0	0	0	0	3
BCBI3031	3	Clinical Biochemistry Lab	0	0	2	0	0	1
BCBI3041	3	Immunology	3	0	0	0	0	3
BCBI3051	3	Immunology Lab	0	0	2	0	0	1

Program Elective courses for **B.Sc. Biochemistry**

Course code	Level	Course Title	L	T	P	J	S	C
BCBI2061#	2	Industrial Biochemistry	3	0	0	0	0	3
BCBI2091#	2	Industrial Biochemistry Lab	0	0	2	0	0	1
BCBI2071#	2	Molecular Cell Biology	3	0	0	0	0	3
BCBI2101#	2	Molecular Cell Biology Lab	0	0	2	0	0	1
BCBI2081#	2	Bioinformatics	3	0	0	0	0	3
BCBI2111#	2	Bioinformatics Lab	0	0	2	0	0	1
BCBI2121*	2	Human Physiology and Nutrition	3	0	0	0	0	3
BCBI2131*	2	Plant Biochemistry	3	0	0	0	0	3
BCBI2141*	2	Genomics and Proteomics	3	0	0	0	0	3
BCBI2151*	2	Genetics	3	0	0	0	0	3
BCBI2161*	2	Nutraceuticals	3	0	0	0	0	3
BCBI2171*	2	Introduction to Nanobiology	3	0	0	0	0	3
BCBI3061^	3	Applied Biochemistry	3	0	0	0	0	3
BCBI3151^	3	Molecular Modeling and Structural Bioinformatics	3	0	0	0	0	3
BCBI3081^	3	Basics of Cancer Biology	3	0	0	0	0	3
BCBI3091^	3	Stem cell Biology	3	0	0	0	0	3
# Opt any ONE course with theory and its lab from the above three sets								
* Opt any TWO courses from above six courses								
^ Opt any TWO courses from the above four courses								
MINOR COURSES TO BE STUDIED UNDER BIOCHEMISTRY*								
Course code	Level	Course Title	L	T	P	J	S	C
BCBI1021	1	Protein Chemistry and Enzymology	3	0	0	0	0	3
BCBI1031	1	Protein Chemistry and Enzymology Lab	0	0	2	0	0	1
BCBI2001	2	Metabolism and Bioenergetics	3	0	0	0	0	3
BCBI2021	2	Biochemical Techniques	3	0	0	0	0	3
BCBI2041	2	Molecular Biology	3	0	0	0	0	3
BCBI2051	2	Molecular Biology Lab	0	0	2	0	0	1
BCBI3001	3	Concepts of Genetic Engineering	3	0	0	0	0	3
BCBI3021	3	Clinical Biochemistry	3	0	0	0	0	3
BCBI3031	3	Clinical Biochemistry Lab	0	0	2	0	0	1
BCBI3041	3	Immunology	3	0	0	0	0	3
*** Offered to other than BSc Biochemistry**								

Minor Courses to Be Studied Under Bioinformatics								
Course code	Level	Course Title	L	T	P	J	S	C
BCBI1081	1	Computational Biology	3	0	0	0	0	3
BCBI1091	1	Computational Biology Lab	0	0	2	0	0	1
CSCI1261	1	Basics of Python Programming	3	0	0	0	0	3
BCBI2241	2	Immunology and Immunoinformatics	3	0	0	0	0	3
CSCI2341	2	Fundamentals of Database Management System	3	0	0	0	0	3
BCBI2251	2	Genomics and Proteomics	3	0	0	0	0	3
BCBI2261	2	Genomics and Proteomics Lab	0	0	2	0	0	1
BCBI3151	3	Molecular Modeling and Structural Bioinformatics	3	0	0	0	0	3
BCBI3161	3	Molecular Modeling and Structural Bioinformatics Lab	0	0	2	0	0	1
BCBI3171	3	Drug Designing	3	0	0	0	0	3

Students pursuing 4th year of the B.Sc. Biochemistry Programme need to choose either Honours or Honours with Research from the following tables respectively.

Honours Courses

Minimum number of credits to be earned is 40, out of which 8 credits must be earned through Minor Enhancement courses.

Minor Enhancement course to be chosen in the specialization the student has studied the Minor.

Course code	Category	Level	Course Title	L	T	P	J	S	C
BCBI4191	PC	4	Metabolic Diseases	4	0	0	0	0	4
BCBI4201	PC	4	Metabolic Diseases Practicals	0	0	4	0	0	2
BCBI4211	PC	4	Clinical Diagnostic Technology	4	0	0	0	0	4
BCBI4221	PC	4	Clinical Diagnostic Technology Practicals	0	0	4	0	0	2
BCBI4231	PC	4	Neuroscience	4	0	0	0	0	4
BCBI3341	PC	3	Neuropsychopharmacology	4	0	0	0	0	4
BCBI4251	PC	4	Advanced Nutritional Biochemistry	4	0	0	0	0	4
BCBI4261	PC	4	Nutritional Biochemistry practicals	0	0	4	0	0	2
BCBI4271	PC	4	Genetics and Epigenetics	4	0	0	0	0	4
BCBI3351	PC	3	Genetics practicals	0	0	4	0	0	2
			Total						**32**

Honours with Research Courses

Minimum number of credits to be earned is 40 out of which 20 credits must be earned through Research Project / Dissertation and 8 credit must be earned through Minor Enhancement course.

Minor Enhancement course to be chosen in the specialization the student has studied the Minor.

Course code	Category	Level	Course Title	L	T	P	J	S	C
BCBI4191	PC	4	Metabolic Diseases	4	0	0	0	0	4
BCBI4211	PC	4	Clinical Diagnostic Technology	4	0	0	0	0	4
DIST4666	FC	4	Dissertation -I	0	0	0	16	0	8
BCBI4231	PC	4	# Neuroscience	4	0	0	0	0	4
BCBI4251	PC	4	# Advanced Nutritional Biochemistry	4	0	0	0	0	4
BCBI4291	PC	4	# Cancer and Nutrition	4	0	0	0	0	4
BCBI2421	PC	2	# Medicinal Plants as Therapeutics	4	0	0	0	0	4
DIST4777	FC	4	Dissertation-II	0	0	0	24	0	12
			Total						**32**
# Opt any ONE course									

Minor Enhancement Courses

Bioinformatics

Course code	Level	Course Title	L	T	P	S	J	C
BCBI4241	400	Statistics for Biology	4	0	0	0	0	4
BCBI4281	400	Omics Technologies	4	0	0	0	0	4

Biotechnology

Course code	Level	Course Title	L	T	P	S	J	C
BTSC4161	400	Genomes and Genomics	4	0	0	0	0	4
BTSC4211	400	Proteins and Proteomics	4	0	0	0	0	4

Chemistry (Opt Any Two Courses)

Course code	Level	Course Title	L	T	P	S	J	C
CHEM4001	400	Advanced Inorganic Chemistry-1	3	0	2	0	0	4
CHEM4011	400	Advanced Organic Chemistry -1	3	0	2	0	0	4
CHEM4021	400	Advanced Physical Chemistry -1	3	0	2	0	0	4
CHEM4031	400	Advanced Analytical Chemistry -1	3	0	2	0	0	4
CHEM4041	400	Advanced Inorganic Chemistry-2	3	0	2	0	0	4
CHEM4051	400	Advanced Organic Chemistry-2	3	0	2	0	0	4
CHEM4061	400	Advanced Physical Chemistry-2	3	0	2	0	0	4

CHEM4071	400	Advanced Analytical Chemistry-2	3	0	2	0	0	4
CHEM4081	400	Medicinal Chemistry	3	0	2	0	0	4
CHEM4131	400	Regulatory affairs and Quality assurance	3	1	0	0	0	4

Mathematics

Course code	Level	Course Title	L	T	P	S	J	C
MATH4521	400	General Operations Research	4	0	0	0	0	4
MATH4421	400	Optimization Techniques and Decision Modelling	4	0	0	0	0	4

Statistics

Course code	Level	Course Title	L	T	P	S	J	C
MATH4431	400	Advanced AI Techniques	4	0	0	0	0	4
MATH4451	400	Visual Analytics and Dashboard Design	4	0	0	0	0	4

Microbiology

Course code	Level	Course Title	L	T	P	S	J	C
MFST4441	400	Microbial Products and Applications	4	0	0	0	0	4
MFST4451	400	Air and Waterborne Diseases	4	0	0	0	0	4

Food Science and Technology

Course code	Level	Course Title	L	T	P	S	J	C
MFST4381	400	Applied Beverage Technology	4	0	0	0	0	4
MFST4431	400	Bioorganic Cultivation of Food Crops	4	0	0	0	0	4

Allocation of credits for 3-year and 4-year B.Sc. Program

	3-year B.Sc. Program		4-year B.Sc. Program (Honours)		4-year B.Sc. Program (Honours with Research)	
Type of Course	Credits	% Of Program (in credits)	Credits	% Of Program (in credits)	Credits	% Of Program (in credits)
University Core	12	10%	12	7.5%	12	7.5%
Faculty Core	18	15%	18	11.25%	38	23.75%
Major Core	32	26%	64	40%	44	25%
Major Electives	16	14%	16	10%	16	12.50%
Program Minor	24	20%	32	20%	32	20%
Open elective	18	15%	18	11.25%	18	11.25%
Total	120	100%	160	100%	160	100%

Course PO Mapping

	PO 1	PO2	PO 3	PO 4	PO5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO4
BCBI 1001 Biomolecules	2							2			
BCBI 1021 Protein Chemistry and Enzymology			3					3			
BCBI 181 Computational Biology		3									
BCBI 2001 Metabolism and Bioenergetics		3						2			
BCBI 2021 Biochemical Techniques		3							3		
BCBI 2061 Industrial Biochemistry						3			2		
BCBI 2071 Molecular Cell Biology	3										2
BCBI 2081 Bioinformatics		3									
BCBI 2041 Molecular Biology					3					3	
BCBI 2121Human Physiology and Nutrition				3				2			
BCBI 2131 Plant Biochemistry				3				2			
BCBI 2141 Genomics and Proteomics		3									
BCBI 2151 Genetics					3					2	
BCBI 2161 Neutraceuticals	1							2			
BCBI 2171 Introduction to Nanobiology		2						1			
BCBI 3001 Concepts of Genetic Engineering					3					3	
BCBI 2251		3									

Genomics and Proteomics											
BCBI 3021 Clinical Biochemistry	3										3
BCBI 3061 Applied Biochemistry					2				2		
BCBI 3151 Molecular Modelling and Structural Bioinformatics		3									
BCBI 3041 Immunology						3					2
BCBI 3081 Basics of Cancer Biology	3										3
BCBI 3091 Stem Cell Biology	2										2
BCBI 3171 Drug Designing		3									

Syllabus

University Core

CSEN1001	IT PRODUCTIVITY TOOLS	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	Familiarity with Computer system and its operation.						

Course Description:

This course introduces all software tools that improve the productivity of a student in enhancing his learning experience with all the activities taken up as part of his coursework.

Course Educational Objectives:

- to impart the skill in preparing technical documents of professional quality using docs, sheets and forms
- to involve the student in preparation of websites, analyzing data and acquaint the student with the skill of processing audio, images, documents etc.

10 hours

List of Experiments:

1. Create a typical document consisting of text, tables, pictures, multiple columns, with different page orientations.
2. Create a technical paper / technical report consisting of table of contents, table of figures, table of tables, bibilography, index, etc.
3. Compose and send customized mail / e-mail using mail-merge.
4. Create / modify a power point presentation with text, multimedia using templates with animation.
5. Create spreadsheet with basic calculations with relative reference, absolute reference and mixed reference methods.
6. Simple report preparation using filtering tool / advanced filtering commands / pivot tables in spreadsheet application.
7. Analyze the results of a examination student wise, teacher wise, course wise, institute-wise.
8. Collecting and consolidating data using collaborative tools like google docs, sheets, forms.
9. Create charts / pictures using online tools like: www.draw.io or smartdraw
10. Create a website of his interest.

Text Books:

1. Katherin Murray, 'Microsoft Office 365 Connect and collaborate virtually anywhere, anytime', Microsoft Press, ISBN: 978-0-7356-5694-9
2. EXCEL 2021 The Comprehensive Beginners to Advanced Users Guide to Master Microsoft Excel 2021. Learn the Essential Functions, New Features, Formulas, Tips and Tricks, and Many More

3. https://drawio-app.com/tutorials/video-tutorials/
   Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics Fourth Edition ISBN-13: 978-1449319274

References

1. https://www.coursera.org/learn/introduction-to-computers-and-office-productivity-software
2. https://www.coursera.org/projects/analyze-data-pivot-tables-crosstabs-google-sheets
3. https://www.coursera.org/learn/excel-advanced#syllabus
4. https://www.coursera.org/learn/how-to-create-a-website
5. https://support.microsoft.com/en-us/office
6. https://www.diagrams.net/
7. https://edu.google.com/

Course Outcomes:

1. Create / alter documents / Technical Paper / Project report with text, pictures, graphs of different styles.
2. Create / modify power point presentations with text, multimedia and to add animation using / creating templates.
3. Perform basic calculations / retrieve data / create pivot tables / chart using a spreadsheet application.
4. Create simple diagrams / charts using online tools like: www.draw.io .
5. Manage documents, presentations, spreadsheets and websites in collaborative mode.

Co-Po Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1					2				1	1	
CO2					2				1	1	
CO3	2	1	1		2				1	1	
CO4					2				1	1	

CO5					2				3	3	

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :06-09-2021 **ACADEMIC COUNCIL:17-09-201**

SDG No. & Statement:4

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

Emotional Intelligence and reasoning skills are essential for achieving inclusive and equitable education and lifelong learning opportunities for oneself and others.

CLAD1001	EMOTIONAL INTELLIGENCE & REASONING SKILLS (SOFT SKILLS 1)	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

Emotional intelligence is a set of skills that are thought to contribute to the appraisal of emotions in oneself and others. It can also help contribute to the effective regulation of emotions as well as feelings (Salovey & Mayer, 1990). In terms of emotional intelligence, self-awareness and self- management have to do with our ability to relate to ourselves. Social awareness and relationship management have to do with our ability to relate to others. Similarly, the ability to solve questions on Analytical Reasoning and Data Sufficiency is a critical area tested in almost all competitive examinations and admission tests. Upon completion, students should be able (1) to deal with their own emotions as well as the emotions of others and relate better with both. Using better knowledge of EI, students will also be able to set more meaningful goals for themselves, choose suitable time management techniques that work best for them and work in teams more effectively. (2) to apply different concepts, ideas, and methods to solve questions in reasoning and data sufficiency

Course Educational Objectives:

- Use EI to relate more effectively to themselves, their colleagues and to others. Apply self-awareness and self-assessment (SWOT) to better understand and manage their own emotions. Apply social awareness to empathize with others and build stronger relationships with others.
- Set meaningful goals based on their strengths and weaknesses and apply time management techniques, such as Q4 organizing to put first things first.
- Manage conflicts and work in teams in an emotionally intelligent manner.
- Solve questions on non-verbal and analytical reasoning, data sufficiency and puzzles

List of Activities & Tasks for Assessment:

Unit	Topics	Hours
1	Self-Awareness & Self-Regulation: Introduction to Emotional Intelligence, *Self-Awareness:* Self-Motivation, Accurate Self-Assessment (SWOT Analysis), Self-Regulation: *Self Control, Trustworthiness & Adaptability*	3

2	Importance, Practising Social Awareness, Building Relationships, Healthy and Unhealthy Relationships, Relationship Management Competencies- Influence, Empathy, Communication, Types of Conflicts, Causes, Conflict Management	3
3	Social Media: Creating a blog, use of messaging applications, creating a website to showcase individual talent, creation of a LinkedIn Profile	2
4	Goal Setting & Time Management: Setting SMART Goals, Time Wasters, Prioritization, Urgent Vs Important, Q2 Organization	3
5	Teamwork: Team Spirit, Difference Between Effective and Ineffective Teams, Characteristics of High Performance Teams, Team Bonding, Persuasion, Team Culture, Building Trust, Emotional Bank Account	4
6	Verbal Reasoning: Introduction, Coding-decoding, Blood relations, Ranking Directions, Group Reasoning	6
7	Analytical Reasoning: Cubes and Dices, Counting of Geometrical figures	3
8	Logical Deduction: Venn diagrams, Syllogisms, Data Sufficiency, Binary logic	4
9	Spatial Reasoning: Shapes, Paper Cutting/Folding, Mirror images, Water images and Rotation of figures	2

References:

1. Verbal Ability & Reading Comprehension by Arun Sharma and Meenakshi Upadhyay
2. Study material for CAT, SAT, GRE, GMAT by TIME, Career Launcher and IMS etc.
3. Quantitative Aptitude by R S Agarwal S Chand Publications
4. Quantitative Aptitude by Pearson Publications

Course Outcomes:

1. Students will be able to relate more effectively to themselves, their colleagues and to others
2. Students will be able to set their short term and long term goals and better manage their time
3. Students will be able to manage conflicts in an emotionally intelligent manner and work in teams effectively
4. Students will be able to solve questions based on non-verbal and analytical reasoning, data sufficiency and puzzle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1		3	3				3				
CO2		3	3				3				
CO3		3	3				3				
CO4	3						3				
CO5											

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :17-09-2021 **ACADEMIC COUNCIL:17-09-201**

SDG No. & Statement:4

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

Emotional Intelligence and reasoning skills are essential for achieving inclusive and equitable education and lifelong learning opportunities for oneself and others.

CLAD1011	LEADERSHIP SKILLS & QUANTITATIVE APTITUDE (SOFT SKILLS 2)	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

Communication Skills is having the ability to convey information to others so that messages are understood, and outcomes delivered. Some essential qualities of Communication Skills include understanding the needs of others, clearly communicating messages, adapting the communication style, and using a range of communication methods. Presentation Skills is having the ability to confidently deliver an engaging message to a group of people which achieves the objectives. Some essential qualities of Presentation Skills include a thorough preparation of content, structuring content logically, managing nerves, engaging your audience, delivering presentation objectives, positively influencing the audience, and responding to audience needs.Tackling questions based on numbers, arithmetic, data interpretation and puzzles requires the application of different rules and concepts of numerical computation, numerical estimation, and data estimation.

Course Educational Objectives:

- Learn and apply, through different individual and group activities, different ideas, and skills to communicate in a positive and impressive manner.
- Apply the goal setting process (based on SWOT) and Q2 organizing for effective time management.
- Apply different concepts in numbers, numerical computation, and numerical estimation to solve questions that often appear in various competitive examinations and admission tests.
- Apply different concepts for tackling questions based on data interpretation, progression and series that are frequently given in various competitive examinations and admission tests.

List of Activities & Tasks for Assessment:

Unit	Topics	Hours
1	Communication Skills: The Communication Process, Elements of Interpersonal Communication, Non-Verbal Communication: Body Language, Posture, Eye Contact, Smile, Tone of Voice, Barriers to Communication. Effective Listening Skills: Active Listening, Passive Listening, Asking Questions, Empathizing, Being Non-Judgmental, Being Open Minded, Mass Communication: Design of Posters, Advertisements, notices, writing formal and informal invitations	5
2	Focus on Audience Needs, focus on the Core Message, Use Body Language and Voice, Start Strongly, Organizing Ideas & Using Visual Aids: SPAM Model, Effective Opening and Closing Techniques, Guy Kawasaki's Rule (10-20-30 Rule), Overcoming Stage Fear, Story Telling	3
3	Problem Solving & Decision Making: Difference Between the Two, Steps in Rational Approach to Problem Solving: Defining the Problem, Identifying the Root Causes, Generating Alternative Solutions, Evaluating and Selecting Solutions, Implementing and Following-Up, Case Studies	3
4	Group Discussion: Understanding GD, Evaluation Criteria, Nine Essential Qualities for Success, Positive and Negative Roles, Mind Mapping, structuring a Response, Methods of Generating Fresh Ideas	4
5	Number Theory: Number System, Divisibility rules, Remainders and LCM & HCF	3
6	Numerical Computation and Estimation - I: Chain Rule, Ratio Proportions, Partnerships & Averages, Percentages, Profit-Loss & Discounts, Mixtures, Problem on Numbers & ages	6
7	Data Interpretation: Interpretation and analysis of data in Tables, Caselets, Line- graphs, Pie-graphs, Boxplots, Scatterplots and Data Sufficiency	3
8	Mental Ability: Series (Number, Letter and Alphanumeric), Analogy (Number, Letter and Alphanumeric) and Classifications	3

References:

1. Verbal Ability & Reading Comprehension by Arun Sharma and Meenakshi Upadhyay
2. Study material for CAT, SAT, GRE, GMAT by TIME, Career Launcher and IMS etc.
3. Quantitative Aptitude by R S Agarwal S Chand Publications
4. Quantitative Aptitude by Pearson Publications

Course Outcomes:

1. Students will be able to communicate 'one-on-one' and 'one-on-many' confidently using both verbal and non-verbal messages and deliver impressive talks/ presentations to a group both with and without the use of PPTs and create posters, advertisements, etc.
2. Students will be able to apply the rational model of problem solving and decision making in their problem solving and decision-making efforts.
3. Students will be able to solve questions based on numbers and arithmetic given in various competitive examinations
4. Students will be able to solve questions based on data interpretation, progressions, and series.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1		3	3				3				
CO2		3	3				3				
CO3	3						2				
CO4	3						2				
CO5											

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :17-09-2021 **ACADEMIC COUNCIL:17-09-2021**

SDG No. & Statement:4

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

Leadership and quantitative aptitude skills are essential skills for achieving inclusive and equitable education and lifelong learning opportunities for oneself and others.

CLAD1021	VERBAL ABILITY & QUANTITATIVE ABILITY (SOFT SKILLS 3)	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

Vocabulary is an important part of verbal ability. An understanding of word formation, prefixes, suffixes, and roots is necessary to remember and use a vast repository of words. Approaching words through word families and other ways of groupings is an effective way of gaining mastery over vocabulary. Understanding and getting acquainted with the different rules and exceptions in the use of grammar and structure, especially from the relevant examination point of view, is crucial to cracking questions given in many competitive tests. Similarly, improving reading comprehension skills and test taking abilities in this area takes time and effort, especially given the fact that most students do not possess strong reading habits. In so far as quantitative aptitude is concerned, students need to develop a strong foundation on the basic mathematical concepts of numerical estimation, geometry, mensuration, data sufficiency, etc. to be able to crack different round 1 tests of major recruiters and admission tests of top Indian and foreign universities.

Course Educational Objectives:

- List and discuss the different word formation methods, word denotation, connotation, collocation, etc. and introduce selected high frequency words, their antonyms, synonyms, etc.
- Apply different advanced reading skills to solve questions based on author's tone, main ideas and sub-ideas, inferences, Para jumbles, etc. that are frequently asked in various competitive exams and admission tests.
- Solve different types of questions based on vocabulary, such as word analogy; structure, grammar, and verbal reasoning; introduce common errors and their detection and correction.
- Solve questions on numerical estimation, mensuration, data sufficiency based on quantitative aptitude. This includes questions on time and work, time and distance, pipes and cisterns, lines and angles, triangles, quadrilaterals, polygons and circles, 2- & 3-dimensional mensuration.

List of Activities & Tasks for Assessment:

1. **Vocabulary Builder:** Understanding Word Formation, Prefixes, Suffixes and Roots, Etymology, Word Denotation, Connotation and Collocation, Synonyms and Antonyms
2. **Reading Comprehension:** Advanced Reading Comprehension: Types of RC passages, Types of Text Structures, Types of RC Questions: Distinguishing Between Major Ideas and Sub Ideas, Identifying the Tone and Purpose of the Author, Reading Between the Lines and Beyond the Lines, Techniques for Answering Different Types of Questions
3. **Para Jumbles:** Coherence and Cohesion, Idea Organization Styles, Concept of Mandatory Pairs and Its Application: Transitional Words, Antecedent-Pronoun Reference, Article Reference, Cause and Effect, Chronological Order, General to Specify, Specify to General, Idea-Example, Idea-Explanation, Etc.
4. **Grammar Usage:** Rules Governing the Usage of Nouns, Pronouns, Adjectives, Adverbs, Conjunctions, Prepositions and Articles
5. **Numerical Computation and Estimation - II:** Time and Work, Pipes and Cisterns, Time and Distance, Problems on Trains, Boats and Streams, Races and Games of Skill, Simple Interest & Compound Interest
6. **Geometry:** Lines and Angles, Triangles, Quadrilaterals & Polygons, and Circles
7. **Mensuration:** 2-Dimensional Mensuration (Triangles, Quadrilaterals and Circles), 3-Dimensional Mensuration (Cubes, Cuboids, Cylinder, Cone, Sphere)

References:

1. Verbal Ability & Reading Comprehension by Arun Sharma and Meenakshi Upadhyay
2. Study material for CAT, SAT, GRE, GMAT by TIME, Career Launcher and IMS etc.
3. Quantitative Aptitude by R S Agarwal S Chand Publications
4. Quantitative Aptitude by Pearson Publications

Course Outcomes:

1. List and discuss word formation methods, selected high frequency words, their antonyms, synonyms, etc.
2. Analyze reading passages and quickly find out the correct responses to questions asked, including para jumbles, by using reading skills like skimming, scanning, reading between the lines, etc.
3. Solve different types of questions based on vocabulary, structure, grammar and verbal reasoning
4. Solve questions on numerical estimation, mensuration, data sufficiency based on quantitative aptitude

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1		2					2				
CO2		2					2				
CO3	3						2				
CO4	3						2				
CO5											

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :17-09-2021 **ACADEMIC COUNCIL:17-09-2021**

SDG No. & Statement:4

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

English language and quantitative aptitude skills are essential skills for achieving inclusive and equitable education and lifelong learning opportunities for oneself and others.

CLAD1031	PRACTICING VERBAL ABILITY & QUANTITATIVE APTITUDE (SOFT SKILLS 4)	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

A sound knowledge of the rules of English grammar, structure and style and its application in detecting errors in writing are important areas of Verbal Ability frequently tested as a part of the written test in many competitive examinations and admission tests of major recruiters and universities respectively. This module focuses on all important areas of grammar and structure commonly asked in major tests, such as GMAT, CAT, XLRI, CRT, etc. Similarly, in the area of Quantitative Aptitude, different kinds of questions are asked from Combinatorics (Permutations & Combinations, Probability], Cryptarithmetic & Modular Arithmetic (Cryptarithmetic, Application of base system (7, 24), Clocks (Base 24), Calendars (Base 7), and Mental Ability (Number series, Letter series & Alpha numeric series, Analogies (Numbers, letters), Classifications, Algebra (Exponents, Logarithms, Problems related to Equations, Special Equations, and Statistics) . This module focuses on all these areas by building on what the students already learnt in their earlier studies.

Course Educational Objectives:

- Apply the rules of grammar to solve questions in Error Detection, Sentence Correction and Sentence Improvement.
- Apply the rules of structure to solve questions in Error Detection, Sentence Correction and Sentence Improvement, Fill-in-blanks and Cloze Passages.
- Explain methods of solving problems in Combinatorics (Permutations & Combinations, Probability], Cryptarithmetic & Modular Arithmetic (Cryptarithmetic, Application of base system (7, 24), Clocks (Base 24), Calendars (Base 7)]
- Explain how to solve questions in Mental Ability (Number series, Letter series & Alpha numeric series, Analogies, Numbers, letters, Classifications] and Algebra (Exponents, Logarithms, Problems related to Equations, Special Equations, Statistics)

List of Activities & Tasks for Assessment:

1. Error Detection: Pronouns, Conjunctions, Prepositions and Articles
2. Error Detection: Tenses and their Uses
3. Sentence Correction: Subject-Verb Agreement, Antecedent-Pronoun Agreement,

Conditional Clauses

4. Sentence Correction: Modifiers (Misplaced and Dangling) & Determiners, Parallelism & Word Order, and Degrees of Comparison
5. Combinatorics: Permutations & Combinations, Probability
6. Crypt arithmetic & Modular Arithmetic: Crypt arithmetic, Application of Base System (7, 24), Clocks (Base 24), Calendars (Base 7)
7. Algebra: Exponents, Logarithms, Word-problems related to equations, Special Equations, Progressions, Statistics

References:

1. Verbal Ability & Reading Comprehension by Arun Sharma and Meenakshi Upadhyay
2. Study material for CAT, SAT, GRE, GMAT by TIME, Career Launcher and IMS etc.
3. Quantitative Aptitude by R S Agarwal S Chand Publications
4. Quantitative Aptitude by Pearson Publications

Course Outcomes:

1. Identify and correct errors in English grammar and sentence construction
2. Identify and correct errors in Structure, Style and Composition
3. Solve problems in Combinatorics, Cryptarithmetic, and Modular Arithmetic
4. Solve problems in Mental Ability and Algebra

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1							3				
CO2							3				
CO3	3						3				
CO4	3						3				
CO5											

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :17-09-2021 **ACADEMIC COUNCIL:17-09-2021**

SDG No. & Statement:4

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

English language and quantitative aptitude skills are essential skills for achieving inclusive and equitable education and lifelong learning opportunities for oneself and others.

CLAD2001	PREPARATION FOR CAMPUS PLACEMENT - 1 (SOFT SKILLS 5A)	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

The course addresses all relevant areas related to campus placements and readies them to ace their upcoming/ ongoing recruitment drives. Specifically, it focuses on students' career preparedness, interview skills, test preparedness, etc.

Course Educational Objectives:

Prepare the students for their upcoming/ ongoing campus recruitment drives.

List of Activities & Tasks for Assessment:

1. Career Preparedness: Resume & Cover Letter Writing, Interview Skills: Elevator Pitch, Making the First Impression, Being Other-Oriented, Being Positive and Curious, communicating with Confidence and Poise, Frequently Asked Questions & How to Answer Them, Pitfalls to Avoid, Etc. Etiquette: Hygiene, Courtesy, Culture differences, Workplace, use of cell phone, Profanity, Slang, Protocol.
2. Verbal Ability: Practicing Reading Comprehension, Error Detection, Sentence Completion, MCQs, FIBs, Para jumbles, Cloze Test, Critical Reasoning.
3. Quantitative Aptitude: Number Systems, Algebra, Geometry, Data Handling, Data Sufficiency, Word Problems
4. Reasoning: Logical and Verbal Reasoning

References:

1. Verbal Ability & Reading Comprehension by Arun Sharma and Meenakshi Upadhyay
2. Study material for CAT, SAT, GRE, GMAT by TIME, CareerLauncher and IMS etc.
3. Quantitative Aptitude by R S Agarwal S Chand Publications

4. Quantitative Aptitude by Pearson Publications

Course Outcomes:

1. Write a power resume and covering letter
2. Answer interview questions with confidence and poise
3. Exhibit appropriate social mannerisms in interviews
4. Solve placement test questions on verbal ability, quantitative aptitude and reasoning

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1		1					3				
CO2		3					3				
CO3	3						3				
CO4	3						3				
CO5											

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :17-09-2021 **ACADEMIC COUNCIL:17-09-2021**

SDG No. & Statement:4

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

Quantitative aptitude, reasoning, verbal and language skills practiced during the preparation for campus placement tests provide essential skills for achieving inclusive and equitable education and lifelong learning opportunities for oneself and others.

CLAD2011	PREPARATION FOR HIGHER EDUCATION (GRE/ GMAT)-1 (SOFT SKILLS 5B)	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

The course offers a special track for students who aspire to go abroad in pursuit of their higher education for which a GRE/ GMAT score is a prerequisite. It covers all four topical areas of these tests and includes fully solved mock tests as well.

Course Educational Objectives:

- Prepare the students to solve questions from all four broad areas of GRE/ GMAT
- Orient the students for GRE/ GMAT through mock tests

List of Activities & Tasks for Assessment:

1. Verbal Reasoning: Reading Comprehension, Sentence Equivalence, Text Completion, Sentence Correction, Critical Reasoning
2. Quantitative Reasoning: Arithmetic, Algebra, Geometry, Data Analysis
3. Analytical Writing Assessment: Issue/ Argument
4. Integrated Reasoning

References:

1. Verbal Ability & Reading Comprehension by Arun Sharma and Meenakshi Upadhyay
2. Study material for CAT, SAT, GRE, GMAT by TIME, CareerLauncher and IMS etc.
3. Quantitative Aptitude by R S Agarwal S Chand Publications
4. Quantitative Aptitude by Pearson Publications

Course Outcomes:

1. Solve questions from all four broad areas of GRE/ GMAT
2. Practice answering several mock tests

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3			2			3				
CO2	3			2			3				
CO3											
CO4											
CO5											

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :17-09-2021 **ACADEMIC COUNCIL:17-09-2021**

SDG No. & Statement:4

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

Quantitative aptitude, reasoning, verbal and language skills practiced during the preparation for GRE/GMAT tests provide essential skills for achieving inclusive and equitable education and lifelong learning opportunities for oneself and others.

CLAD2021	PREPARATION FOR CAT/ MAT – 1 (SOFT SKILLS 5C)	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

The course offers a special track for UG students who aspire to go for higher education in business management in India for which cracking CAT/ MAT/ other related test is mandatory. It covers all four topical areas of these tests and includes fully solved mock tests as well.

Course Educational Objectives:

- Prepare the students to solve questions from all four relevant areas of CAT/ XAT/ MAT, etc.
- Orient the students for CAT/ XAT, etc. through mock tests

List of Activities & Tasks for Assessment:

1. Quantitative Ability: Arithmetic, Algebra, Geometry, Mensuration, Calculus, Trigonometry
2. Data Interpretation: Data Interpretation and Data Sufficiency
3. Logical Reasoning: Data Management, Deductions, Verbal Reasoning and Non- Verbal Reasoning
4. Verbal Ability: Critical Reasoning, Sentence Correction, Para Completion, Para Jumbles, Reading Comprehension

References:

1. Verbal Ability & Reading Comprehension by Arun Sharma and Meenakshi Upadhyay
2. Study material for CAT, SAT, GRE, GMAT by TIME, Career Launcher and IMS etc.
3. Quantitative Aptitude by R S Agarwal S Chand Publications
4. Quantitative Aptitude by Pearson Publications

Course Outcomes:

1. Solve questions from all four relevant areas of CAT/ MAT as listed above

2. Practice test-cracking techniques through relevant mock tests

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3			2			3				
CO2	3			2			3				
CO3											
CO4											
CO5											

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :17-09-2021 **ACADEMIC COUNCIL:17-09-2021**

SDG No. & Statement:4

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

Quantitative aptitude, reasoning, verbal and language skills practiced during the preparation for CAT/ MAT tests provide essential skills for achieving inclusive and equitable education and lifelong learning opportunities for oneself and others.

CLAD2031	PREPARATION FOR CAMPUS PLACEMENT-2 (SOFT SKILLS 6A)	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course builds on the previous course and focuses on all four major areas of campus placements, including career preparedness, mock interviews, verbal ability, quantitative aptitude, and logical reasoning.

Course Educational Objectives:

- To comprehensively prepare all eligible and aspiring students for landing their dream jobs.
- To sharpen the test-taking skills in all four major areas of all campus drives

List of Activities & Tasks for Assessment:

1. Career Preparedness II: Mock Interviews, Feedback and Placement Readiness
2. Verbal Ability II: Practising Reading Comprehension, Error Detection, Sentence Completion, MCQs, FIBs, Para jumbles, Cloze Test, Critical Reasoning
3. Quantitative Aptitude II: Number Systems, Algebra, Geometry, Data Handling, Data Sufficiency, Word Problems
4. Reasoning II: Logical and Verbal Reasoning

References:

1. Verbal Ability & Reading Comprehension by Arun Sharma and Meenakshi Upadhyay
2. Study material for CAT, SAT, GRE, GMAT by TIME, CareerLauncher and IMS etc.
3. Quantitative Aptitude by R S Agarwal S Chand Publications
4. Quantitative Aptitude by Pearson Publications

Course Outcomes:

1. Demonstrate career preparedness and confidence in tackling campus interviews
2. Solve placement test questions of a higher difficulty level in verbal ability, quantitative aptitude and logical reasoning.

3. Practice test-taking skills by solving relevant questions accurately and within time.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1		3	3				3				
CO2							3				
CO3							3				
CO4											
CO5											

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :17-09-2021 **ACADEMIC COUNCIL:17-09-2021**

SDG No. & Statement:4

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

Quantitative aptitude, reasoning, verbal and language skills practiced during the preparation for campus placement tests provide essential skills for achieving inclusive and equitable education and lifelong learning opportunities for oneself and others.

CLAD2041	PREPARATION FOR HIGHER EDUCATION (GRE/GMAT)-2 (SOFT SKILLS 6B)	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

The course offers a special track for students who aspire to go abroad in pursuit of their higher education for which a GRE/ GMAT score is a prerequisite. It covers all four topical areas of these tests at a higher difficulty-level and includes fully solved mock tests as well.

Course Educational Objectives:

- Prepare the students to solve higher level questions from all four broad areas of GRE/ GMAT
- Orient the students for GRE/ GMAT through mock tests

List of Activities & Tasks for Assessment:

1. Verbal Reasoning II: Reading Comprehension, Sentence Equivalence, Text Completion, Sentence Correction, Critical Reasoning
2. Quantitative Reasoning II: Arithmetic, Algebra, Geometry, Data Analysis
3. Analytical Writing Assessment II: Issue/ Argument
4. Integrated Reasoning II

References:

1. Verbal Ability & Reading Comprehension by Arun Sharma and Meenakshi Upadhyay
2. Study material for CAT, SAT, GRE, GMAT by TIME, CareerLauncher and IMS etc.
3. Quantitative Aptitude by R S Agarwal S Chand Publications
4. Quantitative Aptitude by Pearson Publications

Course Outcomes:

1. Solve higher level questions from all four broad areas of GRE/ GMAT
2. Practice answering several mock tests

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	2						3				
CO2	2						3				
CO3											
CO4											
CO5											

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :17-09-2021 **ACADEMIC COUNCIL:17-09-2021**

SDG No. & Statement:4

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

Quantitative aptitude, reasoning, verbal and language skills practiced during the preparation for GRE/GMAT tests provide essential skills for achieving inclusive and equitable education and lifelong learning opportunities for oneself and others.

CLAD2051	PREPARATION FOR CAT/ MAT – 2 (SOFT SKILLS 6C)	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

The course offers a special track for UG students who aspire to go for higher education in business management in India for which cracking CAT/ MAT/ other related test is mandatory. It covers all four topical areas of these tests at a higher level of difficulty and includes fully solved mock tests as well.

Course Educational Objectives:

- Prepare the students to solve all types of questions from all four relevant areas of CAT/ XAT/ MAT, etc.

List of Activities & Tasks for Assessment:

1. Quantitative Ability II: Arithmetic, Algebra, Geometry, Mensuration, Calculus, Trigonometry
2. Data Interpretation II: Data Interpretation and Data Sufficiency
3. Logical Reasoning II: Data Management, Deductions, Verbal Reasoning and Non-Verbal Reasoning
4. Verbal Ability II: Critical Reasoning, Sentence Correction, Para Completion, Para Jumbles, Reading Comprehension

References:

1. Verbal Ability & Reading Comprehension by Arun Sharma and Meenakshi Upadhyay
2. Study material for CAT, SAT, GRE, GMAT by TIME, CareerLauncher and IMS etc.
3. Quantitative Aptitude by R S Agarwal S Chand Publications
4. Quantitative Aptitude by Pearson Publications

Course Outcomes:

1. Solve higher difficulty level questions from all four relevant areas of CAT/ MAT as listed above

2. Practice test-cracking techniques through relevant mock tests

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	2			2			3				
CO2	2			2			3				
CO3											
CO4											
CO5											

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :17-09-2021 **ACADEMIC COUNCIL:17-09-2021**

SDG No. & Statement:4

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

Quantitative aptitude, reasoning, verbal and language skills practiced during the preparation for CAT/ MAT tests provide essential skills for achieving inclusive and equitable education and lifelong learning opportunities for oneself and others.

DOSL1001	CLUB ACTIVITY – PARTICIPANT	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course recognizes student participation in multiple activities organized by various student organizations that pursue specific co-curricular and extra-curricular interests. These activities allow students to engage in and identify and pursue their personal interests and hobbies.

Course Educational Objectives:

- Create opportunities for students to participate in a variety of non-academic experiences
- Interact with and learn from peers in a setting without an external performance pressure
- Allow exploration of interesting activities and reflection about these experiences
- Learn to manage time effectively

List of Student Club Activities:

1. Music (vocals, instruments, technical, recording, mixing, production, management)
2. Dance (Indian classical, western, jazz, latin, contemporary, folk, production, event management)
3. Theatre (classical, experimental, one-act, street, production, direction, casting, etc.)
4. Arts (fine arts, painting, calligraphy, sketching, caricaturing, etc)
5. Craft (origami, model making, sculpture, pottery, etc)
6. Cooking (home-style, baking, confectionery, Indian, intercontinental, etc.)
7. Graffiti (street, mural, collage, multi media, etc)
8. Workshops, quizzes, debates, elocution, etc
9. Filmmaking (adventure, drama, film appreciation, documentary, etc)
10. Photography (conventional, immersive (360), landscape, portrait, technical, editing, etc.)
11. College Fests

12. Designing (graphic design, landscape, interior, etc)
13. Competitive coding
14. Recreational sports activities
15. Other club activities organized by student clubs

List of Activities:

1. Participation in various club-based activities
2. Weekly reflection paper
3. Portfolio (on social media using an Instagram account)
4. Two learning papers (one per semester)

Textbooks:

1. Small move: big Change (Caroline Arnold)
2. How to Win at College: Surprising Secrets for Success from the Country's Top Students (Cal Newport)

References:

1. Making the most of college: Students speak their minds (author - Richard Light)
2. Failing Forward: Turning Mistakes into Stepping Stones for Success (John C Maxwell)
3. The Last Lecture (Randy Pausch)
4. Lean in (Sheryl Sandberg)
5. YouTube- Introduction to various club activities

Course Outcomes:

Upon successful completion of the course, student will be able to

1. Identify personal interest areas
2. Learn from diverse perspectives and experiences
3. Gain exposure to various activities and opportunities for extra-curicular activities
4. Learn to manage time effectively
5. gain confidence

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	2		2				
CO2	3		3		2		2				
CO3		3	2		3	2					
CO4		3	3		2		3				
CO5	3		3		2		3				

Note: 1 - Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

This course recognizes student participation in non-academic events and activities which focus on inclusive partnerships and collaborations with all stakeholders by using all sustainable means to promote lifelong learning.

DOSL1011	CLUB ACTIVITY – MEMBER OF THE CLUB	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course encourages and acknowledges student members' work in organizing events and activities organized by various student organizations that pursue specific co-curricular and extra- curricular interests. These activities allow students to actively learn from the process of conceptualizing and organizing such activities as part of a team.

Course Educational Objectives:

- Create opportunities for students to learn from organizing club activities
- Learn teamwork, leadership, planning and management of events and activities
- Learn to appreciate multiple perspectives, cultures, and individual capabilities
- Learn to manage time effectively

List of Student Club Activities:

1. Music (vocals, instruments, technical, recording, mixing, production, management)
2. Dance (Indian classical, western, jazz, latin, contemporary, folk, production, event management)
3. Theatre (classical, experimental, one-act, street, production, direction, casting, etc.)
4. Arts (fine arts, painting, calligraphy, sketching, caricaturing, etc)
5. Craft (origami, model making, sculpture, pottery, etc)
6. Cooking (home-style, baking, confectionery, Indian, intercontinental, etc.)
7. Graffiti (street, mural, collage, multi media, etc)
8. Workshops, quizzes, debates, elocution, etc
9. Filmmaking (adventure, drama, film appreciation, documentary, etc)
10. Photography (conventional, immersive (360), landscape, portrait, technical, editing, etc.)
11. College Fests
12. Designing (graphic design, landscape, interior, etc)
13. Competitive coding
14. Recreational sports activities

15. Other club activities organized by student clubs

List of Activities:

1. Be a member of a club and organize activities in that particular interest area
2. Learn from diverse perspectives and experiences
3. Learn to design and execute extra-curricular activities
4. Develop management skills through hands on experience
5. Explore different managerial roles and develop competencies

Textbooks:

1. Small move: big Change (Caroline Arnold)
2. How to Win at College: Surprising Secrets for Success from the Country's Top Students (Cal Newport)

References:

1. Making the most of college: Students speak their minds (author - Richard Light)
2. Failing Forward: Turning Mistakes into Stepping Stones for Success (John C Maxwell)
3. The Last Lecture (Randy Pausch)
4. Lean in (Sheryl Sandberg)
5. Youtube- Introduction to various club activities

Course Outcomes:

Upon successful completion of the course, student will be able to

- Be a member of a club and organize activities in that particular interest area
- Learn from diverse perspectives and experiences
- Learn to design and execute extra-curricular activities
- Develop management skills through hands on experience
- Explore different managerial roles and develop competencies

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	2		2				
CO2	3		3		2		2				
CO3		3	2		3	2					
CO4		3	3		2		3				
CO5	3		3		2		3				

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:

SDG 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
SDG17 : Strengthen the means of implementation and revitalize the global partnership for sustainable development

SDG Justification:

This course recognizes student participation in community service endeavours focussing on sustainable development, service to communities. This allows students to develop empathy, citizenship behaviour and inclusive community values.

DOSL1021	CLUB ACTIVITY – LEADER OF THE CLUB	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course encourages and recognizes student members' work in leading the student organizations through various leadership roles. As leaders they work not just to organize events and activities in specific co-curricular and extra-curricular interests, but also lead the teams that form the core members of the clubs. These activities allow students to learn and practice leadership and management skills through real world experience.

Course Educational Objectives:

- Create opportunities for students to learn from organizing club activities
- Learn teamwork, leadership, planning and management of events and activities
- Learn to appreciate multiple perspectives, cultures, and individual capabilities
- Learn to manage time effectively

List of Student Club Activities:

1. Music (vocals, instruments, technical, recording, mixing, production, management)
2. Dance (Indian classical, western, jazz, latin, contemporary, folk, production, event management)
3. Theatre (classical, experimental, one-act, street, production, direction, casting, etc.)
4. Arts (fine arts, painting, calligraphy, sketching, caricaturing, etc)
5. Craft (origami, model making, sculpture, pottery, etc)
6. Cooking (home-style, baking, confectionery, Indian, intercontinental, etc.)
7. Graffiti (street, mural, collage, multimedia, etc)
8. Workshops, quizzes, debates, elocution, etc
9. Filmmaking (adventure, drama, film appreciation, documentary, etc)
10. Photography (conventional, immersive (360), landscape, portrait, technical, editing, etc.)
11. College Fests
12. Designing (graphic design, landscape, interior, etc)

13. Competitive coding
14. Recreational sports activities
15. Other club activities organized by student clubs

List of Activities:

1. Be the leader of the club and implement the charter, vision and mission of the club
2. Learn from diverse perspectives and experiences
3. Learn to lead the team, design and execute extra-curricular activities
4. Develop management skills through hands on experience
5. Explore different managerial roles and develop competencies

Textbooks:

1. Small move: big Change (Caroline Arnold)
2. How to Win at College: Surprising Secrets for Success from the Country's Top Students (Cal Newport)

References:

1. Making the most of college: Students speak their minds (author - Richard Light)
2. Failing Forward: Turning Mistakes into Stepping Stones for Success (John C Maxwell)
3. The Last Lecture (Randy Pausch)
4. Lean in (Sheryl Sandberg)
5. Youtube- Introduction to various club activities

Course Outcomes:

Upon successful completion of the course, student will be able to

- Be the leader of the club and implement the charter, vision and mission of the club
- Learn from diverse perspectives and experiences
- Learn to lead the team, design and execute extra-curricular activities
- Develop management skills through hands on experience
- Explore different managerial roles and develop competencies

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	2		2				
CO2	3		3		2		2				
CO3		3	2		3	2					

CO4		3	3		2		3				
CO5	3		3		2		3				

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:

SDG 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
SDG17 : Strengthen the means of implementation and revitalize the global partnership for sustainable development

SDG Justification:

This course recognizes student participation in community service endeavours focussing on sustainable development, service to communities. This allows students to develop empathy, citizenship behaviour and inclusive community values.

DOSL1031	CLUB ACTIVITY – COMPETITOR	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course encourages and recognizes student members' work in leading the student organizations through various leadership roles. As leaders they work not just to organize events and activities in specific co-curricular and extra-curricular interests, but also lead the teams that form the core members of the clubs. These activities allow students to learn and practice leadership and management skills through real world experience.

Course Educational Objectives:

- Create opportunities for students to learn from organizing club activities
- Learn teamwork, leadership, planning and management of events and activities
- Learn to appreciate multiple perspectives, cultures, and individual capabilities
- Learn to manage time effectively

List of Student Club Activities:

1. Music (vocals, instruments, technical, recording, mixing, production, management)
2. Dance (Indian classical, western, jazz, latin, contemporary, folk, production, event management)
3. Theatre (classical, experimental, one-act, street, production, direction, casting, etc.)
4. Arts (fine arts, painting, calligraphy, sketching, caricaturing, etc)
5. Craft (origami, model making, sculpture, pottery, etc)
6. Cooking (home-style, baking, confectionery, Indian, intercontinental, etc.)
7. Graffiti (street, mural, collage, multimedia, etc)
8. Workshops, quizzes, debates, elocution, etc
9. Filmmaking (adventure, drama, film appreciation, documentary, etc)
10. Photography (conventional, immersive (360), landscape, portrait, technical, editing, etc.)
11. College Fests

12. Designing (graphic design, landscape, interior, etc)
13. Competitive coding
14. Recreational sports activities
15. Other club activities organized by student clubs

List of Activities:

1. Be the leader of the club and implement the charter, vision and mission of the club
2. Learn from diverse perspectives and experiences
3. Learn to lead the team, design and execute extra-curicular activities
4. Develop management skills through hands on experience
5. Explore different managerial roles and develop competencies

Textbooks:

1. Small move: big Change (Caroline Arnold)
2. How to Win at College: Surprising Secrets for Success from the Country's Top Students (Cal Newport)

References:

1. Making the most of college: Students speak their minds (author - Richard Light)
2. Failing Forward: Turning Mistakes into Stepping Stones for Success (John C Maxwell)
3. The Last Lecture (Randy Pausch)
4. Lean in (Sheryl Sandberg)
5. Youtube- Introduction to various club activities

Course Outcomes:

Upon successful completion of the course, student will be able to

1. Be the leader of the club and implement the charter, vision and mission of the club
2. Learn from diverse perspectives and experiences
3. Learn to lead the team, design and execute extra-curricular activities
4. Develop management skills through hands on experience
5. Explore different managerial roles and develop competencies

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	2		2				
CO2	3		3		2		2				
CO3		3	2		3	2					
CO4		3	3		2		3				
CO5	3		3		2		3				

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:

SDG 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
SDG17 : Strengthen the means of implementation and revitalize the global partnership for sustainable development

SDG Justification:

This course recognizes student participation in community service endeavours focussing on sustainable development, service to communities. This allows students to develop empathy, citizenship behaviour and inclusive community values.

DOSL1041	COMMUNITY SERVICES - VOLUNTEER	L	T	P	S	J	C
		0	0	0	0	2	2
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course recognizes student participation in Community service activities organized by various student organizations and other Government and non-government organizations that exist for providing service to communities. These activities allow students to develop empathy, citizenship behaviour and community values.

Course Educational Objectives:

- To help students develop empathy and citizenship behavior
- Enable students to develop an altruistic attitude and community development sensibility
- Allow exploration of community service activities and reflect about these experiences
- Learn to work in small and large teams for achieving community objectives

List of Community Service Activities:

1. Community Health Services
2. Swachh Bharat Abhiyan and other Cleanliness drives
3. Tree Plantation and similar environmental conservation initiatives
4. Rain water harvesting awareness and implementation
5. Fundraising and visits to Orphanages, Old-age homes, etc.
6. Health and disease awareness programs
7. Working with NGOs
8. Disaster mitigation and management training and relief work
9. Rural Upliftment projects
10. Campus awareness and action projects (cleanliness, anti-ragging, blood donation, etc)
11. Community investigations and surveys for development research
12. Educational support for underprivileged (remedial classes, coaching, training, etc)
13. Service camps

14. Advocacy and information literacy initiatives
15. Other activities serving local communities

List of Activities:

1. Participation in various community service activities
2. Weekly reflection paper
3. Portfolio (on social media using an instagram account)
4. Two learning papers (one per semester)

Text Books:

1. Soul of a citizen: living with conviction in Challenging times (author: Paul Rogat Loeb)
2. Community Services intervention: Vera Lloyd

References:

1. A path appears: Transforming lives, creating opportunities (Nicholas Kristof and Sheryl WuDunn)
2. The story of My Experiments with Truth (author: M. K. Gandhi)

Course Outcomes:

1. Experience of volunteering in a variety of Community service activities
2. Gaining empathy for lesser privileged sections of society by experience
3. Understanding the process of generating community awareness
4. Understanding Disaster management and relief through training and experience
5. Developing environmental and sustainability awareness

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3					2				
CO2		3	3				2				
CO3				3	3	2	2				
CO4		3	3								
CO5	3		3				3				

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:

SDG 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
SDG17 : Strengthen the means of implementation and revitalize the global partnership for sustainable development

SDG Justification:

This course recognizes student participation in community service endeavours focussing on sustainable development, service to communities. This allows students to develop empathy, citizenship behaviour and inclusive community values.

DOSL1051	COMMUNITY SERVICES - MOBILIZER	L	T	P	S	J	C
		0	0	0	0	2	2
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course recognizes student leadership in mobilizing community service activities as members of various student organizations or other Government and non-government organizations that exist for providing service to communities. These activities allow students to develop leadership, management skills, empathy, citizenship behavior and community values.

Course Educational Objectives:

- To help students understand leadership in a community environment
- Enable students to develop an altruistic attitude and community development sensibility
- Allow deep understanding of community service through practical experience
- Learn to lead small and large teams for achieving community objectives

List of Community Service Activities:

1. Community Health Services
2. Swachh Bharat Abhiyan and other Cleanliness drives
3. Tree Plantation and similar environmental conservation initiatives
4. Rain water harvesting awareness and implementation
5. Fundraising and visits to Orphanages, Old-age homes, etc.
6. Health and disease awareness programs
7. Working with NGOs
8. Disaster mitigation and management training and relief work
9. Rural Upliftment projects
10. Campus awareness and action projects (cleanliness, anti-ragging, blood donation, etc)
11. Community investigations and surveys for development research
12. Educational support for underprivileged (remedial classes, coaching, training, etc)
13. Service camps
14. Advocacy and information literacy initiatives

15. Other activities serving local communities

List of Activities:

1. Organizing and leading teams in various community service activities
2. Fortnightly reflection paper
3. Portfolio (on social media using an nstagram account)
4. Two learning papers (one per semester)

Textbooks:

1. Soul of a citizen: living with conviction in Challenging times (author: Paul Rogat Loeb)
2. Community Services intervention: Vera Lloyd

References:

1. A path appears: Transforming lives, creating opportunities (Nicholas Kristof and SherylWuDunn)
2. The story of My Experiments with Truth (author: M. K. Gandhi)
3. List of student run and other Government and non- government community service organizations

Course Outcomes:

1. Experience of mobilizing and executing Community service activities
2. Providing opportunities for community service volunteering for other fellow students
3. Understanding the process of mobilizing cash, kind and volunteer support
4. Building leadership and management skills
5. Building empathy and citizenship behavior

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	3					2				
CO2		3	3				2				
CO3				3	3	2	2				
CO4		3	3								
CO5	3		3				3				

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:

SDG 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
SDG17 : Strengthen the means of implementation and revitalize the global partnership for sustainable development

SDG Justification:

This course recognizes student participation in community service endeavours focussing on sustainable development, service to communities. This allows students to develop empathy, citizenship behaviour and inclusive community values.

DOSP1001	BADMINTON	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course provides instruction and the opportunity for participation in sports and physical fitness activities. Skills, strategies, rules, and personal wellness goals are included as appropriate. This course will provide students with an understanding of the fundamental concepts of the physiological functions and training principles associated with the chosen sport.

Course Educational Objectives:

- Understand training principles used in the sport
- Demonstrate knowledge of the game in a recreational /competitive play setting
- Organize an event around the sport
- Demonstrate concepts of warm up, game conditioning, training plans

List of Activities:

1. Watch a sport documentary / training video / game history
2. On field coaching and demonstration session
3. Guided practice and play
4. Event management & game officiating
5. Friendly competitions and structured matches

Instructional Plan:

1. Introduction to Badminton - History and development
2. Rules of the Game, Play Area & dimensions
3. Fundamental Skills - Badminton: Grips - Racket, shuttle
4. Sports Specific fitness and warmup drills
5. Stances and footwork
6. Badminton Gameplay: Service, Forehand, Backhand
7. Preparatory Drills and Fun Games
8. Game Variations: Singles/ Doubles/ Mixed

References:

1. Handbook of the Badminton World Federation (BWF)

Course Outcomes:

1. Learn to play Badminton
2. Understanding of the fundamental concepts such as rules of play, game variations
3. Understanding of the governing structure and administration of the sport
4. Understand the event management of the sport
5. Apply sport concepts into an active physical lifestyle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2				3				
CO2							2				
CO3							2				
CO4		3	3		2		2				
CO5				3	2		3				

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:4

Good Health and Well-being: Ensure healthy lives and promote well-being for all at all ages.

SDG Justification:

The nature of the course facilitates students to engage in various forms of fitness activities and sports-related movements that work on their overall health and wellness. The course focuses on inculcating active living as a lifestyle by making sports fun, engaging and meaningful.

DOSP1011	CHESS	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course provides instruction and the opportunity for participation in sports and physical fitness activities. Skills, strategies, rules, and personal wellness goals are included as appropriate. This course will provide students with an understanding of the fundamental concepts of the physiological functions and training principles associated with the chosen sport.

Course Educational Objectives:

- Understand training principles used in the sport
- Demonstrate knowledge of the game in a recreational /competitive play setting
- Organize an event around the sport
- Demonstrate concepts of warm up, game conditioning, training plans

List of Activities:

1. Watch a sport documentary / training video / game history
2. On field coaching and demonstration session
3. Guided practice and play
4. Event management & game officiating
5. Friendly competitions and structured matches

Instructional Plan:

1. Introduction to Chess - History and development
2. Rules of the Game, Play Area & dimensions
3. Fundamental Skills - Chess: Pieces & functions, basic play
4. Chess board moves & terminology
5. Chess Gameplay: Openings, castling, strategies & tactics
6. Preparatory Drills and Fun Games
7. Game Variations & Officiating

References:

1. International Chess Federation (FIDE) Handbook

Course Outcomes:

1. Learn to play Chess
2. Understanding of the fundamental concepts such as rules of play, game variations
3. Understanding of the governing structure and administration of the sport
4. Understand the event management of the sport
5. Apply sport concepts into an active physical lifestyle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2				3				
CO2							2				
CO3							2				
CO4		3	3		2		2				
CO5				3	2		3				

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:4

Good Health and Well-being: Ensure healthy lives and promote well-being for all at all ages.

SDG Justification:

The nature of the course facilitates students to engage in various forms of fitness activities and sports-related movements that work on their overall health and wellness. The course focuses on inculcating active living as a lifestyle by making sports fun, engaging and meaningful.

DOSP1021	CARROM	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course provides instruction and the opportunity for participation in sports and physical fitness activities. Skills, strategies, rules, and personal wellness goals are included as appropriate. This course will provide students with an understanding of the fundamental concepts of the physiological functions and training principles associated with the chosen sport.

Course Educational Objectives:

- Understand training principles used in the sport
- Demonstrate knowledge of the game in a recreational /competitive play setting
- Organize an event around the sport
- Demonstrate concepts of warm up, game conditioning, training plans

List of Activities:

1. Watch a sport documentary / training video / game history
2. On field coaching and demonstration session
3. Guided practice and play
4. Event management & game officiating
5. Friendly competitions and structured matches

Instructional Plan:

1. Introduction to Carrom - History and development
2. Rules of the Game, Board components & dimensions
3. Fundamental Skills - Carrom: - Striking
4. Gameplay – General
5. Preparatory Drills and Fun Games
6. Game Variations: Singles/ Doubles/ Mixed
7. Preparatory Drills and Fun Games

References:

1. Indian Carrom Federation Handbook - Laws

Course Outcomes:

1. Learn to play Carrom
2. Understanding of the fundamental concepts such as rules of play, game variations
3. Understanding of the governing structure and administration of the sport
4. Understand the event management of the sport
5. Apply sport concepts into an active physical lifestyle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2				3				
CO2							2				
CO3							2				
CO4		3	3		2		2				
CO5				3	2		3				

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:4

Good Health and Well-being: Ensure healthy lives and promote well-being for all at all ages.

SDG Justification:

The nature of the course facilitates students to engage in various forms of fitness activities and sports-related movements that work on their overall health and wellness. The course focuses on inculcating active living as a lifestyle by making sports fun, engaging and meaningful.

DOSP1031	FOOTBALL	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course provides instruction and the opportunity for participation in sports and physical fitness activities. Skills, strategies, rules, and personal wellness goals are included as appropriate. This course will provide students with an understanding of the fundamental concepts of the physiological functions and training principles associated with the chosen sport.

Course Educational Objectives:

- Understand training principles used in the sport
- Demonstrate knowledge of the game in a recreational /competitive play setting
- Organize an event around the sport
- Demonstrate concepts of warm up, game conditioning, training plans

List of Activities:

1. Watch a sport documentary / training video / game history
2. On field coaching and demonstration session
3. Guided practice and play
4. Event management & game officiating
5. Friendly competitions and structured matches

Instructional Plan:

1. Introduction to Football - History and development
2. Rules of the Game, Play Area & dimensions
3. Fundamental Skills - Kicking, heading, ball control, Keeping
4. Movement, throwins, tackling, defense, scoring, defense
5. Gameplay- Formations, passing, FKs, CKs, PK, tactics
6. Preparatory Drills and Fun Games
7. Game Variations: Small sided games, 7v7, 11v11

References:

1. FIFA Laws of the Game

Course Outcomes:

1. Learn to play Football
2. Understanding of the fundamental concepts such as rules of play, game variations
3. Understanding of the governing structure and administration of the sport
4. Understand the event management of the sport
5. Apply sport concepts into an active physical lifestyle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2				3				
CO2							2				
CO3							2				
CO4		3	3		2		2				
CO5				3	2		3				

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:4

Good Health and Well-being: Ensure healthy lives and promote well-being for all at all ages.

SDG Justification:

The nature of the course facilitates students to engage in various forms of fitness activities and sports-related movements that work on their overall health and wellness. The course focuses on inculcating active living as a lifestyle by making sports fun, engaging and meaningful.

DOSP1041	VOLLEYBALL	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course provides instruction and the opportunity for participation in sports and physical fitness activities. Skills, strategies, rules, and personal wellness goals are included as appropriate. This course will provide students with an understanding of the fundamental concepts of the physiological functions and training principles associated with the chosen sport.

Course Educational Objectives:

- Understand training principles used in the sport
- Demonstrate knowledge of the game in a recreational /competitive play setting
- Organize an event around the sport
- Demonstrate concepts of warm up, game conditioning, training plans

List of Activities:

1. Watch a sport documentary / training video / game history
2. On field coaching and demonstration session
3. Guided practice and play
4. Event management & game officiating
5. Friendly competitions and structured matches

Instructional Plan:

1. Introduction to Volley - History and development
2. Rules of the Game, Play Area & dimensions
3. Fundamental Skills - Striking, Ball control, Lifting
4. Sports Specific fitness and warmup drills
5. Stances and footwork
6. Preparatory Drills and Fun Games
7. Gameplay: Jumps, strikes, layoffs, attack, defense

References:

1. FIVB - Official Volleyball Rules

Course Outcomes:

1. Learn to play Volleyball
2. Understanding of the fundamental concepts such as rules of play, game variations
3. Understanding of the governing structure and administration of the sport
4. Understand the event management of the sport
5. Apply sport concepts into an active physical lifestyle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2				3				
CO2							2				
CO3							2				
CO4		3	3		2		2				
CO5				3	2		3				

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:4

Good Health and Well-being: Ensure healthy lives and promote well-being for all at all ages.

SDG Justification:

The nature of the course facilitates students to engage in various forms of fitness activities and sports-related movements that work on their overall health and wellness. The course focuses on inculcating active living as a lifestyle by making sports fun, engaging and meaningful.

DOSP1051	KABADDI	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course provides instruction and the opportunity for participation in sports and physical fitness activities. Skills, strategies, rules, and personal wellness goals are included as appropriate. This course will provide students with an understanding of the fundamental concepts of the physiological functions and training principles associated with the chosen sport.

Course Educational Objectives:

- Understand training principles used in the sport
- Demonstrate knowledge of the game in a recreational /competitive play setting
- Organize an event around the sport
- Demonstrate concepts of warm up, game conditioning, training plans

List of Activities:

1. Watch a sport documentary / training video / game history
2. On field coaching and demonstration session
3. Guided practice and play
4. Event management & game officiating
5. Friendly competitions and structured matches

Instructional Plan:

1. Introduction to Kabaddi - History and development
2. Rules of the Game, Play Area & dimensions
3. Fundamental Skills - Raiding, catching
4. Sports Specific fitness and warmup drills
5. Stances and footwork
6. Preparatory Drills and Fun Games

7. Gameplay: Chain system movement

References:

1. Amateur Kabaddi Federation of India (AKFI) - Official Rules
2. Rules of Kabaddi - International Kabaddi Federation

Course Outcomes:

1. Learn to play Kabaddi
2. Understanding of the fundamental concepts such as rules of play, game variations
3. Understanding of the governing structure and administration of the sport
4. Understand the event management of the sport
5. Apply sport concepts into an active physical lifestyle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2				3				
CO2							2				
CO3							2				
CO4		3	3		2		2				
CO5				3	2		3				

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:4

Good Health and Well-being: Ensure healthy lives and promote well-being for all at all ages.

SDG Justification:

The nature of the course facilitates students to engage in various forms of fitness activities and sports-related movements that work on their overall health and wellness. The course focuses on inculcating active living as a lifestyle by making sports fun, engaging and meaningful.

DOSP1061	KHO KHO	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course provides instruction and the opportunity for participation in sports and physical fitness activities. Skills, strategies, rules, and personal wellness goals are included as appropriate. This course will provide students with an understanding of the fundamental concepts of the physiological functions and training principles associated with the chosen sport.

Course Educational Objectives:

- Understand training principles used in the sport
- Demonstrate knowledge of the game in a recreational /competitive play setting
- Organize an event around the sport
- Demonstrate concepts of warm up, game conditioning, training plans

List of Activities:

1. Watch a sport documentary / training video / game history
2. On field coaching and demonstration session
3. Guided practice and play
4. Event management & game officiating
5. Friendly competitions and structured matches

Instructional Plan:

1. Introduction to Kho Kho - History and development
2. Rules of the Game, Play Area & dimensions
3. Fundamental Skills: Sitting, giving Kho, Pole dive
4. Sports Specific fitness and warmup drills
5. Stances and footwork: Running, sitting
6. Gameplay: Running strategies, ring method, chain method
7. Preparatory Drills and Fun Games

References:

1. Khelo India Official Rulebook of Kho Kho

Course Outcomes:

1. Learn to play Kho Kho
2. Understanding of the fundamental concepts such as rules of play, game variations
3. Understanding of the governing structure and administration of the sport
4. Understand the event management of the sport
5. Apply sport concepts into an active physical lifestyle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2				3				
CO2							2				
CO3							2				
CO4		3	3		2		2				
CO5				3	2		3				

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:4

Good Health and Well-being: Ensure healthy lives and promote well-being for all at all ages.

SDG Justification:

The nature of the course facilitates students to engage in various forms of fitness activities and sports-related movements that work on their overall health and wellness. The course focuses on inculcating active living as a lifestyle by making sports fun, engaging and meaningful.

DOSP1071	TABLE TENNIS	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course provides instruction and the opportunity for participation in sports and physical fitness activities. Skills, strategies, rules, and personal wellness goals are included as appropriate. This course will provide students with an understanding of the fundamental concepts of the physiological functions and training principles associated with the chosen sport.

Course Educational Objectives:

- Understand training principles used in the sport
- Demonstrate knowledge of the game in a recreational /competitive play setting
- Organize an event around the sport
- Demonstrate concepts of warm up, game conditioning, training plans

List of Activities:

1. Watch a sport documentary / training video / game history
2. On field coaching and demonstration session
3. Guided practice and play
4. Event management & game officiating
5. Friendly competitions and structured matches

Instructional Plan:

1. Introduction to Table Tennis - History and development
2. Rules of the Game, Play Area & dimensions
3. Fundamental Skills - TT: Grips - Racket, ball
4. Stances and footwork
5. TT Gameplay- Forehand, Backhand, Side Spin, High Toss. Strokes-Push, Chop, Drive, Half Volley, Smash, Drop-shot, Balloon, Flick, Loop Drive.
6. Preparatory Drills and Fun Games
7. Game Variations: Singles/ Doubles/ Mixed

References:

1. Handbook of the International Table Tennis Federation (ITTF)

Course Outcomes:

1. Learn to play Table Tennis
2. Understanding of the fundamental concepts such as rules of play, game variations
3. Understanding of the governing structure and administration of the sport
4. Understand the event management of the sport
5. Apply sport concepts into an active physical lifestyle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PS01	PSO2	PSO3	PSO4
CO1	3	2	2				3				
CO2							2				
CO3							2				
CO4		3	3		2		2				
CO5				3	2		3				

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:4

Good Health and Well-being: Ensure healthy lives and promote well-being for all at all ages.

SDG Justification:

The nature of the course facilitates students to engage in various forms of fitness activities and sports-related movements that work on their overall health and wellness. The course focuses on inculcating active living as a lifestyle by making sports fun, engaging and meaningful.

DOSP1081	HANDBALL	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course provides instruction and the opportunity for participation in sports and physical fitness activities. Skills, strategies, rules, and personal wellness goals are included as appropriate. This course will provide students with an understanding of the fundamental concepts of the physiological functions and training principles associated with the chosen sport.

Course Educational Objectives:

- Understand training principles used in the sport
- Demonstrate knowledge of the game in a recreational /competitive play setting
- Organize an event around the sport
- Demonstrate concepts of warm up, game conditioning, training plans

List of Activities:

1. Watch a sport documentary / training video / game history
2. On field coaching and demonstration session
3. Guided practice and play
4. Event management & game officiating
5. Friendly competitions and structured matches

Instructional Plan:

1. Introduction to Handball - History and development
2. Rules of the Game, Play Area & dimensions
3. Fundamental Skills - Handball: Throwing, Ball control, Movement
4. Sports Specific fitness and warmup drills
5. Stances and footwork: Jumps, dribbles, catching, throws
6. Gameplay: Shots, throws, movements, attack, defense

7. Preparatory Drills and Fun Games

References:

1. International Handball Federation - Rules of the Game & Regulations

Course Outcomes:

1. Learn to play Handball
2. Understanding of the fundamental concepts such as rules of play, game variations
3. Understanding of the governing structure and administration of the sport
4. Understand the event management of the sport
5. Apply sport concepts into an active physical lifestyle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2				3				
CO2							2				
CO3							2				
CO4		3	3		2		2				
CO5				3	2		3				

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:4

Good Health and Well-being: Ensure healthy lives and promote well-being for all at all ages.

SDG Justification:

The nature of the course facilitates students to engage in various forms of fitness activities and sports-related movements that work on their overall health and wellness. The course focuses on inculcating active living as a lifestyle by making sports fun, engaging and meaningful.

DOSP1091	BASKETBALL	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course provides instruction and the opportunity for participation in sports and physical fitness activities. Skills, strategies, rules, and personal wellness goals are included as appropriate. This course will provide students with an understanding of the fundamental concepts of the physiological functions and training principles associated with the chosen sport.

Course Educational Objectives:

- Understand training principles used in the sport
- Demonstrate knowledge of the game in a recreational /competitive play setting
- Organize an event around the sport
- Demonstrate concepts of warm up, game conditioning, training plans

List of Activities:

1. Watch a sport documentary / training video / game history
2. On field coaching and demonstration session
3. Guided practice and play
4. Event management & game officiating
5. Friendly competitions and structured matches

Instructional Plan:

1. Introduction to Basketball - History and development
2. Rules of the Game, Play Area & dimensions
3. Fundamental Skills - Passing, Receiving, Dribbling
4. Sports Specific fitness and warmup drills
5. Stances and footwork: Jumps, dribbles, catching, throws
6. Preparatory Drills and Fun Games
7. Gameplay: Shots, throws, movements, attack, defense

References:

1. FIBA Basketball Official Rules

Course Outcomes:

1. Learn to play Basketball
2. Understanding of the fundamental concepts such as rules of play, game variations
3. Understanding of the governing structure and administration of the sport
4. Understand the event management of the sport
5. Apply sport concepts into an active physical lifestyle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2				3				
CO2							2				
CO3							2				
CO4		3	3		2		2				
CO5				3	2		3				

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:4

Good Health and Well-being: Ensure healthy lives and promote well-being for all at all ages.

SDG Justification:

The nature of the course facilitates students to engage in various forms of fitness activities and sports-related movements that work on their overall health and wellness. The course focuses on inculcating active living as a lifestyle by making sports fun, engaging and meaningful.

DOSP1101	TENNIS	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course provides instruction and the opportunity for participation in sports and physical fitness activities. Skills, strategies, rules, and personal wellness goals are included as appropriate. This course will provide students with an understanding of the fundamental concepts of the physiological functions and training principles associated with the chosen sport.

Course Educational Objectives:

- Understand training principles used in the sport
- Demonstrate knowledge of the game in a recreational /competitive play setting
- Organize an event around the sport
- Demonstrate concepts of warm up, game conditioning, training plans

List of Activities:

1. Watch a sport documentary / training video / game history
2. On field coaching and demonstration session
3. Guided practice and play
4. Event management & game officiating
5. Friendly competitions and structured matches

Instructional Plan:

1. Introduction to Tennis - History and development
2. Rules of the Game, Play Area & dimensions
3. Fundamental Skills - Tennis: Grips - Racket, ball
4. Stances and footwork
5. Gameplay- Forehand, Backhand, Service, volley, smash
6. Preparatory Drills and Fun Games

7. Game Variations: Singles/ Doubles/ Mixed

References:

1. Handbook of the International Tennis Federation (ITF)

Course Outcomes:

1. Learn to play Tennis
2. Understanding of the fundamental concepts such as rules of play, game variations
3. Understanding of the governing structure and administration of the sport
4. Understand the event management of the sport
5. Apply sport concepts into an active physical lifestyle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2				3				
CO2							2				
CO3							2				
CO4		3	3		2		2				
CO5				3	2		3				

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:4

Good Health and Well-being: Ensure healthy lives and promote well-being for all at all ages.

SDG Justification:

The nature of the course facilitates students to engage in various forms of fitness activities and sports-related movements that work on their overall health and wellness. The course focuses on inculcating active living as a lifestyle by making sports fun, engaging and meaningful.

DOSP1111	THROWBALL	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course provides instruction and the opportunity for participation in sports and physical fitness activities. Skills, strategies, rules, and personal wellness goals are included as appropriate. This course will provide students with an understanding of the fundamental concepts of the physiological functions and training principles associated with the chosen sport.

Course Educational Objectives:

- Understand training principles used in the sport
- Demonstrate knowledge of the game in a recreational /competitive play setting
- Organize an event around the sport
- Demonstrate concepts of warm up, game conditioning, training plans

List of Activities:

1. Watch a sport documentary / training video / game history
2. On field coaching and demonstration session
3. Guided practice and play
4. Event management & game officiating
5. Friendly competitions and structured matches

Instructional Plan:

1. Introduction to Throwball - History and development
2. Rules of the Game, Play Area & dimensions
3. Fundamental Skills - Throwing, Receiving
4. Sports Specific fitness and warmup drills
5. Stances and footwork
6. Preparatory Drills and Fun Games
7. Gameplay: Shots, throws, movements, control

References:

1. World Throwball Federation - Rules of the Game

Course Outcomes:

1. Learn to play Throwball
2. Understanding of the fundamental concepts such as rules of play, game variations
3. Understanding of the governing structure and administration of the sport
4. Understand the event management of the sport
5. Apply sport concepts into an active physical lifestyle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2				3				
CO2							2				
CO3		3	3				2				
CO4					2		2				
CO5				3	2		3				

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:4

Good Health and Well-being: Ensure healthy lives and promote well-being for all at all ages.

SDG Justification:

The nature of the course facilitates students to engage in various forms of fitness activities and sports-related movements that work on their overall health and wellness. The course focuses on inculcating active living as a lifestyle by making sports fun, engaging and meaningful.

ENVS1001	ENVIRONMENTAL STUDIES	L	T	P	S	J	C
		3	0	0	0	0	3*
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

The course enables the students to adapt eco-centric thinking and actions rather than human-centric thinking on natural resources, their utilization and conservation. The course also focuses on the importance of ecosystems, biodiversity and their degradation led to pollution. This course helps in finding solutions through application of control measures to combat pollution and legal measures to achieve sustainable development.

Course Educational Objectives:

- To impart knowledge on natural resources and its associated problems.
- To familiarize learners about ecosystem, biodiversity, and their conservation.
- To introduce learners about environment pollution.
- To acquaint learners on different social issues such as conservation of water, green building concept.
- To make learners understand about the present population scenario, its impacts and role of informational technology on environment and human health.
- To make learners understand about the importance of field visit.

UNIT 1 Multidisciplinary nature of environmental studies & Natural Resources 10 hours

Multidisciplinary nature of environmental studies Definition, scope and importance. Need for public awareness. Natural resources and associated problems. Uses and over exploitation of Forest resources, Water resources, Mineral resources, Food resources, Energy resources. Role of an individual in conservation of natural resources.

Activity:

1. Planting tree saplings
2. Identification of water leakage in house and institute-Rectify or report
3. Observing any one day of a week as Car/bike/vehicle free day.

UNIT 2 Ecosystem and biodiversity 10 hours

Ecosystem: Structure components of ecosystem: Biotic and Abiotic components. Functional components of an ecosystem: Food chains, Food webs, Ecological pyramids, Energy flow in the ecosystem (10% law), Ecological succession.

Biodiversity: Definition, Biogeographical classification of India, Values of biodiversity: consumptive use, productive use, social, ethical, aesthetic. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching, man wildlife conflicts. Conservation of biodiversity: In – situ and Ex-situ

Activity:

1. Visit to Zoological Park-Noting different ecosystem
2. Biodiversity register- Flora and fauna in the campus

UNIT 3 Environmental Pollution 10 hours

Definition Causes, effects, and control measures of: -Air pollution. Water pollution. Soil pollution. Marine pollution. Noise pollution. Nuclear hazards. Solid waste Management: Causes, effects, and control measures. Role of an individual in prevention of pollution. Pollution case studies.

Activity:

1. Visit to treatment plant and documentation.
2. Documentation of segregation of solid waste-Dry and Wet

UNIT 4 Social Issues and the Environment 10 hours

From Unsustainable to Sustainable development Urban problems related to energy. Water conservation, rainwater harvesting, watershed management. Environmental ethics: Issues and possible solutions. Green building concept.

Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies.

Activity:

1. Observing zero hour at individual level-documentation.
2. Eco friendly idols.
3. Rainwater harvesting-creating storage pits in nearby area.

UNIT 5 Human Population and the Environment and Environment Protection Act and Field work **10 hours**

Population growth, variation among nations. Environment and human health. HIV/AIDS, Human rights. Value Education. Women and Child Welfare. Role of Information Technology in Environment and human health. Environment Legislation. Air (Prevention and Control of Pollution) Act. Water (Prevention and Control of Pollution) Act. Wildlife Protection Act. Environmental Protection Act, Issues involved in enforcement of environmental legislation.
Activity:

1. Visit to a local polluted site-industry/agriculture
2. Identifying diseases due to inappropriate environmental conditions

Text Book(s):

1. Erach Bharucha. Textbook of environmental studies for undergraduates courses-Universities Press, India Private Limited. 2019.
2. Kaushik A and Kaushik C.P. Perspectives in Environmental Studies. New Age International Publishers Edition-VI. 2018.
3. Dave D Katewa S.S. Textbook of Environmental Studies, 2nd Edition. Cengage Learning India. 2012.

Additional Reading:

1. Benny Joseph. Textbook of Environmental Studies 3rd edition, McGraw Hill Publishing company limited. 2017.

Reference Book(s):

1. McKinney M.L., Schoch R.M., Yonavjak L. Mincy G. Environmental Science: Systems and Solutions. Jones and Bartlett Publishers. 6th Edition. 2017.
2. Botkin D.B. Environmental Science: Earth as a Living Planet. John Wiley and Sons. 5th edition. 2005.

Journal(s):

1. https://www.tandfonline.com/loi/genv20
2. https://library.lclark.edu/envs/corejournals

Website(s):

https://www.ugc.ac.in/oldpdf/modelcurriculum/env.pdf From Climate Science to Action | Coursera

Course Outcomes:

After the completion of the course student will be able to

1. List different natural resources and their uses

2. Summarize the structure and function of terrestrial and aquatic ecosystems.
3. Identify causes, effects, and control measures of pollution (air, water & soil).
4. Function of green building concept.
5. Adapt value education

CO-PO Mapping:

	PO2	PO1	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2							2		
CO2		2				1		2		
CO3			1						1	
CO4				2						1
CO5	1								1	
CO6					2					1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN: BOS

BOS: 04-07-22 **ACADEMIC COUNCIL:14-07-22**

SDG No. & Statement:

1. SDG-6-Clean water and Sanitation
2. SDG-7-Affordable and clean energy
3. SDG-13 - Climate change
4. SDG-14 - Life below water
5. SDG-15 - Life on Land

SDG Justification:

1. The learner will understand the importance of clean water and sanitation through this course and apply in their daily activities – SDG-6
2. The learner will make use of renewable resources to reduce pollution achieves SDG-7
3. The learner will understand present situation in climate change and takes appropriate steps to combat climate change – SDG-13
4. The learner will understand the existence of life below water – SDG-14
5. The learner will understand to promote sustainable terrestrial ecosystem – SDG15

FINA3001	PERSONAL FINANCIAL PLANNING	L	T	P	S	J	C
		0	0	2	0	0	1*
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	Risk Management in personal financing Fundamentals of Investing Saving money for the future Personal and Family Financial Planning Introduction to Personal Finance Portfolio Selection and Risk Management						

Course Description:

Personal Financial Planning is one of the most significant factors in our lives. It is essential that funds are available as and when required at various stages of life. Unavailability of funds at critical stages of our life leads to financial distress and leads to many medical and non- medical problems. There are certain planned and unplanned events in our life. On the one hand, education of our children, their marriage, our retirement etc. are some of the planned events of our life, but at the same time, some medical urgency, accident or death of an earning member might be some unplanned events. Many of these events are beyond our control, but the availability of funds can be planned to avoid any financial distress. In other words, we cannot stop the rain but can plan for an umbrella.
This course looks at the many challenges an individual faces in a complex financial environment and the rising uncertainties of one's life. It focuses on achieving long-term financial comfort of individual and family through goal setting, developing financial and life strategies, acquiring personal financial planning knowledge and managing risk throughout one's life.

Course Educational Objectives:

- To build students' ability to plan for long-term financial comfort of individual and family through goal setting, developing financial and life strategies.
- To provide students with knowledge on terms, techniques to evaluate investment avenues.
- To build the skill set of the student to enable them to file their tax returns.

UNIT 1 **Basics of Financial Planning** **8 hours**

Financial Planning Meaning, Need, Objectives, Financial Planning Process, Time Value of Money and its application using excel (NP)

UNIT 2 **8 hours**

Risk and Insurance Management

Need for insurance, Requirement of insurance interest, Role of insurance in personal finance, Steps in insurance planning, Life and Non-life insurance products, Life insurance needs analysis (NP)

UNIT 3 **8 hours**

Investment Products and Measuring Investment Returns

Investment Products: Small Saving Instruments, Fixed Income Instruments, Alternate Investments, Direct Equity

Measuring Investment Returns: Understanding Return and its concept, Compounding concept, Real vs Nominal Rate of Return, Tax Adjusted Return, Risk-Adjusted Return (NP)

UNIT 4 Retirement Planning **8 hours**

Introduction to the retirement planning process, estimating retirement corpus, Determining the retirement corpus, Retirement Products (NP)

UNIT 5 Tax Planning **8 hours**

Income Tax: Income tax principles: Heads of Incomes, Exemptions and Deductions, Types of Assesses, Rates of Taxation, Obligations for Filing and Reporting, Tax aspects of Investment Products, Wealth Tax

Textbooks:

1. **National Institute of Securities Management (NISM) Module 1 & XA**
2. **Madhu Sinha, Financial Planning, 2 Edition, McGraw Hill India**
3. **Simplified Financial Management by Vinay Bhagwat, The Times Group**

References:

1. Personal Financial Planning (Wealth Management) by S Murali and K R Subbakrishna, Himalaya Publishing House.
2. Mishra K.C., Doss S, (2009). Basics of Personal Financial Planning 1e. National

Insurance Academy, New Delhi: Cengage Learning.
3. Risk Analysis, Insurance and Retirement Planning by Indian Institute of Banking and Finance.

Course Outcomes:

1. Describe the financial planning process and application of time value of money
2. Application of life and non-life insurance products in financial planning
3. Understand the investment avenues and analysis of investment returns
4. Understand the retirement planning and its application
5. Describe and analysis the Tax Planning

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	1	1	0	0	1	0	0	3	1	1	3
CO2	2	2	0	0	1	1	1	3	1	1	2
CO3	3	2	1	0	1	0	0	3	2	2	3
CO4	3	2	0	1	1	0	1	2	2	3	2
CO5	3	3	0	1	1	1	2	1	2	2	3

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 01-02-2022 **ACADEMIC COUNCIL: 01-04-2022**

SDG No. & Statement:

SDG Justification:

LANG1001	COMMUNICATION SKILLS IN ENGLISH - BEGINNERS	L	T	P	S	J	C
		0	0	4	0	0	2*
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

Communication Skills in English (Beginner) is the first of the three-level courses for a developmental enhancement of learners' communication skills in English. This course focuses on giving learners exposure to factual level of comprehension (listening and reading) and application of the learning (Speaking/Writing) with an awareness for social and personality-based variations in communication. In addition to the LSRW skills, the focus of the course is on schematic thinking skills. This course is activity-based and practice-oriented in terms of procedural knowledge of vocabulary and grammatical structure. This syllabus is carefully developed to enable learners to engage in communication in English avoiding errors and be prepared for next level of learning English.

Course Educational Objectives:

- Train learners to listen actively, follow what is spoken in standard English, and answer questions to demonstrate their understanding of the main points of the speech, repeat part of what someone has said to confirm mutual understanding, though occasionally, there may be a need to ask for repetition or clarification. (Bloom's Taxonomy Level/s: 2 & 3)
- Equip learners with the skills to read and comprehend straightforward texts and simple argumentative writing to identify the topic, the desired/relevant information, the main points of the argument, and the major conclusion/s. (Bloom's Taxonomy Level/s: 2 & 4)
- Help learners apply their knowledge and language skills to make mini oral presentations and produce short coherent written texts using appropriate cohesive devices, suitable vocabulary, and grammatical structures. (Bloom's Taxonomy Level/s:3)
- Enable learners to communicate with reasonable accuracy in familiar contexts with adequate fluency and generally good control by equipping them with a repertoire of frequently used vocabulary, structures, and speech patterns. (Bloom's Taxonomy Level/s: 2 & 3)

List of Activities & Tasks for Assessment:

1. Listening to others and getting to know their experiences, interests and opinions
2. Introducing oneself: Salutation, basic information, relating to the context
3. Starting a conversation: Salutation, expressing purpose, expressing gratitude
4. Sharing one's experiences, interests and opinions
5. Reading short newspaper articles for gist
6. Picking new words from an article and working on them to know the meaning and usage
7. Using the new (unknown) words in own sentences
8. Sharing news with others - initiate, sustain and conclude
9. Understanding the relevance of intonation to meaning from recorded conversations, and applying the learning in pair work (role play)
10. Writing a summary of a story/personal narrative after listening to it twice and making individual notes
11. Reading graphs, charts and maps for specific information, making note of the important information and talking briefly about it within a small peer group
12. Writing a paragraph about oneself: a brief profile including major successes, failures, and goals. Giving compliments/gratitude to others
13. Writing a paragraph (descriptive, complimentary) about others (Family, friends, role model, etc.)
14. Correcting each other's' drafts: errors in language - word choice, structure, and conventions/etiquette
15. Writing a short structured descriptive/narrative essay in 3 paragraphs, reading others' essays, and sharing feedback

References:

1. V. Sasikumar, P. Kiranmayi Dutt, Geetha Rajeevan. (2007). Listening and Speaking - Foundation Books Cunninhum, S. & Moor, P. (nd). New Cutting Hedge (Intermediate). Longman
2. Cambrdige Academic English: An Integrated Skills Course for EAP (Intermediate) By Craig Thaine, CUP (2012)
3. Rutherford, Andrea J. (2007). Basic Communication Skills for Technology: Second Edition. Delhi: Pearson Education.
4. McCarthy, M., O'Dell, F., Mark, G. (2005). English Vocabulary in Use. Spain: Cambridge

University Press.

5. New Headway Academic Skills: Reading, Writing, and Study Skills Student's Book, Level-1 by Sarah Philpot. OUP
6. Philpot, S. & Curnick, L. (2017). Headway: Academic Skills: Reaing, Writing, and Study Skills. Introductory Level. OUP.
7. Thaine, C. (2012). Cambridge Academic English: An Integrated Skills for EAP. Intermediate. CUP.

Online References:

- www.teachingenglish.org.uk
- learnenglishteens.britishcouncil.org
- https://eslflow.com/
- https://www.englishclub.com/
- https://www.oxfordlearnersdictionaries.com/
- https://dictionary.cambridge.org/
- learnenglishteens.britishcouncil.org
- https://freerice.com/categories/english-vocabulary

Course Outcomes:

1. Listen actively, understand and extract the essential information from short talks/conversations/discussions that are delivered in clear, standard speech. (Bloom's Taxonomy Level/s: 2 & 3)
2. Read, understand, and extract specific information from straightforward factual and simple argumentative texts on general topics and subjects of interest. (Bloom's Taxonomy Level/s: 2 & 3)
3. Speak clearly with some confidence on matters related to his/her interests and academic work and make short structured oral presentations on topics of personal interest. (Bloom's Taxonomy Level/s: 3)
4. Write short straightforward connected texts on a range of familiar/general topics using appropriate linking devices to achieve a clear sequence of ideas. (Bloom's Taxonomy Level/s: 3)
5. Acquire sufficient language competency to express oneself in speech and writing with some confidence, using appropriate vocabulary and simple grammatical structures though lexical limitations and/or difficulty with formulation might be evident at times. (Bloom's Taxonomy Level/s: 2 & 4)

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	0	2	2	3	0	0	0				
CO2	0	2	2	3	0	0	0				
CO3	0	0	0	3	0	0	0				
CO4	0	0	0	3	0	0	0				
CO5	0	4	2	0	2	2	4				

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :30-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

SDG No. 4: Statement: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

The course aims to remove inequalities among admitted students with regard to basic communication skills in English and provide them communication as well as learning skills that are useful throughout their lives.

LANG1011	COMMUNICATION SKILLS IN ENGLISH	L	T	P	S	J	C
		0	0	4	0	0	2
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

Communication Skills in English (Intermediate) is the second of the three-level graded courses for a developmental enhancement of communication skills in English. Based on the learning outcomes set in the beginner level syllabus, this course focuses on giving learners more exposure to the use of language for communicative purposes and equip them with next level skills (ref. Bloom's taxonomy) and practice in terms of complexity and cognitive engagement. This course also includes inferential level of comprehension (listening and reading) that involves analysis and application of the language skills and decision-making skills while speaking/writing with an awareness for social and personality-based variations in communication. This course emphasizes guided writing through adequate tasks with pre and post context building. The focus is on stimulation and application of critical thinking in addition to schematic thinking for communication in real-life situations.

Course Educational Objectives:

- Train learners to actively listen to short audio texts with familiar content; guided activity like question-making and responding to others' questions based on the audio text would help learners engage in transactional dialogue; extended activities like extrapolating/critiquing the responses would help learners enhance their schematic thinking. (Bloom's Taxonomy Level/s: 2 & 4)
- Equip learners with strategies to read actively and critically and understand the writers' viewpoints and attitude by providing reading comprehension tasks using authentic texts such as op-ed articles from newspapers, and reports on contemporary problems. (Bloom's Taxonomy Level/s: 4 & 5)
- Help learners understand various aspects and techniques of effective presentations (group/individual) through demonstration and modelling, and enabling them to develop their presentation skills by providing training in using the tips and strategies given. Learners would be encouraged to observe and express opinion on teacher-modelling. Reflection on issues like anxiety, stage-fear, confidence, and levels of familiarity with topic and audience would be addressed. Practice would be given on tone, pitch, clarity and other speech aspects. Detailed peer feedback and instructor's feedback would cover all the significant aspects. (Bloom's Taxonomy Level/s: 2 & 4)

- Enable learners to become aware of the structure and conventions of academic writing through reading, demonstration, scaffolding activities, and discussion. Corrective individual feedback would be given to the learners on their writing. (Bloom

List of Tasks and Activities:

S.No.	Tasks	Activities
1	Listening to subject related short discussions/ explanations/ speech for comprehension	Pre-reading group discussion, Silent reading (Note-making), Modelling (questioning), Post-reading reflection / Presentation
2	Asking for information: asking questions related to the content, context maintaining modalities	Group role-play in a con text (i.e. Identifying the situation and different roles and enacting their roles)
3	Information transfer: Verbal to visual (familiar context), demonstration by teacher, learners' task (guided with scaffolding), learners' task (free), presentation and feedback	Pair work for discussion & feedback, Presentations, question-answer
4	Information transfer: Visual to verbal (unfamiliar context); demonstration by teacher, learners' task (guided with scaffolding), learners' task (free), presentation and feedback	Pre-reading game/modelling, discussion in small groups, individual writing, and feedback
5	Introducing officials to peers and vice versa - Formal context	AV support, noticing, individual performance (3- 4), pair work (in context), teacher modelling, group work for Introducing self and others in a formal context
6	Introducing friends to family and vice versa - Informal context	Teacher modelling/AV support, noticing structure & note-taking, Introducing friends and family in an informal context
7	Vocabulary in context: Find clues in a text and use them to guess the meaning of words/ phrases. Apply the newly learnt vocabulary in communication (speaking and writing).	Comprehending verbal communication: Identifying the contextual clues in oral and written texts; guessing the meaning of words/phrases in context while reading texts and listening to discussions/talks
8	A five-day journal (diary) writing based on learners reading from newspaper on a single relevant/ current social	Note-making (group work), Discussion, Feedback

	issue. Individual oral presentation and feedback from peers and instructor.	
9	Follow the essentials of lectures, talks, discussions, reports and other forms of academic presentations and mak2 individual and group presentations aided with images, audio, video, tabular data, etc.	Making power point presentation aided with images, audio, video, etc. with a small group by listening to academic lectures/talks/ discussions, etc.
10	Self-reflection: Re-reading one's own drafts, identifying errors, correcting the errors, and giving rationalize the changes	Pre-task discussion/modelling, Editing the texts by careful reading and identifying the errors, peer-exchange (Pair work), feedback/consolidation
11	Collaborative work (speaking and writing) in small groups of 3 or 4 learners: discussing a general/ discipline-specific topic: creating outline, assigning specific roles to members of the group; and group presentation followed by peer and instructor feedback	Pre-task modelling (peer/teacher), general discussion on structure, group work (collaboration), feedback
12	Independent reading of different text types using appropriate reference sources by adapting suitable reading styles and speed. Focus on active reading for vocabulary: low-frequency collocations and idiomatic expressions.	Brain-storming, mapping of key terms (content specific), reading and note-making (individual), oral questioning, discussion
13	Role-play (specific social and academic situations): planning (making notes), understanding nuances of speaking in context, coordinating with situational clues and fellow speakers/participants	Peer discussion for outline, A-V support, observing (teacher modelling), role play (guided), role-play (free), feedback
14	Writing instructions: Guidelines - Flowcharts - Procedures to be followed	Pre-task reading, pair work, teacher/peer-discussion, feedback
15	Speaking spontaneously on topics of interest and writing short structured essays on the same topics adopting appropriate academic conventions and grammatical accuracy.	Reading for task preparation, note-making, speaking, reflection and corrective peer and teacher feedback

Reference Books:

1. P. Kiranmayi Dutt, Geetha Rajeevan. (2007). Basic Communication Skills. Foundation Books. CUP
2. Harmer, J. (1998). How to teach English. Longman
3. Sanjay Kumar & Pushp Lata. (2018). Communication Skills: A Workbook. OUP.
4. Cambridge IGCSE: English as a Second Language Teacher's Book Fourth Edition. By Peter Lucantoni. CUP (2014).
5. Cambrdige Academic English: An Integrated Skills Course for EAP (Upper Intermediate) By Martin Hewings, CUP (2012)
6. Richards, J.C. and Bohlke, D. (2012). Four Corners-3. Cambridge: CUP.
7. Headway Academic Skills: Reading, Writing, and Study Skills Student's Book, Level-2 by Sarah Philpot. OUP
8. Latham-Koenig, C. & Oxenden, C. (2014). American English File. Oxfor: OUP.
9. McCarthy, M. & O' Dell. F. (2016). Academic Vocabulary in Use. Cambridge: CUP

Online Resources:

1. https://www.grammarly.com/blog/
2. https://www.nationalgeographic.org/education/
3. https://www.bbc.co.uk/teach/skillswise/english/zjg4scw
4. https://www.englishclub.com/
5. https://www.oxfordlearnersdictionaries.com/
6. https://dictionary.cambridge.org/
7. learnenglishteens.britishcouncil.org
8. https://freerice.com/categories/english-vocabulary
9. http://www.5minuteenglish.com/
10. https://breakingnewsenglish.com/
11. https://www.digitalbook.io/
12. https://librivox.org/

Course Outcomes:

1. Understand the speaker's point of view in fairly extended talks on general or discipline-specific topics, and follow simple lines of argument in discussions on familiar contemporary issues. (Bloom's Taxonomy Level/s: 3)
2. "Read and demonstrate understanding of articles and reports on limited range of contemporary issues in which the writers adopt particular stances. Also provide samples of written communication containing fairly complex information and reasons for choices/opinions/stances. (Bloom's Taxonomy Level/s: 2 & 3)"
3. Make short presentations on a limited range of general topics using slides, and engage in small group discussions sharing experiences/views on familiar contemporary issues and give reasons for choices/opinions/plans. (Bloom's Taxonomy Level/s: 3 & 4)
4. Write clear, fairly detailed text (a short essay) on a limited range of general topics, and subjects of interest, and communicate clearly through email/letter to seek/pass on

information or give reasons for choices/opinions/plans/actions. (Bloom's Taxonomy Level/s: 3)

5. Reflect on others' performance, give peer feedback on fellow learners' presentations, responses to writing tasks and reading comprehension questions. (Bloom's Taxonomy Level/s: 5)

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	0	3	0	3	0	3	0				
CO2	0	2	0	3	2	2	0				
CO3	4	3	3	3	3	3	4				
CO4	0	3	3	3	3	3	0				
CO5	5	0	5	0	0	0	0				

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :30-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

SDG No. 4: Statement: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

The course aims to remove inequalities among admitted students with regard to basic communication skills in English and provide them communication as well as learning skills that are useful throughout their lives.

LANG1021	ADVANCED COMMUNICATION SKILLS IN ENGLISH	L	T	P	S	J	C
		0	0	4	0	0	2
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

Communication Skills in English (Advanced) is the third of the three-level graded courses for a developmental enhancement of communication skills in English. Based on the learning outcomes set in the upper-intermediate syllabus, this course focuses on giving learners exposure to higher level of skills/input processing (ref. Bloom's taxonomy) and practice in terms of complexity and cognitive engagement. This course includes advanced level of comprehension i.e. anaytical, evaluative and extra-polative processing (listening and reading) and involves problem-solving, logical reasoning and decision-making skills in terms of application of the learning (speaking/writing) with an awareness for social and personality based variations in communication. This course provides opportunities with activity-based practice of advanced oral and written communicative skills besides building awareness on the finer nuances of language use for various purposes. This course emhasizes free writing through meaningfully engaging tasks with a pre and post context building. There is ample scope for application of critical thinking through simulated activities for effective communication in real life situations.

Course Educational Objectives:

- Enable learners to listen actively become aware of tone and attitude in speech, and demonstrate their comprehension of fairly complex lines of argument presented by a variety of speakers in talks/presentations/discussions. (Bloom's Taxonomy Level/s: 2 & 4)
- Enable learners to become aware of tone and attitude in written texts, and demonstrate their comprehension of fairly complex lines of argument and points of view presented in a variety of texts by equipping them with upper intermediate to advanced level reading skills and strategies. (Bloom's Taxonomy Level/s:2 & 3)
- Make effective presentations, engage in formal group discussions, and write structured essays/ short reports to highlight the significance of actions/decisions/experiences, and sustain views by providing relevant evidence and argument. (Bloom's Taxonomy Level/s: 3 & 4)
- Equip learners with the skills and strategies to communicate effectively in speech

and writing using the language with a degree of fluency, accuracy and spontaneity, and fairly good grammatical control adopting a level of formality appropriate to the context. Encourage learners to apply their knowledge of language and their communication skills in real life situations. (Bloom's Taxonomy Level/s:3 & 5)

List of Activities & Tasks for Assessment:

S.No.	Tasks	Activities	CO
1	Evaluative and extrapolative reading of a long text/short texts on a current topic related to technology and society, identifying and questioning the author's intention, post- reading discussion in small groups, maintaining group dynamics, arriving at a consensus	Pre-reading group discussion, silent reading (Note-making), modelling (questioning), post-reading reflection and brief presentation of thoughts/ideas/opinions on the theme of the text	3
2	Debate in pairs based on listening to two recorded contemporary speeches by well- known leaders in different fields. Peer feedback and instructor feedback.	Pre-recorded audio/video for listening, student checklist for noticing key words/concepts, pre-task orientation (by teacher), pair work, feedback	1
3	Information transfer: Verbal to visual (unfamiliar context); demonstration by teacher, learners' task (guided with scaffolding), learners' task (free), presentation, question-answer (among students), modification and feedback before the final version is done	Pair work for discussion and feedback, presentations, question-answer	2
4	Information transfer: Visual to verbal (unfamiliar context); demonstration by teacher, learners' task (guided with scaffolding), learners' task (free), presentation, question-answer(among students), modification, editing, proofreading, and feedback before the final version is done	Pre-reading game/ modelling, discussion in small groups, independent writing and feedback	4
5	Expressing opinion on a short argumentative text (e.g. a journal article or a newspaper editorial) and justifying one's opinion/stance; focus on the use of appropriate conventions	Listening to group discussions/ debates, reading news-paper articles on the current issues and expressing opinions in favour or against the topic (in GDs, debates or writing argumentative essays).	3

	of formal and polite speech, and managing bias		
6	Role-play (complex social and academic/professional situations): Focus on significant aspects of delivery including clarity, tone, and use of contextually appropriate vocabulary and conventions, observation, reflective discussion, and self- reflective writing	Reading newspaper/ magazine articles/ blog posts on current social issues, listening to talks/ discussions/ debates etc. and participating in role-plays using expressions appropriate to the context.	1
7	Collaborative writing in groups of 3 -4 on topics that would require data collection and reading followed by recorded peer-reflection and peer-feedback, group presentation and feedback	Pre-task modelling (peer), general discussion on structure, group work (collaboration), presnetation, peer feedback, Open-class discussion	5
8	Formal Group Discussion on topics of current interest and relevance; focus on effective participation, reflection on control over argument/ counter argument, and adherence to the conventions of formal GD	Noticing strategies from AV modelling, teacher scafolding though open-house discussion, Note-making (Group work), Group Discussion (free), post perfromance discussion, Feedback	2
9	Mind-mapping for advanced reading, making correlations across texts, extending author's point of view	Reading texts on abstract topics and comprehending the author's perspective by inferring the unknown words' meaning in the context and making notes using mind-map strategy and presenting it orally.	3
10	Handling question and answer sessions after presentations: justifying arguments, taking counter-arguments, agreeing and disgreeing with rationale	Listening to some lectures, talks, and presentations in the academic seminars and adapting some strategies to handle the Q&A sessions using polite and formal expressions to agree or disagree with the statements.	1
11	Modelling an interview: with a panel of four judges (peers)	Pre-task activity for orientation/ strategies (controlled/guided), Model interview (AV support), Group work (role play), interview in pair (one-to-one), Interview in group (many -to-one), oral corrective feedback (peer/	2

		teacher)	
12	Writing a short reflective report of an event - incident/ meeting/ celebration	Writing a report on meetings/ celebrations/ events etc. by actively involving in such events and giving a short oral presentation on the same.	4
13	Speaking on abstract and complex topics beyond his/her own area of interest/field of study, using the language flexibly and effectively.	Reading texts on abstract topics and comprehending the author's perspectives. Similarly, listening to talks and discussions on an abstract topic of other discipline and making short oral presentation by sharing views and opinions.	3
14	Self-relfection on own speech in context(recorded): tone, pitch, relevance, content; extending the reflections/ideas to others	Listening to selected general discussions (audios and videos) and observing the language production. Recording own speech on some general topic and providing a critical review (self-reflection) on it by focusing on the tone, expressions and relevance of the content, etc.	1
15	Collaborative and individual task: planning, preparing (preparing an outline, structure, setting objectives and presenting the plan of action) and executing a mini-project, and submitting a brief report on the same peer and instructor feedback after the planning stage and on completion of the mini project	Pre-task modelling (peer/teacher), general discussion on structure, group work (collaboration), oral corrective, task distribution, presentation, feedback	5

Reference Books:

1. Latham-Koenig, C. & Oxenden, C. (2014). American English File-5. Oxford: OUPRichards,
2. J.C. and Bohlke, D. (2012). Four Corners-4. Cambridge: CUP.
3. Cambrdige Academic English: An Integrated Skills Course for EAP (Advanced) By Martin Hewings and Craig Thaine, CUP (2012)
4. Berlin, A. (2016). 50 Conversation Classes: 50 Sets of Conversation Cards with an Accompanying Activity Sheet Containing Vocabulary, Idioms and Grammar. Poland: CreateSpace Independent Publishing Platform

5. Zemach, D. E., Islam, C. (2011). Writing Paragraphs: From Sentence to Paragraph. Germany: Macmillan Education.
6. Stewart, J. P., Fulop, D. (2019). Mastering the Art of Oral Presentations: Winning Orals, Speeches, and Stand-Up Presentations. United Kingdom: Wiley.
7. Kroehnert, Gary. (2010). Basic Presentation Skills. Sidney: McGraw Hill.
8. Cunninghum, S. & Moor, P. (nd). Cutting Edge (Advanced) With Phrase Builder. Longman Publishers. CUP
9. McCarthy, M & O'Dell, F. (2017). English Idioms in Use (Advanced). Cambridge: CUP.

Online Resources:

1. https://www.grammarly.com/blog/
2. https://www.nationalgeographic.org/education/
3. https://www.bbc.co.uk/teach/skillswise/english/zjg4scw
4. https://www.englishclub.com/
5. https://www.oxfordlearnersdictionaries.com/
6. https://dictionary.cambridge.org/
7. learnenglishteens.britishcouncil.org
8. https://freerice.com/categories/english-vocabulary
9. http://www.5minuteenglish.com/
10. https://breakingnewsenglish.com/
11. https://www.digitalbook.io/
12. https://librivox.org/

Course Outcomes:

1. Listen to extended lectures, presentations, and discussions on a wide range of contemporary issues and demonstrate understanding of relatively complex lines of argument. (Bloom's Taxonomy Level/s: 2)
2. Make presentations using suitable AV aids and engage in formal group discussions on a wide range of topics of contemporary interest, demonstrating awareness of standard/widely accepted conventions. (Bloom's Taxonomy Level/s: 3)
3. Read and demonstrate understanding of the writer's stance/viewpoint in articles and reports on a wide range of contemporary issues and discipline-specific subjects. (Bloom's Taxonomy Level/s: 2 & 4)
4. Write analytical essays on a wide range of general topics/subjects of interest, and engage in written communication (emails/concise reports) to exchange relatively complex information, giving reasons in support of or against a particular stance/point of view. (Bloom's Taxonomy Level/s: 3 & 4)
5. Complete a mini project that necessitates the use of fairly advanced communication skills to accomplish a variety of tasks and submit a report in the given format. (Bloom's Taxonomy Level/s: 4 & 5)

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	0	2	2	0	2	2	0				
CO2	3	3	0	3	0	0	3				
CO3	2	4	0	4	2	2	0				
CO4	3	4	0	4	0	0	3				
CO5	0	4	0	4	0	0	0				

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :30-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

SDG No. 4: Statement: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

The course aims to remove inequalities among admitted students with regard to basic communication skills in English and provide them communication as well as learning skills that are useful throughout their lives.

MFST1001	HEALTH & WELLBEING	L	T	P	S	J	C
		0	0	2	0	0	1*
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

The course provides the students a better understanding of the role of a proper diet in maintenance of human health. This course emphasizes the composition of the food, and will help to understand how to exercise, the role of sports and physical fitness in development of a good health. The course also focuses on the importance of emotional well-being and mindfulness. This course helps in teaching the role of yoga in maintenance of physical balance.

Course Educational Objectives:

- To provide an understanding of the relationship between food and nutrition
- To emphasize the role of exercise, sports and physical fitness in obtaining a good health
- To explain about the mindfulness and emotional well being
- To teach the role of yoga and meditation in maintaining the body balance

UNIT 1

Understand the relationship between Food and Nutrition and how food composition affects nutritional characteristics. Knowledge about regulatory principles in determining diets and recommended daily allowances. Understand how to create personalised diet/nutrition plans.

UNIT 2

Understand how exercise, activity and sports helps in developing good health. Experiential exposure to the role of proper, specific nutritional interventions along with structured activities on developing proper physical health. Practical exercises and assignments in sports and exercise regimes.

UNIT 3

Introduction to emotional wellbeing and mindfulness. Teaching of mindfulness practices to reduce stress, increase relaxation and improve mental wellbeing.

UNIT 4

Introduction to Yoga theory and how Yoga helps in maintaining balance in the body. Practice of Yoga and meditation to improve overall emotional and physical balance. Practical yoga exercises and meditation techniques

Course Outcomes:

By the end of the course, student will

1. Learn the role of nutrition and diet in maintaining a good health
2. understand how the exercise, sports and physical activities will improve health
3. learn mindfulness practices for reducing stress
4. know the importance of yoga and meditation

APPROVED IN:

BOS :30-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

SDG Justification:

PHPY1001	GANDHI FOR THE 21ST CENTURY	L	T	P	S	J	C
		2	0	0	0	0	2*
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

This course provides the students with basic knowledge on Gandhi's early life, transformations in South Africa and his entry into India's national movement. While going through the social-political, economic, and educational philosophies of Gandhi, the course analyses how his ideologies are relevant even in the 21st century.

Course Educational Objectives:

The objectives of the course are;

- To provide the students with the basic knowledge on Gandhi's life and his philosophies
- To understand the early influences and transformations in Gandhi
- To analyze the role of Gandhi in India's national movement
- To apply Gandhian Ethics while analyzing the contemporary social/political issues
- To appreciate the conflict resolution techniques put forward by Gandhi and its significance in the current scenario.

UNIT 1 MK Gandhi: Childhood and Education

M K Gandhi, Formative Years (1869-1893): Early childhood – study in England – Indian influences, early Western influences.

UNIT 2 From Mohan to Mahatma-South African Experiences

Gandhi in South Africa (1893-1914): South African Experiences – civil right movements in South Africa – invention of Satyagraha – Phoenix settlement- Tolstoy Farm – experiments in Sarvodaya, education, and sustainable livelihood.

UNIT 3 Gandhi and Indian National Movement

Gandhi and Indian National Movement (1915-1947): Introduction of Satyagraha in Indian soil -non- cooperation movement – call for women's participation – social boycott – Quit-India movement – fighting against un-touch ability – Partition of India- independence.

UNIT 4 Gandhi and Sustainable Development

Gandhian Constructive Programs-Eleven Vows-Sarvodaya-Seven Social Sins-Gandhian Economics and Sustainable Development

UNIT 5 Gandhi and Contemporary Issues

Conflict Resolution Techniques of Gandhi-Ecological Challenges and Gandhian solutions-Gandhian Ethics-An Analysis

References:

1. Gandhi, M K. (1941). *Constructive Programme*. Ahmadabad: Navjivan Publishing House
2. Gandhi, M. K. (1948). *The Story of My Experiments with Truth*. Ahmadabad: Navjivan Publishing House
3. Gandhi, M K. (1968). *Satyagraha in South Africa*. Ahmadabad: Navjivan Publishing House.
4. Khoshoo, T N (1995). *Mahatma Gandhi: An Apostle of Applied Human Ecology*. New Delhi:TERI
5. Kripalani, J.B. (1970). *Gandhi: His Life and Thought*. New Delhi: Publications Division.
6. Narayan, Rajdeva (2011). *Ecological Perceptions in Gandhism and Marxism*. Muzaffarpur: NISLS
7. Pandey, J. (1998). *Gandhi and 21st Century*. New Delhi: Concept.
8. Weber, Thomas (2007).Gandhi as Disciple and Mentor. New Delhi: CUP

Course Outcomes:

After the successful completion of the course the students will be able to;

1. Understand the life of Gandhi
2. Appreciate the role of Gandhian non-violence and Satyagraha in India's freedom struggle.
3. Critically examine the philosophy of Gandhi on Education, Sarvodaya, and Satyagraha
4. Analyse the contemporary significance of Gandhian constructive programmes and eleven vows
5. Examine the possible solutions for some of the contemporary challenges like environmental issues, moral degradation and ethical dilemmas.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	3	3	3	3	3	3	2	2
CO2	3	3	2	3	2	3	3	3	3	2	3
CO3	3	3	3	2	3	2	2	3	3	2	2
CO4	3	2	2	3	3	2	2	3	3	2	3
CO5	3	3	2	2	3	3	3	3	3	3	2

Note: 1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

APPROVED IN:

BOS :30-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

SDG Justification:

POLS1001	INDIAN CONSTITUTION AND HISTORY	L	T	P	S	J	C
		2	0	0	0	0	2*
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

This course analyses the basic structure and operative dimensions of the Indian Constitution. It explores various aspects of the Indian political and legal system from a historical perspective highlighting the various events that led to the making of the Indian Constitution. The course also deals with various challenges faced by the constitution and its coping mechanisms. Broadly, the students would understand and explain the working of different institutions and political debates ensuing from the operation of the Indian constitution in action.

Course Educational Objectives:

- To introduce constitutional history of India.
- To explain the process of making Indian constitution
- To analyze Fundamental of Rights, Duties and other principles in constitution
- To create familiarity with political developments which shaped the constitution.

UNIT 1 India as a Nation 6 hours

Khilani, S. (2004). *Introduction, The Idea of India*, Chapter 1. New Delhi: Penguin Books,

pp. 1-15.

Rowat, D. (1950). 'India: The Making of a Nation', International Journal, 5(2), 95-108. Doi:10.2307/40194264

Brass, P. (2018). 'Continuities and Discontinuities between pre- and post-Independence India', Chapter 1.

The Politics of Idea since independence, New Delhi: Cambridge University Press. Pp. 1-30.

UNIT 2 Understanding the Constitution 6 hours

Mehta, U.S. (2011). 'Constitutionalism' in *The Oxford Companion to Politics in India*, (ed) by Nirja Gopal Jayal, and Pratap Bhanu Mehta, New Delhi: Oxford University Press. Pp. 15-27.

Austin, G. (2016), 'The Constituent Assembly: Microcosm in Action' *in The Indian Constitution: Cornerstone of a Nation*, New Delhi: Oxford University Press, pp. 1-25.

Beteille, Andre (2008): "Constitutional Morality," *Economic and Political Weekly*, Vol 43, Issue No 40

Prahladan, Vivek (2012): "Emergence of the Indian Constitution," *Economic and Political Weekly*, Vol 47, Issue No 07.

UNIT 3 The Preamble, Fundamental Rights and Directive Principles of State Policy **6 hours**

Bhakshi, P.M. (2011). 'Preamble' in *The Constitution of India*, New Delhi: Universal Law. Pp. 1-5. Laxmikanth, M. (2017). 'Chapter IV: Preamble of the Constitution' in *Indian Polity*, Chennai: McGraw Hills.

Kumar, Virendra (2007): "Basic Structure of The Indian Constitution: Doctrine of Constitutionally Controlled Governance [From Kesavananda Bharati to I.R. Coelho]" *Journal of the Indian Law Institute*, Vol 49, No 3, pp 365-398.

Austin, G (2016), ' ' in *The Indian Constitution: Cornerstone of a Nation*, New Delhi: Oxford University Press, pp.63-105.

Reddy, S (1980). Fundamental Ness of Fundamental Rights and Directive Principles in the Indian Constitution. *Journal of the Indian Law Institute*, 22(3), pp. 399-407.

Bhatia, Gautam (2017): "The Supreme Court's Right to Privacy Judgement," *Economic and Political Weekly*, Vol 52, Issue No 44

UNIT 4 Citizenship **6 hours**

Jayal, N.G. (2019). 'Reconfiguring citizenship in contemporary India' in *South Asia Journal of South Asian Studies*, pp.33-58.

Roy, Anupama. (2010). 'Chapter I: Enframing the citizen in contemporary times' in *Mapping Citizenship in India*, New Delhi: Oxford University Press.

Das, Veena (2010): "State, Citizenship and the Urban Poor," *Citizenship Studies,* Vol 15, pp 319- 333.Valerian Rodrigue

UNIT 5 Separation and Distribution of Powers **6 hours**

Pal, Ruma. (2016). 'Separation of Powers' in *The Oxford Handbook of the Indian Constitution*, (ed) by Sujit Choudhry, Madhav Khosla, and Pratap Bhanu Mehta, Delhi: Oxford University Press.

Bakshi, P. (1956). 'Comparative Law: Separation of Powers in India'. *American Bar Association Journal, 42*(6), 553-595.

Rao, P. (2005). 'Separation of Powers in a Democracy: The Indian Experience'. *Peace Research, 37*(1), 113-122.

Kumar, Ashwani (2019): "Constitutional Rights, Judicial Review and Parliamentary Democracy,"

Economic and Political Weekly, Vol 51, Issue 15

Tillin, Louise. (2015). 'Introduction' in *Indian Federalism*. New Delhi: Oxford University Press. Pp. 1-30.

Chakrabarty, Bidyut and Rajendra Kumar Pandey. (2008). *Federalism' in Indian Government and Politics*, New Delhi: Sage Publications. Pp. 35-53.

Arora, B. and Kailash, K. K. (2018). 'Beyond Quasi Federalism: Change and Continuity in Indian Federalism', in *Studies in Indian Politics*, pp. 1-7.

Agrawal, Pankhuri (2020): "COVID-19 and dwindling Indian Federalism," *Economic and Political Weekly,* Vol 55, Issue No 26

Recommended Readings:

De, Rohit. (2018). *A People's Constitution – The Everyday Life of Law in the Indian Republic*, USA: Princeton University Press.

Granville Austin, *The Indian Constitution: Cornerstone of a Nation*, Oxford University Press, Oxford, 1966.

Lahoti, R.C. (2004). *Preamble: The Spirit and Backbone of the Constitution of India*. Delhi: Eastern Book Company.

Rajeev Bhargava (ed), *Ethics and Politics of the Indian Constitution*, Oxford University Press, New Delhi, 2008.

Subhash C. Kashyap, *Our Constitution*, National Book Trust, New Delhi, 2011. Tillin, Louise. (2015). *Indian Federalism*. New Delhi: Oxford University Press.

Zoya Hassan, E. Sridharan and R. Sudarshan (eds), *India's Living Constitution: Ideas, Practices, Controversies*, Permanent Black, New Delhi, 2002.

Course Outcomes:

On the successful completion of the course students would be able to:

1. Demonstrate an understanding of the Constitution of India and how constitutional governance is carried out in India
2. Interpret knowledge of the Fundamental Rights and Duties of the Citizens as well as the Obligation of the state towards its citizens
3. Correlate familiarity with key political developments that have shaped the Constitution and amended it from time to time.
4. Equip themselves to take up other courses in law after having done a foundation course on Indian Constitution

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	1	2	1	2	2	3	3	2	3	1	2
CO2	1	1	2	1	2	2	3	2	3	1	2
CO3	1	2	1	2	2	2	3	1	3	1	1
CO4	1	1	1	2	2	2	3	1	3	1	1
CO5	1	1	1	2	2	2	3	2	3	1	2

Note: 1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

APPROVED IN:

BOS :30-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

SDG Justification:

VEDC1001	VENTURE DEVELOPMENT	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

India as part of its "Make in India" initiative has been focusing on creating incubation centers within educational institutions, with an aim to generate successful start-ups. These start-ups will become employment creators than employment seekers, which is the need of the hour for our country. This common course (university core) for all the disciplines is a foundation on venture development. It is an experiential course that starts with students discovering their deeper self in terms of how they might contribute to society by creating exciting new products and services that can become the basis of real businesses. The students learn about the emerging areas of knowledge that are the foundations of any successful company. They will learn how to develop insight into the problems and desires of different types of target customers, and from this, to identify the design drivers for a specific innovation. Students will learn specific design methods for new products and services. The students will learn that as important as the product or service itself, is a strategy for monetizing the innovation – for generating revenue, structuring the operating costs, and creating the operating profit needed to support the business, hire new employees, and expand forward. This course is aimed to be the beginning of what might be the most important journey of personal and career discovery so far in a student's life, one with lasting impact. This is not just a course, but potentially, an important milestone in life that a student remembers warmly in the years to come.

Course Educational Objectives:

Students have the opportunity to:

- Discover who they are – Values, Skills, and Contribution to Society
- Understand how creativity works and permeates the innovation process
- Learn the basic processes and frameworks for successful innovation.
- Gain experience in going through the innovation process.
- Conduct field research to test or validate innovation concepts with target customers.

UNIT 1 **PERSONAL DISCOVERY** **4 hours**

Personal Values, Excite & Excel, Build a Team, Define Purpose, Mission Statement

UNIT 2 IDEATION 10 hours

Ideation & Impact, User Insights - Frameworks, Customer Interviews, Interpreting Results

UNIT 3 SOLUTION DISCOVERY 8 hours

Concept Design, Competitive Analysis, Product Line Strategy, Prototyping Solutions, Reality Check

UNIT 4 BUSINESS MODEL DISCOVERY 4 hours

Understand the Industry, Types of Business Model, Define Revenue Models, Define Operating Models, Define Customer Journey, Validate Business Model

UNIT 5 DISCOVERY INTEGRATION 4 hours

Define Company Impact, Create Value, Tell Your Story

Textbooks:

1. Meyer and Lee, “Personal Discovery through Entrepreneurship”, The Institute for Enterprise Growth, LLC. Boston, MA., USA.

References:

1. Adi Ignatius (Editor-in-Chief), “Harvard Business Review”, Harvard Business Publishing, Brighton, Massachusetts,2021

Course Outcomes:

1. Identify one’s values, strengths and weaknesses and their will to contribute to the society
2. Formulate an idea and validate it with customers
3. Demonstrate prototyping and analyse the competition for the product
4. Create business models for revenue generation and sustainability of their business
5. Come up with a pitch that can used as the basis for actually starting a company based on an impactful innovation and societal impact

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1						3	1				
CO2		3		3	1	3	2				
CO3	1	3	3		3		3				
CO4					1	1	3				
CO5					3	3					

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :30-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

17. Strengthen the means of implementation and revitalize the global partnership for sustainable development.

SDG Justification:

4. The course involves identifying one's personal values and working on real-life problems, thus forming the base to work on their passions even past the collegiate life.

17. The course is developed in collaboration with North-eastern University, USA and the training for the champions is being by North-eastern University.

Faculty Core

CHEM1011	CHEMISTRY-I	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

The students of undergraduate program in science studying chemistry course need to be conversant with the various fields of chemistry. Therefore, one module each on in general, physical and organic chemistry is introduced which helps the student familiarize with the concepts of chemistry essential for allied and interdisciplinary fields of science.

Course Educational Objectives:

To introduce the concepts of general chemistry. The students will be conversant with the chemistry of all the elements that is closely knitted with analytical chemistry, physical chemistry and organic chemistry.

1. To introduce the concepts of atomic theory and arrangement of electrons in orbital level
2. To understand about bonding and energy calculations in molecules
3. To know about the reaction mechanism, reactive species in organic chemistry and concept of aromaticity.
4. To expose the students to concepts of chirality, configuration, isomerism in organic chemistry.
5. To discuss synthetic reactions, mechanism and properties of aromatic alcohol, aromatic and aliphatic ether, aldehydes, and ketones

Section A: Inorganic Chemistry-1

Unit-I **9 Hours**

Atomic Structure: Review of: Bohr's theory and its limitations, dual behavior of matter and

radiation, de Broglie's relation, Heisenberg Uncertainty principle. What is Quantum mechanics? Time independent Schrodinger equation and meaning of various terms in it. Significance of ψ and ψ2, Schrödinger equation for hydrogen atom. Graphical representation of 1s, 2s, 2p, 3s, 3p and 3d orbitals. Rules for filling electrons in various orbitals, Electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy.

Unit-II **9 Hours**

Chemical Bonding and Molecular Structure

Ionic Bonding: General characteristics of ionic bonding. Energy considerations in Ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Statement of Born-Landé equation for calculation

of lattice energy. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character.

Covalent bonding: VB Approach: Shapes of some inorganic molecules and ions on the Basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements.

Unit-III **9 Hours**

Section B: Organic Chemistry-1

Fundamentals of Organic Chemistry

Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance

and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis. Structure, shape and reactivity of organic molecules: Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals. Aromaticity: Benzenoids and Hückel's rule.

Unit-IV **9 Hours**

Stereochemistry

Conformations with respect to ethane, butane and cyclohexane. Inter conversion of Wedge Formula, Newmann, Sawhorse and Fischer representations. Concept of chirality (upto two carbon atoms). Configuration: Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso compounds). Threo and erythro; D and L; cis – trans nomenclature; CIP Rules: R/ S (for upto 2 chiral carbon atoms) and E / Z Nomenclature (for

upto two C=C systems).

Unit- V **9 Hours**

Aliphatic Hydrocarbons

Functional group approach for the following reactions (preparations & reactions) to be studied.

Alkanes: (Upto 5 Carbons). Preparation: Catalytic hydrogenation, Wurtz reaction. Reactions: Free radical Substitution: Halogenation.

Alkenes: (Upto 5 Carbons) Preparation: Elimination reactions: Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff's rule); cis alkenes (Partial catalytic hydrogenation) and trans alkenes (Birch reduction). Addition of HX (Markownikoff's and anti-Markownikoff's addition.

Alkynes: (Upto 5 Carbons) Preparation: Acetylene from CaC2and conversion into Higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal dihalides.

Reactions: formation of metal acetylides, addition of bromine.

Learning Outcomes

The students will learn synthetic reactions, mechanism and properties of aromatic alcohol,

aromatic and aliphatic ether, aldehydes and ketones.

Reference Books:

1. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
2. Cotton, F.A., Wilkinson, G. & Gaus, P.L. Basic Inorganic Chemistry, 3rd ed., Wiley.
3. Huheey, J.E., Keiter, E.A., Keiter, R.L. & Medhi, O.K. Inorganic Chemistry:Principles of Structure and Reactivity, Pearson Education India, 2006.
4. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
5. Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).
6. Eliel, E.L. Stereochemistry of Carbon Compounds, Tata McGraw Hill education, 2000.
7. Finar, I.L. Organic Chemistry (Vol. I & II), E.L.B.S.
8. Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.
9. Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.

Course Outcomes:

On successful completion of this course, students will be able to:

1. Explain the concepts of atomic theory and arrangement of electrons in orbital level
2. Compare/contrast the properties of molecular and ionic compounds.
3. Write the various reaction mechanisms in organic chemistry and concept of aromaticity.
4. Differentiate the properties of aromatic alcohol, aromatic and aliphatic ether, aldehydes and ketones.
5. To discuss synthetic reactions, mechanism and properties of aromatic alcohol, aromatic and aliphatic ether, aldehydes, and ketones

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	1	1	2	2	2	3	1	3	2	2
CO2	3	2	1	1	3	3	3	1	3	3	1
CO3	3	2	1	1	2	3	2	3	1	2	2
CO4	3	2	2	1	2	3	3	3	2	2	2
CO5	2	2	1	2	3	3	2	3	1	2	1

3 - High Correlation, 2 – Medium Correlation, 1- Low Correlation

APPROVED IN:

BOS : 27/08/2021 **ACADEMIC COUNCIL: 17/09/2021**

SDG 3: Ensure healthy lives and promote well-being for all at all ages.

Statement: The given modules and topics included in this course to design and development of new organic molecules as drugs to combat against diseases to establish sustainable health

CHEM1031	CHEMISTRY-II	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

The students of undergraduate program in science need to be conversant with the various aspects of solution chemistry, phase equilibrium, electrochemistry and Functional group chemistry forms the foundation for training a undergraduate students as analytical and synthetic chemist.

Course Educational Objectives:

- To introduce the concept of solution and phase chemistry in physical chemistry
- To introduce functional group chemistry in organic chemistry
- To impart knowledge on the essential functional groups in organic chemistry.
- To impart knowledge on the essential functional groups reactions
- To impart knowledge on the essential functional groups properties

Unit-I **9 Hours**

Section A: Physical Chemistry-1

Solutions

Thermodynamics of ideal solutions: Ideal solutions and Raoult's law, deviations from Raoult's law – non-ideal solutions. Vapour pressure-composition and temperature composition curves of ideal and non-ideal solutions. Distillation of solutions. Leverrule. Azeotropes.

Phase Equilibrium

Phases, components, and degrees of freedom of a system, criteria of phase equilibrium. Gibbs

Phase Rule and its thermodynamic derivation. Derivation of Clausius – Clapeyron equation

and its importance in phase equilibria.

Unit-II **9 Hours**

Conductance

Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Kohlrausch law of independent migration of ions. Transference number and its experimental determination using Hittorf and Moving boundary methods. Ionic mobility. Applications of conductance measurements: determination of degree

of ionization of weak electrolyte, solubility and solubility products of sparingly soluble salts, ionic product of water, hydrolysis constant of a salt. Conductometric titrations (only acid base).

Unit-III **9 Hours**

Section B: Organic Chemistry-2

Carboxylic acids and their derivatives: Carboxylic acids (aliphatic and aromatic) Preparation: Acidic and Alkaline hydrolysis of esters. Reactions: Hell – Vohlard - Zelinsky Reaction. Carboxylic acid derivatives (aliphatic): (Upto 5 carbons) Preparation: Acid chlorides, Anhydrides, Esters and Amides from acids and their inter conversion. Reactions: Reformatsky Reaction. Amines (Aliphatic and Aromatic): (Upto 5 carbons), Preparation: from alkyl halides, Hofmann Bromamide reaction. Reactions: Carbylamine test, Hinsberg test. Electrophilic substitution (case aniline): nitration, bromination, sulphonation.

Unit-IV **9 Hours**

Amino Acids, Peptides and Proteins:

Preparation of Amino Acids: Strecker synthesis using Gabriel's phthalimide synthesis. Zwitterion, Isoelectric point and Electrophoresis. Reactions of Amino acids: ester of –COOH group, acetylation of –NH2group, ninhydrin test. Overview of Primary, Secondary, Tertiary and Quaternary Structure of proteins. Synthesis of simple peptides (upto dipeptides) by N-protection (t-butyloxycarbonyl and phthaloyl) & C-activating groups and Merrifield solid-phase synthesis.

Unit-V **9 Hours**

Carbohydrates: Classification, and General Properties, Glucose and Fructose (open chain and cyclic structure), Determination of configuration of monosaccharides, absolute configuration of Glucose and Fructose, Mutarotation, ascending and descending in monosaccharides. Structure of disacharrides (sucrose, cellobiose, maltose, lactose) and polysacharrides (starch and cellulose) excluding their structure elucidation.

Course Outcomes

On successful completion of this course, students will be able to:

1. Apply phase rule to one component and two component systems
2. Use the thermodynamic properties: G, H and S from EMF data.
3. Explain the synthesis and reactions carboxyl Functional group and derivatives.
4. Select correct method aminao acid preparation and differentiate the primary, secondary and tertiary amino acids
5. Classify the different carbohydrates

Text Books:

1. Barrow, G.M. Physical Chemistry Tata McGraw-Hill (2007).
2. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Finar, I. L. Organic Chemistry (Volume 2), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
5. Nelson, D. L. & Cox, M. M. Lehninger's Principles of Biochemistry 7th Ed., W. H. Freeman.
6. Berg, J.M., Tymoczko, J.L. & Stryer, L. Biochemistry, W.H. Freeman, 2002.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	1	3	3	3	1	3	2	1
CO2	3	1	1	2	2	2	3	1	3	2	1
CO3	3	2	1	1	2	3	3	3	2	1	2
CO4	2	2	1	2	2	2	3	3	1	3	3
CO5	2	2	1	1	3	3	3	3	1	2	3

3 - High Correlation, 2 – Medium Correlation, 1- Low Correlation

APPROVED IN:

BOS : 27/08/2021 **ACADEMIC COUNCIL: 17/09/2021**

SDG 4: Ensuring an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities.

Statement: The modules and topics mentioned in this course are designed to ensure all-inclusive and thorough education with equity to all persons and promote learning opportunities at all times.

CHEM1021	CHEMISTRY-I LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

The students of undergraduate program in science in Chemistry need to be conversant with the various basic methodologies of chemistry. Therefore, one module each on in inorganic, physical and organic chemistry is introduced which helps the student familiarize with the techniques essential for developing the foundation of practical chemistry

Course Educational Objectives:

- To know about the practical idea about Estimations of unknown concentrations of acids or bases using neutralization reactions
- To learn about principle involved in different redox reactions like permanganometry, dichrometry and Iodometry
- To understand the method of detection of extra elements in organic compounds
- To demonstrate the practical concepts involved in working of chromatography
- To expose the methods to separate mixture of aminoacids using paper chromatography

Section A: Inorganic Chemistry - Volumetric Analysis

1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.

2. Estimation of oxalic acid by titrating it with KMnO4.

3. Estimation of water of crystallization in Mohr's salt by titrating with KMnO4.

4. Estimation of Fe (II) ions by titrating it with K2Cr2O7 using internal indicator.

5. Estimation of Cu (II) ions iodometrically using Na2S2O3.

Section B: Organic Chemistry

1. Detection of extra elements (N, S, Cl, Br, I) in organic compounds (containing upto two extra elements)

2. Separation of mixtures by Chromatography: Measure the Rf value in each case (combination of two compounds to be given)

Identify and separate the components of a given mixture of 2 amino acids (glycine, aspartic acid, glutamic acid, tyrosine or any other amino acid) by paper chromatography

Identify and separate the sugars present in the given mixture by paper chromatography.

Course Outcomes:

On successful completion of this course, students will be able to:

- Estimations of unknown concentrations of acids or bases using neutralization reactions
- Distinguish the permanganometry, dichrometry and Iodometry
- Choose the method of detection of extra elements in organic compounds
- To separate mixture of aminoacids using paper chromatography

Reference Books:

1. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.

2. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.

3. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbookof Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.

4. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960.

B.Sc. Physical Science

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	1	3	3	3	1	3	3	1
CO2	3	1	1	2	2	3	3	1	3	3	1
CO3	2	2	1	2	2	3	3	3	2	1	2
CO4	3	2	1	2	2	2	3	3	1	3	3
CO5	3	2	1	1	3	2	3	3	1	3	3

3 - High Correlation, 2 – Medium Correlation, 1- Low Correlation

APPROVED IN:

BOS : 27/08/2021 **ACADEMIC COUNCIL: 17/09/2021**

SDG 3: Ensure healthy lives and promote well-being for all at all ages.

Statement: The given modules and topics included in this course to design and development of new organic molecules as drugs to combat against diseases to establish sustainable health

CHEM1051	CHEMISTRY-III	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

The students of undergraduate program in science need to be conversant with the various instrumental and analytical techniques in analytical chemistry for training undergraduate students as analytical chemist.

Course Objectives:

1. To familiarize the students with various types of basic statistical tools.
2. To study about the basic principles of atomic, molecular techniques and separation methods.
3. To emphasize the importance of UV Vis spectroscopy and atomic spectroscopy in quantitative determination of Metal ions.
4. To impart knowledge on the basic concepts of pH metry and conductometry.
5. To compare the different separation methods like chromatography and solvent extraction.

Unit -I **9 Hours**

Qualitative and quantitative aspects of analysis

Evaluation of analytical data, errors, accuracy and precision, methods of their expression, statistical test of data; F, Q and t test, rejection of data, and confidence intervals. Optical methods of analysis Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law.

Unit -II **9 Hours**

UV-Visible Spectrometry: Basic principles of instrumentation (choice of source, monochromator and detector) for single and double beam instrument; Infrared Spectrometry: Basic principles of instrumentation (choice of source, monochromator& detector) for single and double beam instrument.

Unit-III **9 Hours**

Flame Atomic Absorption and Emission Spectrometry: Basic principles of Instrumentation (choice of source, monochromator, detector, choice of flame and Burner designs. Techniques for the quantitative estimation of trace level of metal ions from water samples.

Unit-IV **9 Hours**

Thermal methods of analysis Theory of thermogravimetry (TG), basic principle of instrumentation. Electroanalytical methods Classification of electroanalytical methods, basic principle of pH metric, potentiometric and conductometric titrations.

Unit-V **9 Hours**

Separation techniques

Solvent extraction: Classification, principle and efficiency of the technique. Mechanism of extraction: extraction by solvation and chelation. Technique of extraction: batch, continuous

and counter current extractions. Chromatography: Classification, principle, and efficiency of the technique. Mechanism of separation: adsorption, partition & ion exchange. Development of chromatograms: frontal, elution and displacement methods.

Text Books:

1. Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6thEd., Pearson, 2009.
2. Willard, H.H. et al.: Instrumental Methods of Analysis, 7th Ed. Wardsworth Publishing Company, Belmont, California, USA, 1988.
3. Christian, G.D. Analytical Chemistry, 6th Ed. John Wiley & Sons, New York, 2004.
4. Harris, D.C.: Exploring Chemical Analysis, 9th Ed. New York, W.H. Freeman, 2016.
5. Khopkar, S.M. Basic Concepts of Analytical Chemistry. New Age International Publisher, 2009.\
6. Skoog, D.A. Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning India Ed.
7. Mikes, O. Laboratory HandBook of Chromatographic & Allied Methods, Elles Harwood Series on Analytical Chemistry, John Wiley & Sons, 1979.
8. Ditts, R.V. Analytical Chemistry; Methods of separation, van Nostrand, 1974

Course Outcomes:

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

1. list various types of statistical tools and the instruments for chemical analysis.
2. explain the role of various parts of instrumentation of atomic and molecular techniques
3. identify suitable analytical technique for chemical analysis.

4. distinguish atomic and molecular techniques.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3				2		1				3
CO2	3				3		1			1	3
CO3	3				2		1			1	3
CO4	3				3		1			2	3
CO5	3				2		1				3

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 27/08/2021 **ACADEMIC COUNCIL: 17/09/2021**

SDG No. & Statement:

SDG 4: Ensuring an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities.

SDG Justification:

Statement: The modules and topics mentioned in this course are designed to ensure all-inclusive and thorough education with equity to all persons and promote learning opportunities at all times.

CHEM1041	CHEMISTRY-II LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

The students of undergraduate program in science in Chemistry need to be conversant with the various basic methodologies of chemistry. Therefore, one module each on in inorganic, physical and organic chemistry is introduced which helps the student familiarize with the techniques essential for developing the foundation of practical chemistry

Course Educational Objectives:

1. To make student learn the practical application of solution, phase and electrochemistry for quantitative analysis
2. To estimate the unknown concentrations of acids using conductometer and potentiometer.
3. To understand the method of functional group detection of an organic compound.
4. To expose the methods to separate mixture of aminoacids using paper chromatography
5. The students also learn to differentiate between reducing and non-reducing sugars by qualitative analysis.

Section A: Physical Chemistry

Distribution

Study of the equilibrium of one of the following reactions by the distribution method:

I2(aq) + I-(aq) I3-(aq)

Cu2+(aq) + xNH2(aq) [Cu(NH3)x]2+

Conductance

I. Determination of cell constant

II. Determination of equivalent conductance, degree of dissociation and dissociation

constant of a weak acid.

III. Perform the following conductometric titrations:

i. Strong acid vs. strong base

ii. Weak acid vs. strong base

Potentiometry

Perform the following potentiometric titrations:

i. Strong acid vs. strong base

ii. Weak acid vs. strong base

iii. Potassium dichromate vs. Mohr's salt

Section B: Organic Chemistry I

Systematic Qualitative Organic Analysis of Organic Compounds possessing mono functional groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines) and preparation of one derivative.

Organic Chemistry II

1. Separation of amino acids by paper chromatography

2. Determination of the concentration of glycine solution by formylation method.

3. Titration curve of glycine

4. Action of salivary amylase on starch

5. Effect of temperature on the action of salivary amylase on starch.

6. Differentiation between a reducing and a nonreducing sugar.

Reference Books:

1. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook ofactical Organic Chemistry, Prentice-Hall, 5th edition, 1996.
2. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960.
3. Khosla, B. D.; Garg, V. C. & Gulati, Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).
4. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry, Universities Press

Course Outcomes

On successful completion of this course, students will be able to:

1. Select the correct the practical application of solution, phase and electrochemistry for quantitative analysis
2. Estimate the unknown concentrations of acids using conductometer and potentiometer.
3. Choose the correct method to detect the functional group of an organic compound.
4. Separate mixture of aminoacids using paper chromatography
5. Differentiate between reducing and non-reducing sugars by qualitative analysis.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	1	1	1	3	1	3	3
CO2	3	2	1	1	3	3	3	1	3	3	1
CO3	2	2	1	2	2	3	3	3	2	1	2
CO4	3	2	1	1	3	2	3	3	1	3	3
CO5	3	3	3	1	2	1	1	3	2	3	3

3 - High Correlation, 2 – Medium Correlation, 1- Low Correlation

APPROVED IN:

BOS : 27/08/2021 **ACADEMIC COUNCIL: 17/09/2021**

SDG 4: Ensuring an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities.

Statement: The modules and topics mentioned in this course are designed to ensure all-inclusive and thorough education with equity to all persons and promote learning opportunities at all times.

CSCI1001	BASICS OF INFORMATION TECHNOLOGY	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course features about the technology of computer and understanding the prerequisites for learning signals converting to output data. This course helps students learn about network and how the data can be retrieved and also understand operating systems types, and applications

Course Educational Objectives:

- To learn computer data processing
- To understand audio-video and data storage
- To gain knowledge on computer memory
- To learn about operating systems types
- To gain knowledge on internet

UNIT 1 Data and Information, Acquisition of Numbers and Textual Data and Acquiring Image Data 8 hours

Data and Information: Introduction, Types of data, Simple model of a computer, Data processing using a computer, Desktop computer.

Acquisition of Numbers and Textual Data: Introduction, input units, internal representation of numeric data, Representation of characters in computers, Error Detecting codes.

Acquiring Image Data: Introduction, acquisition of textual data, acquisition of pictures, storage formats for pictures, Image compression fundamentals, Image acquisition with a digital camera.

UNIT 2 Acquiring Audio Data, Acquisition of Video and Data storage 8 hours

Acquiring Audio Data - Basics of Audio Signals, Acquiring and storing Audio Signals, Compression of Audio Signals.

Acquisition of Video: Computing a moving Scene with a video camera, Compression of Video Data, MPEG Compression standard.

Data storage: Introduction, Storage cell, Physical devices used as storage cells, Random access memory, Read only memory, Secondary storage, Compact disk read only memory (CDROM), Archival store.

UNIT 3 Central Processing Unit and Output Devices 8 hours

Central Processing Unit: Introduction, Structure of a central processing unit, Specifications of a CPU, Interconnection of CPU with memory and I/O units, Embedded processors.

Output Devices: Video Display Devices, Touch Screen, E-ink display, Printers, Audio Output.

UNIT 4 Computer Networks and Computer Software 8 hours

Computer Networks: Introduction, Local Area Network (LAN), Applications of LAN, Wide Area Network (WAN), Internet, Naming computers connected to Internet, Future of Internet Technology.

Computer Software: Introduction, Operating system, Programming languages, Classification of programming languages, Classification of Programming Languages based on applications.

UNIT 5 Data organization and Some Internet Applications 8 hours

Data organization: Introduction, Organizing a database, Structure of a database, Database Management System, Example of database design, Non-text databases, Archiving databases. Processing Numerical Data: Introduction, Use of spreadsheets, Numerical computation examples.

Some Internet Applications: Introduction, Email, World Wide Web, Information Retrieval from the WWW, Other facilities provided by Browsers, Audio on the internet, Accessing pictures and video via internet

Textbooks:

1. Introduction to Information Technology by V. Rajaraman, PHI Learning Pvt.Ltd. 2013.

References:

2. Computing Fundamentals by Peter Norton, Tata Mc. Graw Hill, 6th edition, 2006.

3. Fundamentals of Computers by E.Balagurusamy, Tata McGraw Hill, 2009

Course Outcomes:

On successful completion of this course, students will be able to:

1. To learn computer data processing
2. To understand audio-video and data storage
3. To gain knowledge on computer memory
4. To learn about operating systems types
5. To gain knowledge on internet-www

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3	3	2	2	1	2	2	2	2
CO2	2	2	2	3	2	1	2	2	2	2	2
CO3	1	2	2	2	3	2	1	2	2	1	3
CO4	3	3	3	3	2	2	2	2	2	2	3
CO5	3	3	3	3	2	2	2	2	2	2	3

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 22-08-22 **ACADEMIC COUNCIL: <<date>>**

SDG No. & Statement: 4

4. Aims at ensuring inclusive and equitable quality education and promote lifelong learning opportunities for all

SDG Justification:

The course involves identifying one's personal values and working on real-life problems, thus forming the base to work on their passions even past the collegiate life.

PHYS1091	BIOPHYSICS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure							

Course Description:

The subject of Biophysics is one of the important interdisciplinary areas in teaching, training and learning which is considered to be important in terms of human resource development and National development. The main emphasis of biophysics is on the quantitative analysis of the physical and chemical aspects of the functions of biological molecules, organisms and entities. The techniques and methodologies that biophysics relies on are closer to Physics and Chemistry, but areas of application are in the biological, medical and related sciences.

Course Educational Objectives:

1. To learn about radiation biophysics
2. To understand transport phenomenon
3. To study UV-visible, and other important techniques like NMR, ESR etc.
4. To gain knowledge on microscopic techniques
5. To understand the concepts of thermodynamics

UNIT 1 Radiation Biophysics 8 hours

Ionising radiation, Interaction of radiation with matter, Measurement of Radiation, Radioactive isotopes. Types of Radioactivity-Natural, Artificial and induced Radioactivity and radioactive decay law. Measurement of Radioactivity -Geiger Muller counter, proportional counter and scintillation counter. Biological effects of radiation and radiation protection and therapy.

UNIT 2 Transport process 8 hours

Light scattering, Diffusion –factors effecting diffusion, Fick's law, diffusion of electrolytes, accelerated diffusion and biological significance sedimentation, osmosis, viscosity, chromatography and electrophoresis and optical activity .Biophysical phenomena in biochemical studies-pH meter - principle, electrode system and factors effecting in its measurement.

UNIT 3 Physical Techniques in structure determination 8 hours

Ultraviolet and Visible spectroscopy, fluorescence and phosphorescence methods, Infrared spectroscopy- bending, near, mid and far infrared region. Raman spectra- principle and instrumentation. NMR, ESR Instrumentation.

UNIT 4 Microscopies 8 hours

Optical microscope, Electron microscopy, emerging trends in microscopy. X ray diffraction-diffraction of x rays, structure determination, phase determination procedures. Laser-characteristics, population inversion, stimulated and spontaneous and relation (no derivation) and Holography

UNIT 5 Biomolecular structures, Bioenergetics and Biological systems 8 hours

Biomolecular structures-Concepts of classical physics and limitations, quantum principles of atomic
Structure. Bioenergetics-Thermodynamics-reversible thermodynamics and irreversible thermodynamics. Photo bioenergetics and chemo bioenergetics. Biological systems: Neuro biophysics-Molecular transport across cell membrane and nerve impulse generation.

Textbooks:

1. Essentials of Biophysics: P.Narayanan. New Age India Intl.
2. Handbook of Radiobiology by KT Jaypee Brothers, Medical Publishers Pvt. Ltd.

References:

1. An Introduction to radiation protection by A Martin & SA Harbison, 4th Edition, Springer Publishers.
2. Laser Tissue Interactions: Fundamentals and Applications by MH Niemz, Springer Publishers.
3. Understanding biophotonics- Fundamentals, Advances and Applications by K Tsia, 1st Edition, CRC press.

Course Outcomes:

On successful completion of this course, students will be able to:

1. To learn about radiation biophysics
2. To understand transport phenomenon
3. To study UV-visible, and other important techniques like NMR, ESR etc.

4. To gain knowledge on microscopic techniques
5. To understand the concepts of thermodynamics

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	1	1	2	1	2	1	2	1
CO2	2	2	2	1	1	2	1	3	2	1	1
CO3	2	2	2	1	1	2	1	2	2	2	1
CO4	3	3	3	3	2	2	3	3	2	3	3
CO5	2	2	2	1	1	2	1	2	1	2	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 22-08-2022 **ACADEMIC COUNCIL: 22-08-2022**

SDG No. & Statement: 4

4. Aims at ensuring inclusive and equitable quality education and promote lifelong learning opportunities for all

SDG Justification:

The course involves identifying one's personal values and working on real-life problems, thus forming the base to work on their passions even past the collegiate life.

PHYS1101	BIOPHYSICS LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	None						
Preferable exposure							

Course Description:

The subject of Biophysics is one of the important interdisciplinary areas in teaching, training and learning which is considered to be important in terms of human resource development and National development. The main emphasis of biophysics is on the quantitative analysis of the physical and chemical aspects of the functions of biological molecules, organisms and entities. The techniques and methodologies that biophysics relies on are closer to Physics and Chemistry, but areas of application are in the biological, medical and related sciences.

Course Educational Objectives:

1. To learn about radiation biophysics
2. To understand transport phenomenon
3. To study UV-visible, and other important techniques like NMR, XRD etc.
4. To gain knowledge on microscopic techniques
5. To understand the concepts of thermodynamics

List of experiments:

1. Plateau characteristics of radioactive source
2. Intensity variation of radioactive material
3. Wavelength of colors using spectrometer
4. Determination of wavelength of LASER
5. Optical activity
6. X-ray diffraction – determination of interplanar spacing from X-ray spectra
7. Analysis of infrared spectra - Identification of various groups

8. Analysis of UV spectra -Identification wavelength corresponding to absorption

Textbooks:

1. Radiation Biophysics, Second Edition - by Edward L. Alpen
2. Physical Chemistry: Principles and Applications in Biological Sciences by Tinoco. I. et al..

References:

1. Physics of the Life Sciences by Newman, J.
2. Drenth, J. (2010) Principles of Protein X-ray Crystallography, Spri

Course Outcomes:

1. To learn about radiation biophysics
2. To understand transport phenomenon
3. To study UV-visible, IR, and other important techniques like NMR, XRD etc.
4. To gain knowledge on microscopic techniques
5. To understand the concepts of thermodynamics

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	1	1	2	1	2	1	2	1
CO2	2	2	2	1	1	2	1	3	2	1	1
CO3	2	2	2	1	1	2	1	2	2	2	1
CO4	3	3	3	3	2	2	3	3	2	3	3
CO5	2	2	2	1	1	2	1	2	1	2	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 22-08-2022 **ACADEMIC COUNCIL: 22-08-2022**

SDG No. & Statement: 4

4. Aims at ensuring inclusive and equitable quality education and promote lifelong learning opportunities for all

SDG Justification:

The course involves identifying one's personal values and working on real-life problems, thus forming the base to work on their passions even past the collegiate life.

Program Core

BCBI1001	BIO MOLECULES	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

Biochemistry is a discipline, which aims at understanding the chemical properties of the biomolecules, their structural architecture, principles of stereochemistry and molecular forces responsible for the activities of biomolecules. The course includes their importance in understanding various bio molecular reactions and how they fold to their native, functional forms.

Course Educational Objectives:

- To understand the role of water, pH, buffers & osmotic pressure in biological system
- To understand the structural and biological roles of carbohydrates (Mono, oligo, polysaccharides).
- To gain the concept of lipids, their biological and chemical roles.
- To acquire and understand the structures of DNA and RNA, sequence determination and synthesis.
- To study the structure & biological role of porphyrins and to remember chemistry and physiological role of vitamins

UNIT 1 Biophysical Concepts 8 hours

Basic classification of biomolecules, Role of water in biological processes. Biological importance of pH, pKa of functional groups in proteins and nucleic acids. Importance of buffers in biological systems. Significance of osmotic pressure in biological systems

UNIT 2 Carbohydrates 8 hours

Classification, monosaccharides, D and L designation, open chain and cyclic structures, epimers and anomers, mutarotation, reactions of carbohydrates. Structure and biological importance of disaccharides (sucrose, lactose, maltose). Biological importance of structural polysaccharides (cellulose) and storage polysaccharides (starch, glycogen).

UNIT 3 **Lipids** **8 hours**

Classification, saturated and unsaturated fatty acids, structure and properties of fats and oils. General properties and structures of phospholipids, sphingolipids and cholesterol. Bio membranes - Behaviour of amphipathic lipids in water. Formation of micelles, bilayers, vesicles, liposomes.

UNIT 4 **Nucleic Acids** **8 hours**

Structure of purines and pyrimidines, nucleosides, nucleotides. Importance of phosphodiester bond. Watson-Crick DNA double helix structure, Types of RNA and DNA. Effect of acids, alkali and nucleases on DNA and RNA. Denaturation of nucleic acids. Structure and properties of porphyrins

UNIT 5 **8 hours**

Basic structure of Bacteria, plant and animal cell. Membrane composition and organization, Fluid mosaic model. Structure and functions of cell organelles – Mitochondria, Chloroplast, Endoplasmic reticulum, Nucleus, Golgi body.

Textbooks:

1. Textbook of Biochemistry by West and Todd, Oxford and IBH, 4th Ed.
2. Principles of Biochemistry by Nelson cox, Freeman, 4th Ed.

References:

1. Biochemistry by Vote and Vote, John Wiley and Sons, 3rd Ed.
2. Outlines of Biochemistry by Conn and Stumpf, John Wiley and Sons, 5th Ed

Course Outcomes:

On successful completion of this course, students will be able to:

1. Learn prepare various buffers and determine their pH.
2. Perform qualitative identification of various carbohydrates like glucose, fructose etc.
3. Prepare osazones of various carbohydrates and learn their identification.
4. Qualitatively identify lipids based on their biochemical properties.
5. Analyse the absorption maxima of colored substances.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	1							1			
CO2	2							2			
CO3	2							2			
CO4	2							2			
CO5	2							2			

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 22-08-22 **ACADEMIC COUNCIL: 22-08-22**

SDG No. & Statement:

SDG Justification:

BCBI1011	BIOCHEMISTRY LAB	L	T	P	S	J	C
		0	0	2	0	0	`1
Pre-requisite	NONE						
Co-requisite	None						
Preferable exposure	None						

Course Description:

Biochemistry is a discipline, which aims at understanding the chemical properties of the biomolecules, their structural architecture, principles of stereochemistry and molecular forces responsible for the activities of biomolecules. This course includes preparation of buffers and identification of various biomolecules like carbohydrates, lipids etc. using biochemical tests.

Course Educational Objectives:

- To prepare various buffers and determine their pH.
- To perform qualitative identification of various carbohydrates like glucose, fructose etc.
- To prepare osazones.
- To qualitatively identify lipids based on their biochemical properties.
- To find out the absorption maxima of colored substances.

List of experiments:

1. Preparation of buffers (acidic, neutral, and alkaline) and determination of *p*H.
2. Qualitative identification of carbohydrates- glucose, fructose, ribose/ xylose, maltose, sucrose, lactose, starch/glycogen.
3. Preparation of osazones and their identification.
4. Qualitative identification of lipids- solubility, saponification, acrolein test, Salkowski test, Lieberman-Burchard test.
5. Absorption maxima of colored substances- *p*-Nitrophenol, Methyl orange.

Textbooks:

1. Biochemical methods by Sadasivam and Manikam, Wiley Eastern Limited.
2. An introduction to practical Biochemistry by D. T. Plummer, McGraw Hill.

Course Outcomes:

On successful completion of this course, students will be able to:

1. Learn prepare various buffers and determine their pH.
2. Perform qualitative identification of various carbohydrates like glucose, fructose etc.
3. Prepare osazones of various carbohydrates and learn their identification.
4. Qualitatively identify lipids based on their biochemical properties.
5. Analyse the absorption maxima of colored substances.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	2							2			
CO2	3							3			
CO3	2							2			
CO4	3							3			
CO5	2							2			

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 22-08-22 **ACADEMIC COUNCIL: 22-08-22**

SDG No. & Statement:

SDG Justification:

BCBI1021	PROTEIN CHEMISTRY AND ENZYMOLOGY	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	NONE						
Co-requisite	None						
Preferable exposure	None						

Course Description:

The course deals with basic chemistry of amino acids and protein with their specific reaction mechanisms. The courses more emphasize on the role of protein as enzymes with their classification, kinetics of enzyme action and mechanism of enzyme catalysis

Course Educational Objectives:

- To explain the amino acid reactions and formations of peptide bonds
- To impart knowledge on proteins properties and structural organization of protein structure
- To provide the details about the enzyme classification and enzyme characteristics
- To describe enzyme action using the kinetics
- To deliver molecular mechanism of enzyme catalysis

UNIT 1 **8 hours**

Amino Acids and Peptides: Classification, structure, chemical reactions of amino acids due to carbonyl and amino groups. Essential and non-essential amino acids, Peptide bond - nature and conformation.

UNIT 2 **8 hours**

Proteins: Classification based on solubility, shape, and function. General properties of proteins, denaturation, and renaturation of proteins. Structural organization of proteins- primary, secondary, tertiary, and quaternary structures (Eg. Hemoglobin).

UNIT 3 **8 hours**

Enzymes – Classification. Enzyme specificity. Active site. Activation energy, transition state. Lock and key and induced fit models. Definition of holo-enzyme, apo-enzyme, coenzyme, cofactor. Fundamentals of enzyme assay, enzyme units.

UNIT 4 **8 hours**

Enzyme Kinetics - Factors affecting the catalysis- substrate concentration, pH, temperature. Michaelis - Menten equation for uni-substrate reaction (derivation not necessary), significance of Km and Vmax. Enzyme inhibition- irreversible and reversible inhibitions.

UNIT 5 **8 hours**

Outline of mechanism of enzyme action- acid-base and covalent catalysis. AT Case as an allosteric enzyme. Covalent modification- phosphorylation and zymogen activation (trypsinogen and chymotrypsin).

Textbooks:

1. Fundamentals of Enzymology by Nicole C. Price and Lewis Stevens, Oxford Uni. Press.
2. Understanding Enzymes by Trevor Palmer, Harvard publishing

References:

1. Biochemistry by Voet and Voet, John Wiley and Sons, 3rd Ed.
2. Biochemistry by Stryer, WH Freeman and CO. 4th Ed.
3. Biochemistry by Lehninger, Kalyani Publishers**.**

Course Outcomes:

On successful completion of this course, students will be able to:

1. Explain the amino acid reactions and formations of peptide bonds
2. Impart knowledge on proteins properties and structural organization of protein structure
3. Outline the details about the enzyme classification and enzyme characteristics
4. Describe enzyme action using the kinetics
5. Illustrate the molecular mechanism of enzyme catalysis

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3										3
CO2	3										3
CO3	3										3
CO4	3										3
CO5	**3**										3

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 22-08-22 **ACADEMIC COUNCIL: 22-08-22**

SDG No. & Statement:

SDG Justification:

BCBI1031		**L**	**T**	**P**	**S**	**J**	**C**

	PROTEIN CHEMISTRY AND ENZYMOLOGY LAB	0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

Amino acids are the building blocks proteins, which have wide biological activities. One of the function of proteins is catalyzing the biochemical reactions in living organisms and favor the reaction under physiological conditions. The enzymology lab covers identification of amino acids using qualitative tests, the assay of amylase, protease, catalase. The lab course also covers the analysis of factors pH, temperature affecting the enzyme catalysis taking acid phosphatase as reference enzyme.

Course Educational Objectives:

- To qualitative identification of amino acids -histidine, tyrosine, tryptophan, cysteine and arginine.
- To assay of amylase activity in crude potato extract
- To assay the protease activity
- To assay the catalase activity
- To determine the effect of pH, temperature on phosphatase activity

List of Experiments:

1. Qualitative identification of amino acids – histidine, tyrosine, tryptophan, cysteine, arginine
2. Assay of amylase
3. Assay of protease
4. Assay of catalase
5. Assay of phosphatase
6. Determination of optimum temperature for phosphatase.
7. Determination of optimum pH for phosphatase.

Textbooks:

1. Experimental Biochemistry: A student companion by Beedu Sashidhar Rao and Vijay Deshpande, I.K. International Pvt. Ltd., New Delhi.
2. Laboratory Manunal in Biochemistry by Jayaraman, New Age International Publishers, New Delhi.

References:

1. Introductory practical biochemistry by SK Sawhney & Randhir singh. Narosa publications.
2. Biochemical methods by S Sadasivan & A Manickam. New Age international publishers

Course Outcomes:

By the end of this course, the student will be able to

1. Identify the histidine, tyrosine, tryptophan, cysteine and arginine
2. Determine the amylase, protease, catalase activity in various biological samples
3. Analyse the effect of pH and temperature on enzyme activity
4. Design an enzyme assay for determination enzyme activity
5. Apply the knowledge of enzyme activity for the industrial applications

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3		1					3			
CO2	3		1	1				3			1
CO3	1		3					2			
CO4			3					2			
CO5			3					2			

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 22-08-22 **ACADEMIC COUNCIL: 22-08-22**

SDG No. & Statement:

SDG Justification:

BCBI2001	METABOLISM AND BIOENERGETICS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

The student will be able to review and consolidate concepts in the areas of Metabolism and Bioenergetics, focusing on the main metabolic pathways in a living cell, their regulation and disturbances in disease, and how energy is obtained and transduced to meet the cell's requirements.

Course Educational Objectives:

- To understand the overview and interplay of metabolic pathways.
- To describe the individual reactions, cofactors, inhibition, energetics and regulation of pathways.
- To correlate the pathways with diseases associated directly or indirectly with them.
- To understand the clinical applications of synthetic purine and pyrimidine analogs.
- To comprehend the thermodynamics involved in energetics of biochemical pathways.

UNIT 1 **8 hours**

Carbohydrate metabolism: Concept of anabolism and catabolism. Glycolytic pathway. Citric acid cycle. Amphipathic role. Anaplerotic reactions. Glycogenolysis and glycogenesis. Pentose phosphate pathway. Gluconeogenesis.

UNIT 2 **8 hours**

Lipid Metabolism - Catabolism of fatty acids (β- oxidation) with even number of carbon atoms, Ketogenesis, de novo synthesis of fatty acids. Biosynthesis and degradation of triacylglycerol. Biosynthesis of cholesterol

UNIT 3 **8 hours**

Thermodynamic principles – Chemical equilibria; free energy, enthalpy (H), entropy (S). Oxidation-reduction reactions. Organization of electron carriers and enzymes in mitochondria. Oxidative phosphorylation. Uncouplers and inhibitors of oxidative phosphorylation.

UNIT 4 **8 hours**

Amino acid Metabolism: General reactions of amino acids - transamination, decarboxylation and deamination, Glycogenic and ketogenic amino acids. Urea cycle and regulation. Biosynthesis of serine and phenylalanine.

UNIT 5 **8 hours**

Metabolism of Nucleic acid: Biosynthesis and regulation of purine and pyrimidine nucleotides. Catabolism of purines and pyrimidines.

Textbooks:

1. Textbook of Biochemistry by West and Todd, Oxford and IBH, 4th Ed.
2. Principles of Biochemistry by Nelson cox, Freeman, 4th Ed.
3. Biochemistry by Voet and Voet, John Wiley and Sons, 3rd Ed.

References:

1. Outlines of Biochemistry by Conn and Stumpf, John Wiley and sons, 5th Ed.
2. Biochemistry by Matthews, PSN, 3rd Ed.
3. Biochemistry by Lehninger, Kalyani Publishers, 2nd Ed.
4. Biochemistry by Stryer, WH Freeman and CO, 4th Ed.

Course Outcomes:

On successful completion of this course, students will be able to:

1. Acquires knowledge related to the role of TCA cycle in central carbon metabolism, importance of anaplerotic reactions and redox balance.
2. Gains an overview and interplay of metabolic pathways of lipids .
3. Understands the thermodynamics involved in energetics of biochemical pathways.
4. Gains insights into metabolic process of amino acids.
5. Understand the nucleic acid metabolic pathways and diseases associated with it

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3							2			
CO2	3							2			
CO3	3							2			
CO4	3							2			
CO5	3							2			

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 22-08-22 **ACADEMIC COUNCIL: 22-08-22**

SDG No. & Statement:

SDG Justification:

BCBI2011	Metabolism and Bioenergetics Lab	L	T	P	S	J	C

		0	**0**	**2**	**0**	**0**	**1**
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

Quantitative analysis of various biomolecules finds application in identification, estimation, and analysis of homogenates of biological importance. The practical knowledge of Quantitative analysis in Biochemistry lab course equips the students with better learning outcomes in analysis and research.

Course Educational Objectives:

- To learn about practical implications and their use in analysis and identification of molecules.
- To acquires working knowledge of analytical methods commonly used in the laboratory.

List of Experiments

1. Estimation of amino acid by Ninhydrin method.
2. Estimation of protein by Biuret method.
3. Estimation of protein by Lowry method.
4. Estimation of glucose by DNS method.
5. Estimation of glucose by Benedict's titrimetric method.
6. Estimation of total carbohydrates by Anthrone method.
7. Absorption spectra of protein-BSA, Nucleic acids- Calf thymus DNA

Textbooks:

1. Biochemical methods by Sadasivam and Manikam, Wiley Eastern Limited.
2. An introduction to practical Biochemistry by D. T. Plummer, McGraw Hill.

References:

1. Laboratory manual in Biochemistry by J. Jayaraman, Wiley Eastern Limited.
2. Introductory Practical Biochemistry by S. K. Sawhney and Randhir Singh, Narosa.

Course Outcomes:

On successful completion of this course, students will be able to:

1. Obtains knowledge about preparation of reagents, chemical usage, spectral analysis.
2. Acquires working knowledge of analytical methods commonly used in quantitative analysis laboratory.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3							2			
CO2	3							2			
CO3	3							2			
CO4	3							2			
CO5	3							2			

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 22-08-22 **ACADEMIC COUNCIL: 22-08-22**

SDG No. & Statement:

SDG Justification:

BCBI2021	BIOCHEMICAL TECHNIQUES	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

Biochemical studies rely on the availability of appropriate analytical techniques and their applications. This undergraduate course deals with the different biochemical techniques such as cell disruption methods, centrifugation, spectrophotometry, chromatography, electrophoresis, and radioactivity to gain knowledge on the biomolecules such as proteins, nucleic acids, and their functions.

Course Educational Objectives:

- To learn the basic concepts and applications of various biochemical techniques.
- To study the isolation, purification and characterization of biomolecules using various centrifugal, chromatographic, electrophoretic and spectrophotometric techniques.
- To understand the concept of radioactivity and handling function to perform
- Operations in biochemical realm.
- To identify and apply the appropriate methodology in biochemical studies.
- To execute the methodology for biochemical characterization of biomolecules.

UNIT 1 **8 hours**

Homogenization - Methods of disrupting cells and tissues. Centrifugation -Basic principles of sedimentation, Principle, methodology and applications of analytical and preparative ultracentrifugation.

UNIT 2 **8 hours**

Principle and applications of chromatographic techniques- paper, thin layer, gel filtration, ion- exchange and affinity chromatography.

UNIT 3 **8 hours**

Principles and applications of polyacrylamide (native and SDS) and agarose gel electrophoresis, Criteria of purity.

UNIT 4 **8 hours**

Introduction to spectroscopy, light-matter interaction, Beer-Lambert law, chromophores and fluorophores Absorption spectroscopy UV, Visible, Atomic absorption spectroscopy.

UNIT 5 **8 hours**

Introduction to radioactivity, Nature and units of radioactivity, detection, and measurement of radioactivity – GM and Scintillation counters. Autoradiography. Applications of radioisotopes in biology.

Textbooks:

1. A Biologists guide to Principles and techniques of practical Biochemistry by B.D. Williams, Edward Arnold.
2. Principles and Techniques of Biochemistry and Molecular Biology by Keith Wilson, John Walker, Cambridge University Press,7th Ed.

References:

1. Biophysical chemistry principles and techniques by Upadhyay, Upadhyay and Nath, Himalaya publishing.
2. Instrumental methods of chemical analysis by Chatwal and Anand, Himalaya Publishers, 5thEd.
3. Modern Experimental Biochemistry by Rodney F. Boyer.

Course Outcomes:

On successful completion of this course, students will be able to:

1. Acquaint with basic instrumentation, principle and procedure of various sophisticated instruments like HPLC, Ultra-centrifugation, Mass Spectroscopy, GM counters etc.
2. Gains knowledge about the basic concept and applications of various biochemical Techniques
3. Will be conversant with the techniques required for isolation, purification and characterization of biomolecules
4. Gains knowledge about the application of radioactive techniques in biological realm
5. Learn about the methodology and application of biochemical techniques

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1		3							3		
CO2		3							3		
CO3		2							3		
CO4		2							3		
CO5		3							2		

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 22-08-22 **ACADEMIC COUNCIL: 22-08-22**

SDG No. & Statement:

SDG Justification:

BCBI2031	BIOCHEMICAL TECHNIQUES LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This skill-based course will teach the students the various biochemical separation principles and instrumentations that are used in the analytical laboratories. This course covers both fundamental and applications of the instruments that are routinely used for the characterization of biomolecules.

Course Educational Objectives:

- To describe general principles involved in separation of biomolecules from foods.
- To understand the steps involved in the separation of amino acids and plant pigments by chromatographic approaches.
- To separate proteins using electrophoresis
- To isolate important biomolecules
- To partially characterize an unknown molecule

List of Experiments

1. Separation of amino acids by paper chromatography.
2. Separation of sugars by paper chromatography
3. Separation of plant pigments by TLC.
4. Separation of serum proteins by PAGE.
5. Isolation of casein from milk.
6. Isolation of starch from potatoes
7. Spectrophotometry: The absorption spectrum and determination of molar absorption coefficient of aromatic amino acids

Textbooks:

1. Biochemical methods by Sadasivam and Manikam, Wiley Eastern Limited.
2. An introduction to practical Biochemistry by D. T. Plummer, Mc Graw Hill.

References:

1. Laboratory manual in Biochemistry by J. Jayaraman, Wiley Eastern Limited.
2. Introductory Practical Biochemistry by S. K. Sawhney and Randhir Singh, Narosa Experimental Biochemistry by B.S. Rao and V. Deshpande, I.K. International

Course Outcomes:

On successful completion of this course, students will be able to

1. The student will obtain hands-on training in basic separation techniques in biochemistry and gain expertise in the isolation of various biomolecules.
2. Will be able explain and execute the steps involved in the separation using chromatographic approaches.
3. Will be able to separate serum proteins by electrophoresis.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1		3							3		
CO2		2							3		
CO3		2							3		
CO4		3							3		
CO5		2							3		

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 22-08-22 **ACADEMIC COUNCIL: 22-08-22**

SDG No. & Statement:

SDG Justification:

BCBI2041	MOLECULAR BIOLOGY	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

Molecular Biology deals with the basics and understanding of the central dogma. It helps the student in knowing the organization of the genome, replication, transcription, translation and their regulation in both prokaryotes and eukaryotes. This knowledge can be employed in determining the function of various genes and proteins for better understanding of cellular life.

Course Educational Objectives:

- To understand the organization of nuclear genome.
- To understand the DNA replication in both prokaryotes and eukaryotes.
- To gain the knowledge of promoters, RNA polymerase, mechanism of transcription in both prokaryotes and eukaryotes, and regulation of gene expression.
- To gain the knowledge of genetic code, knowledge of ribosome, mechanism of translation (protein synthesis) in both prokaryotes and eukaryotes.
- To gain the knowledge of inhibition of protein synthesis), and post translational modifications.

UNIT 1 **8 hours**

Genome Organization and Replication: Organization of genome in prokaryotes and eukaryotes. Experimental evidence to prove nucleic acids as genetic material. Nature and structure of the gene.

UNIT 2 **8 hours**

Models of replication, Meselson-Stahl's experimental proof for semi-conservative model. DNA replication in prokaryotes and eukaryotes.

UNIT 3 **8 hours**

Transcription: Transcription in prokaryotes and eukaryotes – Initiation-Elongation-Termination. Role of RNA polymerase and promoters in transcription. Regulation of gene expression Lac and Tryptophan operon.

UNIT 4 **8 hours**

Genetic code and Translation: Genetic code, deciphering of genetic code, Nirenberg's and Khorana's experiments, wobble hypothesis, degeneracy of genetic code.

UNIT 5 **8 hours**

Protein Synthesis - Ribosome structure, activation of amino acids (aminoacyl t-RNA synthetases). Initiation, elongation, and termination of protein synthesis. Inhibitors of protein synthesis. Post- translational modifications.

Textbooks:

1. Molecular Biology of the gene by Watson, Pearson, 5th Ed.
2. Molecular Biology of the cell by Alberts, Garland science, 4th Ed.
3. Biochemistry by Matthews, Pearson, 3rd Ed.

References:

1. Biochemistry by Voet and Voet, John Wiley and sons, 3rd Ed.
2. Molecular cell Biology by Lodish, Freeman, 6th Ed.
3. Principles of Biochemistry by Nelson cox. PALG, 4th Ed.
4. Biochemistry by L.Stryer, Freeman, 5th Ed.
5. Molecular Biology by Robert F.Weaver, McGraw Hill

Course Outcomes:

By the end of this course, the student will be able to

1. Understand the organization of nuclear genome (prokaryotes and eukaryotes).
2. Understand the DNA replication (prokaryotes and eukaryotes) along with enzymes involved in DNA.
3. Gain the knowledge of promoters, RNA polymerase, mechanism of transcription in both prokaryotes and eukaryotes; and regulation of gene expression .
4. Gain the knowledge of genetic code and ribosome.
5. Gain the knowledge of mechanism and inhibition of translation (protein synthesis); and the knowledge of post translational modifications.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1					2					2	
CO2					3					3	
CO3					3					3	
CO4					3					3	
CO5					3					3	

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 22-08-22 **ACADEMIC COUNCIL: 22-08-22**

SDG No. & Statement:

SDG Justification:

BCBI2051	MOLECULAR BIOLOGY LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	NONE						
Co-requisite	None						
Preferable exposure	None						

Course Description:

Molecular Biology laboratory deals with understanding the principles of isolating DNA & RNA, determining the purity of isolated DNA & RNA, and quantifying the isolated DNA & RNA from different sources. It helps the student to analyse isolated DNA content for better understanding of cellular life.

Course Educational Objectives:

- To understand the principles of isolating genomic DNA from various sources such as onion/liver/coconut endosperm.
- To understand the principles of isolating plasmid DNA.
- To understand the principles of determining the purity of isolated DNA.
- To understand the principles of quantifying or estimating DNA
- To understand the principles of quantifying or estimating RNA.

Practical's Laboratory Sessions

1. Isolation of DNA from onion/liver/coconut endosperm.
2. Isolation of plasmids.
3. Determination of purity of nucleic acids by UV-spectrophotometric method.
4. Estimation of DNA by diphenylamine method.
5. Estimation of RNA by orcinol method

Textbooks:

1. Lab manual in Biochemistry by J. Jayaraman, Wiley Eastern Limited.
2. Biochemistry – a lab course by J.M. Becker, Academic Press.

References:

1. Experimental Biochemistry: A student companion by Beedu Sashidhar Rao and Vijay Deshpande, I.K. International Pvt. Ltd., New Delhi**.**

Course Outcomes:

By the end of this course, the student will be able to

1. Understand the principles of isolating genomic DNA from various sources such as onion/liver/coconut endosperm and will be able to isolate genomic DNA from onion/liver/coconut endosperm .

2. Understand the principles of isolating plasmid DNA and will be able to isolate plasmid DNA.
3. Understand the principles of determining the purity of isolated DNA and will be able to determine the purity of isolated DNA (genomic and plasmid DNA.
4. Understands the principles of quantifying or estimating DNA and will be able to determine the quantity of DNA.
5. Understands the principles of quantifying or estimating RNA and will be able to determine the quantity of RNA.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1					2					2	
CO2					2					2	
CO3					2					2	
CO4					2					2	
CO5					2					2	

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 22-08-22 **ACADEMIC COUNCIL: 22-08-22**

SDG No. & Statement:

SDG Justification:

BCBI3001	CONCEPTS OF GENETIC ENGINEERING	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

Genetic engineering also known as recombinant DNA technology is the field of biology that studies the various techniques used to cut and join genetic material, especially DNA from different biological species, and to introduce the resulting hybrid DNA into an organism to form new combinations of heritable genetic material. It has been used to create powerful research tools and model organisms and used to address current problems in agriculture and medical fields. Applications for genetic engineering are increasing to identify the locations and functions of specific genes in the DNA sequence of various organisms to develop transgenic varieties with superior qualities and desired traits.

Course Educational Objectives:

- To understand the concept of recombinant DNA technology.
- To compare different types of cloning and expression vectors. To learn about construction, screening of gene libraries and blot analysis techniques.
- List several present-day applications of genetic engineering and analyse the benefits and drawbacks of manipulating an organism's DNA
- To learn the concept of RNA silencing
- To study various methods of gene therapy, delivery systems for gene therapy and applications of genetic engineering.

UNIT 1 **8 hours**

Outlines of recombinant DNA technology. Restriction endonucleases, RFLP, restriction maps. Isolation of gene fragments using restriction endonucleases, Ligation of fragments – Cohesive and blunt ends, Homopolymer tailing

UNIT 2 **8 hours**

Cloning vectors – plasmids, bacteriophages, cosmids, Ti - plasmid. Expression vectors, viral vectors, YAC, BAC. Cloning strategies – shot gun experiments, cDNA cloning in bacteria. PCR

UNIT 3 **8 hours**

Prokaryotic hosts – E. coli, B. subtilis, Eukaryotic hosts – Yeast and mammalian cell lines. Gene transfer techniques: Biological delivery systems - Agrobacterium tumefaciens, SV40, Retroviral systems, Artificial delivery systems - Gene gun, Microinjection, Lipofection, Electroporation, Ca - DNA coprecipitation.

UNIT 4 **8 hours**

Identification of recombinants. Expression of cloned genes in bacteria, plant and animal cells. Blot analysis - Southern, Northern and Western blot.

UNIT 5 **8 hours**

Applications of rDNA technology: Applications of rDNA technology in agriculture, industry, and medicine. Production of insulin, monoclonal antibodies. Transgenic plants - production of golden rice, transgenic animals - mouse and sheep.

Textbooks:

1. Human Molecular Genetics by Tom Strachan and Andrew Read, Taylor & Francis Publisher, 3rd Ed.
2. Principles of gene manipulation & genomics by Primrose & Twyman, Oxford, 7th Ed.

References:

1. Molecular cell biology by Lodish, Freeman, 6th Ed.
2. Molecular Biotechnology - Principles and applications of Recombinant DNA by Glick, 2nd Ed.

Course Outcomes:

By the end of this course, the student will be able to

1. Understand the concept of rDNA technology, restriction endonucleases, mapping.
2. Learn the different types of vectors, cloning in bacteria.
3. Learn the prokaryotic and eukaryotic hosts and their role in rDNA technology.
4. Understand the methods to identify recombinants, study the expression in bacteria, plants and animals.
5. Expression of cloned genes in bacteria, plant and animal cells Understand the present day applications of genetic engineering with both advantages and disadvantages.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1					2				2		
CO2					3				3		
CO3					3				3		
CO4					3				3		
CO5					3				3		

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 22-08-22 **ACADEMIC COUNCIL: 22-08-22**

SDG No. & Statement:

SDG Justification:

BCBI3011	GENETIC ENGINEERING LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

Genetic engineering has wide applications in the field of medical, agriculture, industry and environment. The practical knowledge of the course equips the students with better learning outcomes of rDNA technology in all fields to address current problems.

Course Educational Objectives:

- To provide students with experimental knowledge and hands on experience in understanding how to manipulate specific genes to produce desired traits to address current problems facing humanity.
- To learn how to construct restriction map and also to ligate the DNA from different sources.
- To provide hands on experience with amplification of DNA isolated from different sources.
- To express genes by transformation of cloned genes into bacteria E.coli and plant cells.
- To learn the technique of Southern blotting.

Genetic Engineering:

1. Restriction digestion and construction of restriction map using restriction enzymes
2. Ligation of restricted DNA fragments
3. Amplification of DNA using specific primers by PCR
4. Preparation of competent *E.coli* cells, transformation and expression of cloned gene
5. *Agrobacterium* – mediated gene transfer into plants and expression of genes
6. Southern Blotting

Textbooks:

1. Biotechnology: A laboratory course by Becker J.M.
2. Green, M. R., & Sambrook, J. Molecular Cloning: a Laboratory Manual. Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press.

References:

1. Lab manual in Biochemistry by J. Jayaraman, Wiley Eastern Limited
2. Biochemistry – A lab course by J. M. Becker, Academic Press.

Course Outcomes:

On successful completion of this course, students will be able to:

1. Acquires working knowledge of manipulating genes and techniques involved in the process.
2. Gains knowledge in constructing a restriction map and ligation process.
3. Gains hands on experience with amplification of DNA isolated from different sources.
4. Expression of genes by transformation of cloned genes into bacteria E.coli and plant cells.
5. Acquires knowledge on the technique of Southern blotting.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1					3				3		
CO2					3				3		
CO3					3				3		
CO4					3				3		
CO5					3				3		

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 22-08-22 **ACADEMIC COUNCIL: 22-08-22**

SDG No. & Statement:

SDG Justification:

BCBI3021	CLINICAL BIOCHEMISTRY	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

Clinical Biochemistry has contributed immensely to the growth of modern medical and health science. They have applications in clinical diagnosis, understanding pathology of diseases, treatment of diseases, designing of drugs and understanding their metabolism. Keeping in pace with the developmental trends in various subareas of Biochemistry it is expected that the students undertaking Clinical Biochemistry course become conversant with the fundamentals and at the same time at the end of the programme they exhibit certain levels of learning outcomes applicable to healthy living.

Course Educational Objectives:

- To familiarize students with the specific characteristic features of clinical biochemistry.
- To understand the pathophysiology and molecular basis of the most prevalent diseases.
- To understand the role of diagnostic enzymes in disease diagnosis.
- To bring awareness about differential diagnosis and importance of function tests.
- To know how basic biochemistry can be applied to medical diagnosis, treatment, and management of diseases.

UNIT 1 **8 hours**

Blood and blood disorders. Plasma proteins in health and disease. Causes, management, and types of anemias, haemoglobinopathies and thalassemia's.

UNIT 2 **8 hours**

Plasma lipoproteins, cholesterol, triglycerides and phospholipids in health and disease. Clinical features of atherosclerosis. Enzyme patterns in myocardial infarction.

UNIT 3 **8 hours**

Disorders of gastric function, methods of evaluation. Pancreatic exocrine disorders malabsorption syndromes. Pancreatic endocrine disorders-Diabetes mellitus.

UNIT 4 **8 hours**

Structure and functions of the liver. Liver diseases-jaundice, hepatitis. Tests for conjugated and total bilirubin in serum, albumin: globulin ratio, hippuric acid and bromsulphthalein tests. Serum enzymes in liver diseases- SGPT, GGT and alkaline phosphatase.

UNIT 5 **8 hours**

Kidney-structure of nephron, urine formation, normal and abnormal constituents of urine. Biological buffers. Tests for creatinine and phenol red test. Renal disorders-Glomerulonephritis, CKD, Renal stones.

Textbooks:

1. Biochemical aspects of human disease by RS Elkeles and AS.Tavil, Blackwell Scientific publications.
2. Textbook of Medical Biochemistry by M. N. Chatterjee, Jaypee, 6th Ed.
3. Textbook of Biochemistry with clinical corelationships by Devlin, JOHNpublishers, 6thEd.

References:

1. Textbook of Biochemistry by S. Nagini, Scitech publishers.
2. Clinical biochemistry by S. Ramakrishna and Rajiswami.

Course Outcomes:

On successful completion of this course, students will be able to:

1. Describe and identify defects in metabolism and correlate them with deficiency of key metabolic enzymes (CO1).
2. Report the enzymes assayed in the clinical laboratory and their clinical significance (CO2)
3. Arrive at common methods of analysis metabolic function of various organs (CO3).
4. Relate laboratory results to clinical diagnosis and relationship to heart, liver, kidney and pancreas function (CO4).
5. Know the biochemical and molecular tools needed to accomplish preventive, diagnostic, and therapeutic intervention on hereditary and acquired disorders (CO5).

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	2										1
CO2	3										3
CO3	3										2
CO4	3										2
CO5	3										3

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 22-08-22 **ACADEMIC COUNCIL: 22-08-22**

SDG No. & Statement:

SDG Justification:

BCBI3031	CLINICAL BIOCHEMISTRY LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

Clinical Biochemistry has applications in clinical diagnosis, understanding pathology of lifestyle and other diseases. The practical knowledge of diagnostics in Clinical Biochemistry lab course equips the students with better learning outcomes in diagnosis and research.

Course Educational Objectives:

- To learn about practical implications of clinical biochemistry and use in diagnosis
- To identify of diagnostic molecules.
- To acquires working knowledge of analytical methods commonly used in the clinical laboratory.
- To understand pathology of lifestyle diseases
- To apply knowledge of clinical biochemistry in health and disease

List of Experiments:

1. Determination of blood group and Rh typing.
2. Estimation of Hb
3. Estimation of blood glucose
4. Estimation of serum bilirubin.
5. Estimation of serum SGPT.
6. Estimation of serum creatinine.
7. Urine analysis for albumin, sugars and ketone bodies.

Textbooks:

1. Practical Clinical Biochemistry by Harold Varley.

References:

1. Experimental Biochemistry by Beed Sashidhar Rao and Vijay Deshpande, IKI Pvt. Ltd.

Course Outcomes:

On successful completion of this course, students will be able to:

1. Obtains knowledge about diagnostic enzymology and biomarkers in health and disease.
2. Acquires working knowledge of analytical methods commonly used in the clinical laboratory.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3										2
CO2	3										3
CO3	3										2
CO4	3										3
CO5	2										3

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 22-08-22 **ACADEMIC COUNCIL: 22-08-22**

SDG No. & Statement:

SDG Justification:

BCBI3041	IMMUNOLOGY	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

Immunology is the study of how the body defends itself against disease. It also helps us to understand how the immune system is tricked into attacking its own tissue, leading to diseases like rheumatoid arthritis, diabetes, or allergy. The development of both has long been linked with the development of vaccines for smallpox and anthrax. More recently, the application of modern techniques of biology to the immune system has led to a dramatic increase in our understanding of the immune system and its impact on body function, as well as in the control of microbial and other types of disease. The overall aim of this course is to give insights about immunology which is a very active area for both fundamental research and for the development of new biotechnological products to diagnose or prevent disease.

Course Educational Objectives:

- To have an overview of immune system, organs and cells of immune system, and immune responses.
- To learn about antigens and epitopes and their role as immunogen.
- To learn structure, function, and types of antibodies.
- To learn about types of antigen-antibody interactions and hypersensitivity.
- To learn about various immunological techniques, transplantation immunology and immunomodulation.

UNIT 1 **8 hours**

Immunology: Anatomical and Physiological barriers. Organization of immune system. Innate and Adaptive immune systems. Organs and cells of immune system. Humoral and Cell mediated Immune System. Immune responses.

UNIT 2 **8 hours**

Concept of Receptors, Immunogen. Antigen and types, Hapten and adjuvants, Epitopes and types, MHC and types, HLA and types, Antigen processing and presentation.

UNIT 3 **8 hours**

Antibody, Immunoglobulin classes, structure, and function. Isotypes, Allotypes and Idiotypes. Theories of antibody formation - clonal selection theory. Antibody diversity. Immune regulation. Cytokines, Interleukins, Interferons, and their role. Inflammation.

UNIT 4 **8 hours**

Antigen-Antibody interactions and types. Complement components and its role. Hypersensitivity and types. Immunodeficiencies and types. Immunological tolerance and immunosuppression. Autoimmunity and breakdown of self - tolerance.

UNIT 5 **8 hours**

Immunodiagnostics - RIA, ELISA. Vaccines and their types. Monoclonal antibodies and their applications, Hybridoma technology. Transplantation immunology. Immunomodulation.

Textbooks:

1. Textbook of Microbiology by Ananthnarayan, ORIE, 7th Ed.

References:

1. Immunology Kuby.
2. Immunology, Ivan Roitt

Course Outcomes:

By the end of this course, the student will be able to

1. Understand the overview of immune system, organs and cells of immune system, and immune responses.
2. Explains about antigens and epitopes and their role as immunogen.
3. Learn about structure, function, and types of antibodies; and immune regulation.
4. Understand about types of antigen-antibody interactions, hypersensitivity and immunodeficiencies .
5. Explain about various immunological techniques, vaccines, monoclonal antibodies, transplantation immunology and immunomodulation.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1						3					3
CO2						3					3
CO3						3					3
CO4						3					3
CO5						3					3

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 22-08-22 **ACADEMIC COUNCIL: 22-08-22**

SDG No. & Statement:

SDG Justification:

BCBI3051	IMMUNOLOGY LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course aims to identify the blood groups, cell count analysis in blood. Quantitative analysis of various biomolecules finds application in identification, estimation, and analysis of homogenates of biological importance. The practical knowledge of Quantitative analysis in Biochemistry lab course equips the students with better learning outcomes in analysis and research.

Course Educational Objectives:

- To learn about practical implications and their use in analysis and identification of molecules.
- To acquires working knowledge of analytical methods commonly used in the laboratory.

List of Experiments:

1. Identification of A, B, O blood groups.
2. Total Leukocyte Count of the given blood sample.
3. Differential Leukocyte Count of the given blood sample.
4. Separation of serum and plasma from the blood sample (demonstration).
5. VDRL and WIDAL test
6. Immunodiffusion by Ouchterlony method.
7. ELISA
8. Immunoelectrophoretic

Textbooks:

1. Immunology methods manual - The comprehensive source book by Lefkovits. I6. Manual of clinical laboratory immunology by Rose NR.
2. The experimental foundations of modern immunology by Clark W.R.

Course Outcomes:

On successful completion of this course, students will be able to:

1. Obtains knowledge about blood grouping, cell count.
2. Acquires working knowledge of analytical methods commonly used in disease conditions

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1						2					3
CO2						3					3
CO3											
CO4											
CO5											

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 22-08-22 **ACADEMIC COUNCIL: 22-08-22**

SDG No. & Statement:

SDG Justification:

BCBI2061	INDUSTRIAL BIOCHEMISTRY	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course encompasses areas such as enzyme production, vitamin production, fuel and waste management and imparts basic concepts for the development of useful products taking advantage of natural resources. This course also gives insights into the bioethical problems created by biological and medical progress and its impact along with intellectual property rights and their protection.

Course Educational Objectives:

- To study the microbiology, biochemistry, and engineering in an integrated fashion with the goal of using microorganisms and cell and tissue cultures to manufacture useful products.
- To acquaint with the upstream and downstream processes of fermentation technology.
- Acquainting with the major products of traditional biotechnology industry of food and flavor ingredients, industrial alcohol, antibiotics, and citric acid.
- Impart an overview of relevance use of microbial biofertilizers and biopesticides.
- To gain insights into bioethical issues and IPR.

UNIT 1 **8 hours**

Fermentation technology - surface, submerged and continuous culture techniques. Design and operation of fermenters, Agitation and Aeration, selection and growth of microorganisms in controlled environments, medium development.

UNIT 2 **8 hours**

Production of fermented milks, cheese, alcoholic beverages. Fermentative production of penicillin, amylase, and glutamic acid.

UNIT 3 **8 hours**

Microbial transformation - types, techniques and commercial applications, Bioleaching, Biodegradation, Biomass and Bioenergy.

UNIT 4 **8 hours**

Sewage water treatment - primary, secondary and tertiary treatments. Biofertilizers - Aneabena, Azolla; Biocontrol agents- Insecticidal toxins of Bacillus thuringiensis

UNIT 5 **8 hours**

Biosafety guidelines and regulations, animals in research. Ethical, legal and social implications (ELSI) of HGP. Intellectual property rights.

Textbooks:

1. Industrial Microbiology by Prescott, CBS Publishers, 4th Ed.
2. Biotechnology by Crueger, PANI Publishhers.

References:

1. Principles of Fermentation Technology by Stanbury
2. Industrial Microbiology by A.H.PatelUNIT – I

Course Outcomes:

On successful completion of this course, students will be able to:

1. Comprehend the microbiology, biochemistry and engineering in an integrated fashion with the goal of using microorganisms to manufacture useful products.
2. Design medium for microbial growth, solve the mass balance of production process,
3. propose and use the sterilizers for removal of microbial contaminants, state the
4. significance of aeration and agitation for synthesis of bioproducts and modes of
5. operation of Fermenter.
6. Analyse the upstream and downstream processes of fermentation technology.
7. Collect knowledge of relevant use of microbial biofertilizers and biopesticides.
8. Apply the insights gained about bioethical issues and IPR in career and research.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1						2					3
CO2						2					3
CO3						2					3
CO4						2					3
CO5						2					3

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 22-08-22 **ACADEMIC COUNCIL: 22-08-22**

SDG No. & Statement:

SDG Justification:

BCBI2091	INDUSTRIAL BIOCHEMISTRY LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

The course offers hands-on training for UG students who aspire to go for higher education in industrial biochemistry. Imparts knowledge in areas such as enzyme, vitamin production and imparts basic concepts for the development of useful products.

Course Educational Objectives:

1. To impart knowledge on fermentation.
2. To familiarize learners about production of citric acid, wine and amylase.
3. To introduce learners about improving the fermentative efficiencies.
4. To acquaint learners on production of biofertilizers

Bioprocess Technology:

1. Fermentative production of citric acid by Aspergillus niger and quantification of citric acid
2. Fermentative production of amylase by Bacillus subtilis and quantification of amylase
3. Fermentative production of fruit wine
4. Quantification of fruit wine and calculation of fermentation efficiency
5. Production of Biofertilizer using Azolla / Nostoc

Textbooks:

1. A manual of Industrial Microbiology and Biotechnology by Demain A.L.
2. Immobilization of enzymes and cells: Methods in Biotechnology by Bickerstaff G.F.
3. Biotechnology: A laboratory course by Becker J.M.

References:

1. Molecular Cloning: A laboratory manual Vals. 1-3, Sambrook, J.
2. Lab manual in Biochemistry by J. Jayaraman, Wiley Eastern Limited
3. Biochemistry – A lab course by J. M. Becker, Academic Press

Course Outcomes:

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

1. Analyse the upstream and downstream processes of fermentation technology.
2. Design medium for microbial growth, understand the significance of aeration and agitation for synthesis of bioproducts and modes of operation of Fermenter.
3. Understand the biochemistry, microbiology and engineering using microorganisms to manufacture useful products.
4. Gain knowledge of relevant use of microbial biofertilizers.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1						3			3		
CO2						3			3		
CO3						3			3		
CO4						3			3		
CO5						3			3		

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 22-08-22 **ACADEMIC COUNCIL: 22-08-22**

SDG No. & Statement:

SDG Justification:

BCBI2071	MOLECULAR CELL BIOLOGY	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

Cell biology is essentially the study of life, health, and disease, depend upon the intricate relationship between the cellular and nuclear components. This course encompasses cells and their organelles, membrane biology, cell communication, advanced cell biology, and cell signalling. Completion of this course improves the understanding of the cellular basis for life and opens up new approaches for the investigation, diagnosis, and treatment of disease.

Course Educational Objectives:

- To study the structure of prokaryotic and Eukaryotic cells
- To study functions of their organelles, composition of the plasma membrane, and membrane transport mechanisms.
- To study the cellular communications and signal transduction mechanism in eukaryotic and prokaryotic cells.
- To learn the applications of different types of microscopes for studying cell morphology
- To understanding mitosis, meiosis, and cell cycle.

UNIT 1 Cell and organelles 8 hours

Structure of prokaryotic and Eukaryotic cells. Structure and functions of mitochondria, chloroplast, nucleus, endoplasmic reticulum, Golgi, lysosomes, ribosomes.

UNIT 2 Membrane Biology 8 hours

Structure and composition of the plasma membrane. Membrane transport - Membrane channels and pumps, exocytosis, and endocytosis. Intracellular trafficking.

UNIT 3 8 hours

Cell communication: Cytoskeletal elements. Extracellular matrix, cell-cell interactions. Cell-matrix interactions. Cellular communication – exosomes, bacterial chemotaxis, and quorum sensing.

UNIT 4 8 hours

Advanced Cell Biology: Cell morphology - Phase contrast, fluorescent, confocal, and electron microscopy. Mitosis and Meiosis. Cell cycle and its regulation.

UNIT 5 8 hours

Cell signaling: Signal transduction, General features, types of signal transducers. G - proteins, secondary messengers - cAMP, cGMP, calcium, DAG, IP3, nitric oxide.

Textbooks:

1. Molecular Biology of the Cell by B. Alberts et al. Garland publications incorporation, 4th Ed.
2. Molecular Cell Biology by Harvey Lodish et. al. W. H. Freeman, 4th Ed.

References:

1. Cell and Molecular Biology by E. D. P. De Roberties, International edition.
2. The Cell: A molecular approach by Geoffery M Cooper, 2nd Ed.

Course Outcomes:

By the end of this course, the student will be able to

1. Draw the structure of the cell, distinguish bacterial, plant, and animal cells, locate cell organelles along with their functions
2. Know the structure and composition of the plasma membrane and understand membrane transport mechanisms.
3. Understand cell-cell interactions and explain different types of cellular communications.
4. Observe cells and their internal structures using different types of microscopes, compare and contrast mitosis and meiosis and understand cell cycle and its regulation.
5. Understand mechanisms signal transduction, second messenger concept of signalling pathways .

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3										3
CO2	3										3
CO3	3										3
CO4	3										3
CO5	3										3

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 22-08-22 **ACADEMIC COUNCIL: 22-08-22**

SDG No. & Statement:

SDG Justification:

BCBI2101	MOLECULAR CELL BIOLOGY LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

Cell biology is essentially the study of life, health, and disease, depend upon the intricate relationship between the cellular and nuclear components. This course encompasses cells and their organelles, membrane biology, cell communication, advanced cell biology, and cell signalling. Completion of this course improves the understanding of the cellular basis for life and opens up new approaches for the investigation, diagnosis, and treatment of disease.

Course Educational Objectives:

- To study the structure of prokaryotic and Eukaryotic cells and their organelles
- To carry out cytological studies for identification of stages of mitosis
- To perform cytological studies for identification of stages of meiosis in inion flow bud
- To learn karyotyping of human chromosomes
- To isolate and estimate chlorophyl from leaf tissue

Experiments

1. Microscopic observation of prokaryotic and eukaryotic cells and their organelles using permanent slides
2. Preparation of cytological studies for identification of stages of mitosis
3. Preparation of cytological studies for identification of stages of meiosis in inion flow bud
4. Karyotypic study of human chromosomes
5. Extraction and identification of carbohydrates from wild potatoes and sweet potatoes
6. Isolation and estimation of chlorophyl from leaf tissue

Textbooks:

1. Cell Biology : Practical Manual by Dr. Renu Gupta et al. Prestige Publishers
2. Cell Biology Laboratory Manual by Dr. William H. Heidcamp, (Free online copy).
3. Cell Biology: A Laboratory Handbook, Volumes 1, 2, 3; Edited by Julio E. Celis, Academic Press.

Course Outcomes:

By the end of this course, the student will be able to

1. Differentiate prokaryotic cells and eukaryotic cells
2. Identify changes in different phases of mitosis and meiosis.
3. Extract and identify carbohydrates from wild potatoes and sweet potatoes
4. Carryout karyotyping of human chromosomes.
5. Isolate and estimate chlorophyll from plant tissue.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1						2		3			
CO2	3										3
CO3	3										3
CO4	3										3
CO5		3							3		

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 22-08-22 **ACADEMIC COUNCIL: 22-08-22**

SDG No. & Statement:

SDG Justification:

BCBI2081	BIOINFORMATICS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

Bioinformatics / Computational Biology is the science of storing, retrieving and analyzing large amounts of biological information. The course depicts the types of biological information being generated and stored into the repositories. The important public data banks provide details of biological systems and components will be discussed. It reviews a wide range of applications using biological databases including computational sequence analysis, sequence homology searching, protein sequence analysis and phylogenetic analysis.

Course Educational Objectives:

- To understand explosion, nature and types of biological data and its role in biological research to solve real world biological problems.
- To understand the concept and types of literature databases, nucleic acid databases, protein databases, protein structure databases, metabolic databases, and their uses
- To understand the concept and principles of sequence alignments - types, methods, tools and applications
- To understand the concept and principles of multiple sequence alignments methods, tools and applications.
- To understand the concept and principles of phylogenetic trees, methods, tools and applications.

UNIT 1 **8 hours**

Biological Data: Nature and Types of Biological Data; Bioinformatics: Definition, Scope and Applications; Biological Databases: NAR Databases Categories, Nucleic Acid Sequence Databases-NCBI, EMBL and DDBJ; Literature databases- PubMed and PubMed Central.

UNIT 2 **8 hours**

Protein Sequence Databases- UniProt, NCBI-Protein and TrEMBL; Protein Structure Databases- PDB, SCOP, CATH; Metabolic Pathway Databases- KEGG, BioCyc.

UNIT 3 **8 hours**

Concepts of Sequence-Homology, Similarity and Identity; Types of Homology- Orthologs and Paralogs; Sequence Alignment Strategies-Global and Local; Sequence Alignment Methods-Dot Matrix Method, Measures of sequence similarity. Scoring Matrices: PAM and BLOSUM, Comparison between PAM and BLOSUM

UNIT 4 **8 hours**

Sequence Alignment Methods- Dynamic Programming: Use of Needleman and Wunsch Algorithm for Global Alignment, Use of Smith and Waterman Algorithm for Local Alignment. Database Similarity Searching: Outline of BLAST Search Steps, Parameters, Variants and Applications

UNIT 5 **8 hours**

Multiple sequence alignment - Definition, Properties, Features, Tools and its Applications; Phylogenetics Basics – Terminology, Forms of Tree Representation and Overview of Tree Construction Methods.

Textbooks:

1. Introduction to Bioinformatics, Lesk, A.M; Oxford University Press,Fourth ed.
2. Bioinformatics and Functional Genomics, Jonathan Pevsner; Wiley, 2nd Ed.

References:

1. Introduction to Bioinformatics, Teresa K. Attwood, David J. Parry-Smith; PearsonEducation
2. Essential Bioinformatics, JinXiong; Cambridge University Press, First ed.

Course Outcomes:

Upon completion of the course, the students will be able to:

1. Classify different types of Biological Databases .
2. Understand basics of sequence alignment and implementation of matrices.
3. Explain about the concept of pairwise sequence alignment, algorithms and tools for pairwise alignment .
4. Describe about Multiple Sequence Alignment, its significance, algorithms and tools used for MSA .
5. Describe about the various techniques, algorithms and tools used for Phylogenetic Analysis.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1		2							2		
CO2		2							2		
CO3		3							3		
CO4		3							3		
CO5		3							3		

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 22-08-22 **ACADEMIC COUNCIL: 22-08-22**

SDG No. & Statement:

SDG Justification:

BCBI2111	BIOINFORMATICS LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

Bioinformatics / Computational biology is defined as the application of tools of computation and analysis to the capture and interpretation of biological data. This course describes the main tools/databases of the bioinformatics for analysis and provides hands-on demonstrations like how they are being used to interpret biological data and to further understanding of disease.

Course Educational Objectives:

- To explore data available in major bioinformatics resources.
- To perform biological literature search.
- To retrieve nucleotide, protein sequences, structural and metabolic data in different formats.
- To identify homologous sequences and phylogenetic analysis.

Practical's Laboratory Sessions:

1. NAR Database Category List
2. Biological Literature Databases– PubMed, PubMed Central
3. Nucleic Acid Sequence Databases– NCBI Nucleotide
4. Nucleic Acid Sequence Databases –EMBL ENA
5. Nucleic Acid Sequence Databases – DDBJ
6. Protein Sequence Databases – UniProt
7. Protein Structural Databases – PDB
8. Protein Structural Databases – SCOP
9. Protein 3D Structural Databases – CATH
10. Metabolic Pathway Databases – KEGG
11. Metabolic Pathway Databases – BioCyc
12. Pairwise Sequence Alignment – UsingBLAST
13. Multiple Sequence Alignment – UsingClustal Omega Tool
14. Phylogenetic Tree Construction – Using Phylogeny.fr Tool

Course Outcomes:

By the end of this practical, the student will be able to

1. Differentiate between three major bioinformatics resources.
2. Search and retrieve right kind of biological literature
3. Retrieve and analyze sequence and structural data in their respective formats and their importance.
4. Identify the homologous sequences and understand the concept of sequence searches.
5. Construct MSAs and phylogenetic trees to infer sequence relationships.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1		3							3		
CO2		3							3		
CO3		3							3		
CO4		3							3		
CO5		3							3		

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 22-08-22 **ACADEMIC COUNCIL: 22-08-22**

SDG No. & Statement:

SDG Justification:

BCBI2121	HUMAN PHYSIOLOGY AND NUTRITION	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

Human Physiology and Nutrition deals with the basic physiological function in human systems and explains the role of nutrition, vitamins, and minerals in diet. In human systems, the vital physiological systems involved to maintain life like digestion, respiration, circulation, muscular system, and endocrine system are explained along with abnormal functions. Further, the balanced diet, basal metabolic rate, protein energy malnutrition, nutraceuticals, functional foods, and nutritional aspects of vitamins and minerals are explained.

Course Educational Objectives:

- To acquire knowledge on digestion and absorption of biomolecules, respiration, and transportation of gases in blood.
- To understand heart structure, cardiac cycle, muscle structure, and mechanism of muscle contraction.
- To study endocrine system with function and abnormalities of various hormonal changes.
- To learn about the role of nutrition in human health with aspects of marasmus, and kwashiorkor.
- To understand the structure, functional and nutritional aspects of vitamins, minerals, nutraceuticals, and functional foods.

UNIT 1 **8 hours**

Digestive and Respiratory System: Digestion and absorption of carbohydrates, lipids and proteins. Respiration and transportation of gases in blood (oxygen and CO_2), Bohr's effect.

UNIT 2 **8 hours**

Circulatory and muscle physiology: Heart- structure of the heart, cardiac cycle, cardiac factors controlling blood pressure. Kinds of muscles, structure of myofibril, organization of contractile proteins and mechanism of muscle contraction.

UNIT 3 **8 hours**

Endocrinology- organization of endocrine system. Outlines of chemistry, physiological role and disorders of hormones of pancreas, thyroid, parathyroid, gonads, adrenals, pituitary and hypothalamus. Mechanism of hormonal action- signal transduction pathways for adrenaline, glucocorticoids, and insulin.

UNIT 4 **8 hours**

Nutrition: Balanced diet. BMR and factors affecting it. Specific dynamic action of foods. Recommended dietary allowance (RDA) for children, adults, pregnant and lactating women. Biological value of proteins. Sources of complete proteins. Malnutrition- Kwashiorkor, Marasmus and PEM. Role of essential fatty acids in human nutrition. Obesity and starvation.

UNIT 5 **8 hours**

Nutritional aspects of Vitamins and Minerals: Vitamins- sources, structure, biochemical roles, deficiency disorders of water- and fat-soluble vitamins. Bulk and trace elements-Ca, Mg, Fe, I, Cu, Mo, Zn, Se and F. Introduction to nutraceutical and functional foods.

Textbooks:

1. Textbook of human Physiology by Guyton, Elesvier,11thEd.
2. Essentials of Medical Physiology by K. Sembulingam, PremaSembulingam, Jaypee, 2nd Ed.

References:

1. Textbook of Biochemistry & Human Biology by G.P.Talwar PHI, 3rd Ed.
2. Textbook of Medical Biochemistry by M.N.Chatterjee, Jaypee 6th Ed.
3. Molecular Endocrinology by Bolander, Elsevier 3rd Ed.

Course Outcomes:

By the end of this course, the student will be able to

1. To acquire knowledge on digestion and absorption of biomolecules, respiration, and transportation of gases in blood.
2. To understand heart structure, cardiac cycle, muscle structure, and mechanism of muscle contraction.
3. To study endocrine system with function and abnormalities of various hormonal changes.
4. To learn about the role of nutrition in human health with aspects of marasmus, and kwashiorkor.
5. To understand the structure, functional and nutritional aspects of vitamins, minerals, nutraceuticals, and functional foods.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1				3				2			
CO2				3				2			
CO3				2				2			
CO4	2										1
CO5	2							2			

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 22-08-22 **ACADEMIC COUNCIL: 22-08-22**

SDG No. & Statement:

SDG Justification:

BCBI2131	PLANT BIOCHEMISTRY	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

Plants are vital resources for the survival of animals and their metabolites have various applications. The course offers the basic knowledge on the biochemical processes of production of organic compounds by fixing atmospheric simpler molecules like carbon dioxide and Nitrogen. It also covers the important hormones actions occurring in the plant growth, secondary metabolites produced in plants with their uses and plant defence mechanisms.

Course Educational Objectives:

1. To explain the mechanism of photosynthetic mechanism
2. To impart knowledge on nitrogen fixation mechanism
3. To present the actions of important phytohormones in plant development
4. To deliver the mechanism of mutations and their role in genetic analysis
5. To describe the concept of population genetics

UNIT 1 **8 hours**

Photosynthesis: Plastids, Photo phosphorylation- cyclic and non-cyclic. ATP synthase. Rubisco, CO2 fixation in C3, C4 and CAM plants. Photo respiration-significance, mechanism.

UNIT 2 **8 hours**

Nitrogen Fixation: Nitrogen cycle, Non-biological and biological nitrogen fixation. Symbiotic nitrogen fixation, Nitrogenase system. nif genes. Ammonia incorporation into organic compounds.

UNIT 3 **8 hours**

Plant Hormones: Structure, function and mode of action of plant hormones- Auxins, Gibberellins, Cytokinins, Abscisic acid, Ethylene and Strigolactones. Phytochromes.

UNIT 4 **8 hours**

Plant secondary metabolites: Structure and function of Secondary metabolites-terpenes, saponins, phenolic compounds-lignin, flavonoids, tannins and nitrogen containing secondary compounds-alkaloids.

UNIT 5 **8 hours**

Plant defense mechanisms: Role of Cutin, Waxes, suberin in defense. Anti-Oxidant enzyme systems in plant defense. Mechanism of biotic and abiotic stress factors –pathogens, insects, heat shock, drought and salinity. Thigmonastic and mimicry in plant defense.

Textbooks:

1. Principles of Biochemistry by Nelson cox, Freeman, 4th Ed.
2. Plant Physiology by Taiz and Zeiger, 3rd Ed.

References:

1. Plant Biochemistry by Hans-Walter Heldt, 3rd Ed
2. Biochemistry and Molecular Biology of Plants by Bob B. Buchanan, 2nd Edition

Course Outcomes:

By the end of this course, the student will be able to

1. Explain the mechanism of photosynthetic mechanism
2. Impart knowledge on nitrogen fixation mechanism
3. Present the actions of important phytohormones in plant development
4. Deliver the mechanism of mutations and their role in genetic analysis
5. Describe the concept of population genetics

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1				3				2			
CO2				3				2			
CO3				3				2			
CO4				3				2			
CO5				3				2			

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 22-08-22 **ACADEMIC COUNCIL: 22-08-22**

SDG No. & Statement:

SDG Justification:

BCBI2141	GENOMICS AND PROTEOMICS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

Genomics and proteomics are fast-growing fields that develop extensive data for a particular organism to one specific condition and help to deal with complex situations in many cases. The knowledge of genomics and proteomics helps narrow down the experimental procedures to achieve reliable results faster and validate them.

Course Educational Objectives:

- To acquire knowledge on genome sequencing strategies and methods of assembly.
- To acquire knowledge on concepts, tools, and databases of comparative genomics.
- To identify different regions of the genome with their functions using numerous methods.
- To understand different strategies and methods employed in protein separation and quantification for whole samples of proteins at a time.
- To understand different principles of protein-protein and protein-DNA interactions.

UNIT 1 **8 hours**

Large scale genome sequencing strategies - shotgun, hierarchal, high throughput sequencing; Genome assembly, and annotation; Tools for genome assembly.

UNIT 2 **8 hours**

Basic concepts and applications of comparative genomics; Whole-genome alignment; Tools and Databases for comparative genomics.

UNIT 3 **8 hours**

Identification of genes, promoters, splice sites, repetitive elements, CpG islands.

UNIT 4 **8 hours**

Protein sequence-structure-function relationship; Motifs, and Domains; Protein expression analysis–2D-gel electrophoresis and protein chip technology; post-translational modifications.

UNIT 5 **8 hours**

Protein-Protein Interactions, Yeast Two-Hybrid system, STRING, Protein-DNA interactions.

Textbooks:

1. Bioinformatics and Functional Genomics, Pevsner, J., John Wiley and Sons.
2. Essential Bioinformatics, Jinxiong, Cambridge University Press
3. Principles of Proteomics – RM. Twyman, Spl. Indian Ed.

References:

1. Principles of genome analysis and. Genomics, Primrose, S.B. and Twyman, R.M., Third Edition, Blackwell Publishing Company.
2. Bioinformatics: Genes, Proteins and Computers – Orengo, Jones and Thornton
3. Introduction to protein science – AM. Lesk, 2nd Ed.

Course Outcomes:

By the end of course, the student will be able to

1. Understand the concept of genomics and proteomics and its necessity to solve biological problems.
2. Employ good strategies for sequencing the genome of a particular sample. And use different methods and tools to assembly the gene fragments obtained in genome sequencing.
3. Identify, predict, and annotate the different sequences in the genome assembled by employing suitable tools. And understand the concept, tools, and databases of comparative genomics.
4. Understand the basic principles of the protein sequence-structure-function relationship. And the role of motifs and domains in the structure-function of protein.
5. Understand the basic principles of protein expression analysis, post-translational modifications, protein-protein interactions, and protein-DNA interactions to solve biological problems.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1		3							3		
CO2		3							3		
CO3		3							3		
CO4		3							3		
CO5		3							3		

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 22-08-22 **ACADEMIC COUNCIL: 22-08-22**

SDG No. & Statement:

SDG Justification:

BCBI2151	GENETICS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

One of the most important processes of living organisms is to reproduce the offspring with same characteristics and little variation. The inheritance patterns are analysed and predicted using the knowledge of genetics. The course covers the basic principles of inheritance, mechanism of inheritance of characters, mutations, variation, and principles of population genetics.

Course Educational Objectives:

- To explain the principles of heredity and Mendel's experiments
- To impart knowledge on deviations of Mendel's laws and their causes
- To provide the details about the mechanism of similarity and variations while genetic information passage to next generations
- To deliver the mechanism of mutations and their role in genetic analysis
- To describe the concept of population genetics

UNIT 1 **8 hours**

History of Genetics, Concepts of Phenotype, Genotype, Heredity, Variation. Heredity and Environment. Mendel experiments on pea plants, Mendelian principles of inheritance.

UNIT 2 **8 hours**

Limitations to Mendel's laws. Incomplete dominance and Co-dominance, Complementary gene interaction, Supplementary gene interaction, Epistasis-Dominant epistasis, and recessive epistasis. Multiple alleles. Extra chromosomal inheritance.

UNIT 3 **8 hours**

Linkage and crossing over. Recombination. Sex-Linked, Sex-influenced, Sex- limited inheritance. Epigenetic mechanism of inheritance. Concept of Forward genetics and reverse genetic approach

UNIT 4 **8 hours**

Mutation types, mechanism, and their significance. Basic concept of genetic diseases. Mutagenic methods in genetic analysis-mutagenic agents, methods of isolation of mutants and analysis of mutant progeny.

UNIT 5 **8 hours**

Concepts of a population, gene pool, allele frequencies and genotype frequencies. Genetic Polymorphism. Genetic equilibrium- Hardy-Weinberg Law, factors affecting Hardy-Weinberg Law. Concept of gene evolution, genetic biodiversity.

Textbooks:

1. Principles of Heredity by Robert Tymarin.A, Tata McGraw Hill, 7th Ed.
2. Genetics by M. W. Strickberger, Mac Millan, 3rd Ed..

References:

1. Principles of Genetics by Sinnet, McGraw Hill, 5th Ed..
2. Principles of genetics by Gardner, M. J. Simmons, D. P. Snustad, 8th ed

Course Outcomes:

By the end of this course, the student will be able to

1. Explain the principles of heredity and Mendel's experiments
2. Impart knowledge on deviations of Mendel's laws and their causes
3. Outline the details about the mechanism of similarity and variations while genetic information passage to next generations
4. Describe the mechanism of mutations and their role in genetic analysis
5. Illustrate the concept of population genetics

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3				1					2	
CO2	3				1					2	
CO3	3				2					2	
CO4	2				2					2	
CO5	1				1					1	

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 22-08-22 **ACADEMIC COUNCIL: 22-08-22**

SDG No. & Statement:

SDG Justification:

BCBI2161	NUTRACEUTICALS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

Functional foods and nutraceuticals deal with the basic structures, sources, and biological function of functional foods including prebiotics, probiotics, and dietary fiber. Further it explains about the sources, structure, functional, and biological activities of Nutraceuticals.

Course Educational Objectives:

- To acquire knowledge on sources, structures of phytochemical compounds.
- To understand the functional importance of prebiotics.
- To understand the structures and functions of probiotics.
- To understand the functional importance of nutraceuticals
- Digestion and absorption of functional food products.

UNIT 1 **8 hours**

Introduction to Functional Foods-definition, history, and types. Components of functional foods. Stages involved in development of functional foods. Perceived effect of diet on disease prevention. Understanding benefits of functional foods.

UNIT 2 **8 hours**

Probiotics: Taxonomy and important features of probiotic micro-organisms. Health effects of probiotics. Probiotics in various foods: fermented milk products, non-milk products etc. Quality Assurance of probiotics and safety.

UNIT 3 **8 hours**

Prebiotics: Definition, chemistry, sources, and bioavailability, effect of processing, physiological effects, effects on human health and potential applications in risk reduction of diseases. Perspective for food applications for the non-digestible carbohydrates, Dietary fiber, Resistant starch, Gums.

UNIT 4 **8 hours**

Nutraceuticals: Definition, chemistry, sources, Classification of nutraceuticals - based on food source, mechanism of action and chemical nature. Role of flavonoids, isoprenoids, isoflavones, carotenoids, tocotrienols, terpenoids, polyunsaturated fatty acids, sphingolipids, lecithin, choline.

UNIT 5 **8 hours**

Concepts of dietary supplements: phytochemicals, dietary fiber, omega 3 and 6 fatty acids. Non-essential nutrients as dietary supplements. Fortified foods: skim milk, hemp milk, yogurt, whole grain bread, eggs. Role of nutraceuticals in health and disease management.

Textbooks:

1. Aluko, Rotimi, Functional Foods and Nutraceuticals, Springer-Verlag New York Inc.,2012.

References:

1. Satinder Kaur Brar, Surinder Kaur and Gurpreet Singh Dhillon, Nutraceuticals Functional Foods,2014.

Course Outcomes:

By the end of this course, the student will be able to

1. To acquire knowledge on sources, structures of phytochemical compounds.
2. To understand the functional importance of prebiotics.
3. To understand the structures and functions of probiotics.
4. To understand the functional importance of nutraceuticals
5. Digestion and absorption of functional food products.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3							3			
CO2						3					3
CO3						2					2
CO4						2					2
CO5				2							3

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 22-08-22 **ACADEMIC COUNCIL: 22-08-22**

SDG No. & Statement:

SDG Justification:

BCBI2171	INTRODUCTION TO NANOBIOLOGY	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

Nanobiology is the understanding and control of matter at the nanometer scale, where unique phenomena enable novel applications. Encompassing nanoscale science, engineering, and technology, nanotechnology involves imaging, measuring, modeling, and manipulating matter at this length scale. Knowledge in Nanobiology will help considerably to improve, even revolutionize, many technology and industry sectors: information technology, homeland security, medicine, transportation, energy, food safety, and environmental science, among many others.

Course Educational Objectives:

- To understand the concept of nanomaterials and nanomaterial synthesis.
- To understand the role of nano technology in tissue regeneration.
- To study the concepts of bioimaging.
- To learn the various applications of carbon tubes, dendrimers, liposomes, metallic nanoparticles, and Quantum dots.
- To understand the role of nanoparticles in cancer drug delivery.

UNIT 1 **8 hours**

Fundamentals of Nanotechnology: Definition of nanomaterial. Mechanical, optical, electronic, magnetic nanomaterials. Chemical properties of Nanomaterials. Metal nanoparticles, magnetic nanoparticles.

UNIT 2 **8 hours**

One-dimensional, two-dimensional, and three-dimensional nanoparticles. Synthesis of Nanomaterials: Concepts of Bottom Up and Top-down Approach and biological synthesis using sol -gel process.

UNIT 3 **8 hours**

Nanostructures, Biological products of nanoparticles using fungi, bacterial, yeast and actinomycetes. DNA- protein nanostructures: oligonucleotide- enzyme conjugates; Concept of Magnetosomes.

UNIT 4 **8 hours**

Advantages of nano-sizing. Lab-on chip nanotechnology for better and easy diagnosis; Role of nano technology in tissue regeneration; nano probes for bioimaging, cancer detection.

UNIT 5 **8 hours**

Carbon tubes, Dendrimers, liposomes, metallic nanoparticles, Quantum dots. Introduction to nanocarriers; Role of nanoparticles in cancer drug delivery. Nano toxicity.

Textbooks:

1. Nanotechnology, Richard Booker, Earl Boysen, Wiley Publications, 2005.

References:

1. Nano: The Essentials. T.Pradeep, McGraw Hill Education, 2010.
2. Nanochemistry: A chemical approach to nanomaterials by G.A.Ozin, A.C.Arsenault, and L.D.Cademartiri, RSe Publishing, 2007.

Course Outcomes:

By the end of this course, the student will be able to

1. To learn the concepts of various types of nano Materials
2. To understand various approaches of nana material synthesis
3. To learn the concepts of nano structures and their applications
4. To understand the concepts of bio imaging
5. To understand the role of nano particles in cancer-drug delivery

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1		3							2		
CO2		3							2		
CO3		3							2		
CO4		3							2		
CO5		3							2		

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 22-08-22 **ACADEMIC COUNCIL: 22-08-22**

SDG No. & Statement:

SDG Justification:

BCBI3061	APPLIED BIOCHEMISTRY	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

Applied Biochemistry deals with the basics and understanding of the central dogma where the genes are located. This knowledge can be employed in determining the function of various genes and proteins for better understanding of cellular life and development of transgenic organisms.

Course Educational Objectives:

- To understand the concept of measuring nucleic acid and protein interactions.
- To understand mapping of genes and finger printing techniques.
- To learn different techniques in gene amplification and synthesis.
- To gain knowledge on stem cells, markers and stem cell applications.
- To acquaint the methods of gene therapy and their applications

UNIT 1 **8 hours**

Methods for measuring nucleic acid and protein interactions – foot printing, CAT assay, gel shift analysis. DNA markers in genetic analysis – RFLP, RAPD, minisatellites, microsatellites.

UNIT 2 **8 hours**

Mapping genes – Chromosomal walking, chromosomal jumping, DNA fingerprinting, single nucleotide polymorphism, FISH, Transposon tagging, site-directed mutagenesis

UNIT 3 **8 hours**

Amplification of DNA: Polymerase Chain Reaction, cDNA synthesis, Rapid amplification of cDNA ends (RACE-PCR), Chemical synthesis of genes

UNIT 4 **8 hours**

Stem cells – embryonic and adult stem cells. Stem cell markers. Stem cell plasticity and differentiation. Application of stem cells in medicine

UNIT 5 **8 hours**

Gene therapy: Methods of gene therapy- Ex vivo, In situ, In vivo, somatic and germline. Types and use of rDNA constructs for Gene therapy, Delivery systems for gene therapy.

Textbooks:

1. Human Molecular Genetics by Tom Strachan and Andrew Read, Taylor & Francis Publisher, 3rd Ed.
2. Principles of gene manipulation & genomics by Primrose & Twyman, Oxford, 7th Ed.
3. Molecular cell biology by Lodish, Freeman, 6th Ed.
4. Molecular Biotechnology - Principles and applications of Recombinant DNA by Glick, 2nd Ed.

References:

1. Stem Cells: Basics and Applications by Koushik k Deb, Satish M Totey Tata McGraw-Hill Education, 2009.
2. Stem Cells: From Mechanisms to Technologies edited by Michal K. Stachowiak, Emmanuel Tzanakaki, Publishers: World Scientific.
3. Stem Cells: From Basic Research to Therapy, Volume 1 by Federico Calegari, Claudia Waskow, CRC Press.

Course Outcomes:

By the end of this course, the student will be able to

1. Understand the concept of measuring nucleic acid and protein interactions.
2. Learn and understand the concept of mapping of genes and finger printing techniques.
3. Acquaint the different techniques in gene amplification and synthesis.
4. Gain knowledge on stem cells, markers and stem cell applications.
5. Understand the methods of gene therapy and their applications.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1					2				2		
CO2					3				2		
CO3					2				2		
CO4					3				2		
CO5					3				2		

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 22-08-22 **ACADEMIC COUNCIL: 22-08-22**

SDG No. & Statement:

SDG Justification:

BCBI3151	MOLECULAR MODELING AND STRUCTURAL BIOINFORMATICS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course introduces fundamental concepts and methods of molecular modeling and structural bioinformatics. Topics covered include representation of chemical molecules, molecular graphics, force fields, structure prediction and structure alignment methods. The main goal of structural bioinformatics is to provide computational approaches for predicting and analyzing 3D structures. Understanding the 3D structures of biological macromolecules is crucial for understanding their function. Applications of structural bioinformatics are oriented towards medical fields and pharmacological research, especially, drug design.

Course Educational Objectives:

- Describe the basic theoretical aspects of molecular modeling techniques
- Evaluate the successes and limitations of molecular modeling
- Describe the protein structure prediction methods
- Evaluate and discuss protein modeling methods
- Describe the structural alignment methods

UNIT 1 **8 hours**

Representation of Chemical Compounds - Line Notations, Standard Structure Exchange Formats; Molecular Surfaces, Molecular Graphics; Molecular Modeling Methods – Outline, Advantages, Disadvantages and Applications.

UNIT 2 **8 hours**

Molecular Mechanics: Force Fields – Definition and Features, Functional Forms –Bond Stretching, Angle Bending, Torsional Terms, Out-of-plane Bending, Crossterms, Electrostatic, Vander Waals and Hydrogen Bonding interactions; Force fields for Biomolecules.

UNIT 3 **8 hours**

Protein Primary and Secondary Structure Analysis: Primary Sequence Analysis, Secondary Structure Prediction – Chou-Fasman, GOR, Neural Network.

UNIT 4 **8 hours**

Protein Modeling & Evaluation: Homology modelling, Fold Recognition and Abinitio. Error Estimation and Precision, Stereo Chemical Parameters.

UNIT 5 **8 hours**

Structure Alignment and Comparison: Concept of Protein Structure Comparison and Alignment, Structural Alignment Methods - CE, VAST, DALI, SSAP, TM-align.

Textbooks:

1. Molecular Modelling: Principles and Applications, A.R. Leach; Pearson Seconded.
2. Structural Bioinformatics, Jenny Gu, Philip E. Bourne, Wiley, Seconded.
3. Chemoinformatics: A Textbook, Johann Gasteiger, Thomas Engel, Wiley.

References:

1. Essential Bioinformatics, JinXiong; Cambridge University Press, First ed.
2. Introduction to Bioinformatics, Lesk, A.M; Oxford University Press, Fourth ed.

Course Outcomes:

After completion of the course, student will be able to:

1. Access and browse a range of structural data repositories
2. Determine whether appropriate structural information exists about a given small molecule, macromolecule or complex, applying available structure-quality information
3. Build a structural model for a protein which has a structurally characterised relative and evaluate its quality
4. Predict the function of a protein-based on sequence and structure data.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1		3							3		
CO2		3							3		
CO3		3							3		
CO4		3							3		
CO5		3							3		

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 22-08-22 **ACADEMIC COUNCIL: 22-08-22**

SDG No. & Statement:

SDG Justification:

BCBI3081	BASICS OF CANCER BIOLOGY	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course is designed with fundamentals of cancer cells. It introduces etiology of cancer, molecular basis of cancer, cancer diagnosis. It also introduces principles of cancer therapy.

Course Educational Objectives:

- To study the characteristics of human cancer cells, causes of cancer. Prevalence of cancer.
- To identify different types of tumors and cancers.
- To study the molecular basis of cancer
- To study the principles and applications of cancer prediction and diagnostic methods
- To study the principle of different types of therapies

UNIT 1 **8 hours**

Fundamentals of cancer cells - characteristics of human cancer cells, causes of cancer. Prevalence of cancer.

UNIT 2 **8 hours**

Etiology - Types of tumors - Benign and malignant tumors. Types of cancer - Carcinoma, Sarcoma, Lymphoma.

UNIT 3 **8 hours**

Molecular basis of cancer - Carcinogenesis. Tumor suppressor and oncogenes. Basics of cell cycle, metastasis, apoptosis and angiogenesis.

UNIT 4 **8 hours**

Principle of diagnostic methods – Blood Tests, Biopsy, Diagnostic Imaging – X-rays, CAT scan and MRI, Mammography.

UNIT 5 **8 hours**

Treatment - Principles of chemotherapy, radiation therapy, immune therapy gene therapy, nano therapy.

Textbooks:

1. The Biology of Cancer, Janice Gabriel, John Wiley & Sons Ltd., 2nd Ed.
2. Molecular Pathology and Diagnostics of Cancer (Cancer Growth and Progression), Domenico Coppola, Springer.

References:

1. An Introduction to Cellular and Molecular Biology of Cancer, Oxford Medical publications.
2. Cancer Biology, Raymond W. Ruddon, Oxford University Press, Inc., 4th Ed.

Course Outcomes:

By the end of this course, the student will be able to

1. Understand fundamentals of cancer cells
2. Know the etiology and types of cancers
3. Understand the molecular basis of cancer
4. Know the principles of diagnostic methods
5. Know the treatment and prevention of cancer

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3										3
CO2	3										3
CO3	3										3
CO4	3										3
CO5	**3**										3

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS: 22-08-22 **ACADEMIC COUNCIL: 22-08-22**

SDG No. & Statement:

SDG Justification:

BCBI3091	STEM CELL BIOLOGY	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

Stem cell Biology has emerged as a new and most exciting field of life science in view of its potential clinical applications. Our understanding of stem cells has grown rapidly over the last decade, but the apparently tremendous therapeutic potential of stem cells has not yet been realized. The routine use of stem cells in therapeutics and tissue regeneration is greatly anticipated.

Course Educational Objectives:

- To understand the concept of stem cells.
- To learn the concepts of iPS and stem cell niche.
- To study the applications of stem cells in the treatment of cancer, neurodegenerative diseases etc.,
- To learn the concepts of stem cell transplantation and tissue remodeling
- To study the role of animal models in stem cell research.

UNIT 1 **8 hours**

Types of stem cells-Embryonic, adult and Umbilical cord blood stem cells. Characteristic features of stem cells Differences and similarities in adult and embryonic stem cells. Localization of stem cells in different tissues.

UNIT 2 **8 hours**

Stem cell markers. Tissue specific stem cells. Hematopoietic stem cells. Neural stem cells. Cardiac stem cells. Induced pluripotency. The concept of stem cell niche.

UNIT 3 **8 hours**

Stem cells in gene therapy, Applications of stem cells in regenerative medicine- myocardial infraction, cancer, diabetes, aging and other neurodegenerative diseases: Parkinson's. Concept of stem cell transplantation.

UNIT 4 **8 hours**

Stem Cells in Drug Screening and Toxicology. Disease Modeling with Stem Cells. Stem Cells in Tissue Remodelling. Introduction to regenerative medicine.

UNIT 5 **8 hours**

Stem cells from cord blood and their cryopreservation. Maintenance of stem cells. Animal models in stem cell research. Ethical and regulatory issues involving stem cell research.

Textbooks:

1. Stem Cells: Basics and Applications by Koushik k Deb, Satish M Totey Tata McGraw-Hill Education, 2009.

References:

2. Stem Cells: From Mechanisms to Technologies edited by Michal K. Stachowiak, Emmanuel Tzanakaki, Publishers: World Scientific.
3. Stem Cells: From Basic Research to Therapy, Volume 1 by Federico Calegari, Claudia Waskow, CRC Press.

Course Outcomes:

1. Able to understand the concept of stem cells.
2. To learn the concept of iPS and stem cell niche.
3. The application of stem cells in the treatment of cancer, neurodegenerative diseases etc.,
4. Learn the concept of stem cell transplantation and tissue remodeling
5. Study the role of animal models in stem cell research

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	2								3		
CO2	2								3		
CO3	2								3		
CO4	2								3		
CO5	2								3		

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 22-08-22 **ACADEMIC COUNCIL: 22-08-22**

SDG No. & Statement:

SDG Justification: