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

Accredited by NAAC with A^{++} Grade

CURRICULUM AND SYLLABUS

OF

UMFST04 B.Sc. Microbiology

w.e.f. 2021-22 admitted batch

(Updated up to 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.

B.Sc. Microbiology

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

B.Sc. Microbiology

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

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO 1 To expose students to the theory and laboratory skills in microbiology

PEO 2 To make students competent in Microbiology and allied areas by providing them hands-on experience.

PEO 3 To instill the ability for research and entrepreneurship in the students

PEO 4 To increase the student's ability in integrating various aspects of microbiology

Mapping of the Mission of the School with the PEOs

	PEO1	PEO2	PEO3	PEO4
M1	**3**	**3**	**3**	**3**
M2	**3**	**3**	**3**	**3**
M3	**3**	**3**	**3**	**3**
M4	**3**	**3**	**3**	**3**
M5	**3**	**3**	**3**	**3**

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

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

PO1 Will gain basic knowledge about microbiology principles with an understanding of bacteriology, cell biology, virology, mycology, immunology, pathogenesis, laboratory diagnosis, prevention, and control of common diseases in the country.

PO2 They learn the important recombinant DNA techniques exploiting the knowledge obtained in the field of microbial genetics.

PO3 Show the hands-on-experience in the areas of nucleic acid and protein purification techniques.

PO4 They will also acquire laboratory safety knowledge and ethics applicable to research.

PO5 They will also learn to accurately calculate and reporting observations and analysis.

PO6 They imbibe the excellent knowledge on microbiological skills applicable to clinical research.

PO7 Relate and include the principles of microbiology in practical, real-world situations and problems.

PSO1 Will implement basic principles of bacteriology, cell biology, molecular biology, virology, mycology, and immunology in real-world situations and problems.

PSO2 Understand the importance of recombinant DNA techniques correlating the knowledge gained in the field of microbial genetics.

PSO3 Learn the detailed principles, procedures, and applications of chromatographic and electrophoretic techniques to purify proteins and nucleic acids to homogeneity.

PSO4 Understand the importance of spectrophotometric techniques in quantitating the concentrations successfully.

Curriculum Structure

(Flexible 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

Programme Core courses for B.Sc. Microbiology								
Course code	**Level**	**Course Title**	**L**	**T**	**P**	**J**	**S**	**C**
MFST1051	1	Introductory Microbiology	3	0	0	0	0	3
MFST1061	1	Introductory Microbiology Practical	0	0	2	0	0	1
MFST1071	1	Microbial Genetics	3	0	0	0	0	3
MFST1081	1	Microbial Genetics Practical	0	0	2	0	0	1
MFST2061	2	Cell and Molecular Biology	3	0	0	0	0	3
MFST2071	2	Microbial Physiology and Biochemistry	3	0	0	0	0	3
MFST2081	2	Cell and Molecular Biology Practical	0	0	2	0	0	1
MFST2091	2	Microbial Physiology and Biochemistry Practical	0	0	2	0	0	1
MFST2101	2	Recombinant DNA Technology	3	0	0	0	0	3
MFST2111	2	Recombinant DNA Technology Practical	0	0	2	0	0	1
MFST3061	3	Immunology	3	0	0	0	0	3

MFST3071	3	Industrial Microbiology	3	0	0	0	0	3
MFST3081	3	Immunology Practical	0	0	2	0	0	1
MFST3091	3	Industrial Microbiology Practical	0	0	2	0	0	1
MFST3101	3	Medical Microbiology	3	0	0	0	0	3
MFST3111	3	Medical Microbiology Practical	0	0	2	0	0	1

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

Course code	Level	Course Title	L	T	P	J	S	C
MFST2301	2	Biofilms	3	0	0	0	0	3
MFST2321	2	Biofilms Practical	0	0	2	0	0	1
MFST2311	2	Microbes in Sustainable Agriculture	3	0	0	0	0	3
MFST2331	2	Microbes in Sustainable Agriculture Practical	0	0	2	0	0	1
MFST2341	2	Marine Microbiology	3	0	0	0	0	3
MFST2351	2	Food Microbiology	3	0	0	0	0	3
MFST2361	2	Bioenergy and Biofuels	3	0	0	0	0	3
MFST2371	3	Virology	3	0	0	0	0	3
MFST3221	3	Bioremediation	3	0	0	0	0	3
MFST3231	3	Instrumentation and Biotechniques	3	0	0	0	0	3
MFST3241	3	Microbial Biotechnology	3	0	0	0	0	3

Note 1: Students should acquire a minimum of 16 credits from the program elective courses

Note 2: Theory and corresponding lab course are co-requisites (For example if a student opts to study MFST2301 OR 2311 must complete the corresponding lab course

Open Elective (OE)*

* opt eligible Programme Elective (PE) courses from other programmes as an open elective courses and earn 18 credits

Eligible MINOR courses to be offered to the students of B.Sc. Microbiology Program

Stream	Major course	Minor course (Select one)
Life Sciences	Microbiology	Biochemistry
		Bioinformatics
		Biotechnology
		Food Science and Technology
		Biotechnology

Minor Courses in 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 in 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
Minor Courses in Microbiology								
MFST1051	1	Introductory Microbiology	3	0	0	0	0	3
MFST1061	1	Introductory Microbiology Practical	0	0	2	0	0	1
MFST1071	2	Microbial Genetics	3	0	0	0	0	3
MFST2061	2	Cell and Molecular Biology	3	0	0	0	0	3
MFST2071	2	Microbial Physiology and Biochemistry	3	0	0	0	0	3
MFST2081	2	Microbial Physiology and Biochemistry Practical	0	0	2	0	0	1
MFST3061	2	Immunology	3	0	0	0	0	3
MFST3071	3	Industrial Microbiology	3	0	0	0	0	3

MFST3091	3	Industrial Microbiology lab	0	0	2	0	0	1
MFST3101	3	Medical Microbiology	3	0	0	0	0	3
* Eligibility: This minor course is offered to the students of B.Sc. Biochemistry/Biotechnology/Food Science &Tech/Environmental Science/Chemistry								
Minor courses in Biotechnology								
BTSC1021	1	Cell Biology	3	0	0	0	0	3
BTSC1031	1	Cell Biology Lab	0	0	2	0	0	1
BTSC2011	2	Bioanalytical Techniques	3	0	0	0	0	3
BTSC2001	2	Enzymology & Metabolism	3	0	0	0	0	3
BTSC3011	3	General Immunology	3	0	0	0	0	3
BTSC2041	3	Molecular Biology & rDNA technology	3	0	0	0	0	3
BTSC2031	3	Molecular Biology & rDNA technology Lab	0	0	2	0	0	1
BTSC3001	3	Plant & Animal Biotechnology	3	0	0	0	0	3
BTSC3021	3	Plant & Animal Biotechnology Lab	0	0	2	0	0	1
BTSC3041	3	Industrial Biotechnology	3	0	0	0	0	3
* Eligibility: This minor course is offered to the students of B.Sc. Biochemistry/ Microbiology/ Food Science &Tech/ Environmental Science/Chemistry.								
Minor Courses in Food Science and Technology*								
MFST1001	1	Principles of Food Science	3	0	0	0	0	3
MFST1011	1	Principles of Food Science Practical	0	0	2	0	0	1
MFST1021	1	Fundamentals of Food Technology	3	0	0	0	0	3
MFST2001	2	Technology of Plantation Crops	3	0	0	0	0	3
MFST2011	2	Food Processing and Preservation Technology	3	0	0	0	0	3
MFST2031	2	Food Processing and Preservation Technology Practical	0	0	2	0	0	1
MFST2041	2	Food Microbiology	3	0	0	0	0	3
MFST3001	3	Technology of Animal Foods	3	0	0	0	0	3
MFST3021	3	Technology of Animal Foods Practical	3	0	0	0	0	3
MFST3011	3	Food Biochemistry	3	0	0	0	0	3
* Eligibility: This minor course is offered to the students of B.Sc. Biochemistry/Microbiology/ Biotechnology/Environmental Science/Chemistry								

Students pursuing 4th year of the B.Sc. Microbiology programme need to choose either Honours or Honours with Research courses 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	Level	Course Title	L	T	P	J	S	C
MFST4471	400	Introduction to Pharmaceutical Microbiology	4	0	0	0	0	4
MFST4481	400	Introduction to Pharmaceutical Microbiology (Practical)	0	0	4	0	0	2
MFST4491	400	Epidemiology of Microbial Infections	4	0	0	0	0	4
MFST4501	400	Epidemiology of Microbial Infections (Practical)	0	0	4	0	0	2
MFST4511	400	Principles of Vaccinology	4	0	0	0	0	4
MFST4521	400	Principles and Applications of Bioinformatics	4	0	0	0	0	4
MFST4531	400	Principles and Applications of Bioinformatics (Practical)	0	0	4	0	0	2
MFST4541	400	Human Disease Management	4	0	0	0	0	4
MFST4551	400	Human Disease Management (Practical)	0	0	4	0	0	2
MFST4561	400	Functional Diversity of Microorganisms	4	0	0	0	0	4
		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	Level	Course Title	L	T	P	J	S	C
MFST4471	400	Introduction to Pharmaceutical Microbiology	4	0	0	0	0	4
MFST4491	400	Epidemiology of Microbial Infections	4	0	0	0	0	4
DIST4666	400	Dissertation - 1 (Review of Literature & Research	0	0	0	0	8	8
MFST4461	400	# Microbial Plant Pathology	4	0	0	0	0	4
MFST4411	400	# Food Product Development	4	0	0	0	0	4
MFST4391	400	# Biowaste Utilization and Value Addition	4	0	0	0	0	4
MFST4431	400	# Bioorganic Cultivation of Food Crops	4	0	0	0	0	4
DIST4777	400	Dissertation - II	0	0	0	0	12	12
		Total						**32**

Opt any 1 out of 4 Courses

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 & FST								
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

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%	40	25%
Major Electives	16	14%	16	10%	20	12.25%
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

Course Code	Course Name	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CSEN1001	IT Productivity Tools^	1	1	1	1	1	1	1	1	1	1	1
CLAD1001	Emotional Intelligence & Reasoning Skills (Soft Skills 1)	1	1	1	2	1	1	1	1	1	1	1
CLAD1011	Leadership Skills &	1	1	1	2	1	1	1	1	1	1	1

	Quantitative Aptitude (Soft Skills 2)											
CLAD1021	Verbal Ability & Quantitative Ability (Soft Skills 3)	1	1	1	2	1	1	1	1	1	1	1
CLAD1031	Practicing Verbal Ability & Quantitative Aptitude (Soft Skills 4)	1	1	1	1	1	1	1	1	1	1	1
CLAD2001	Soft skills 5A	1	1	1	1	1	1	1	1	1	1	1
CLAD2011	Soft skills 5B	1	1	1	1	1	1	1	1	1	1	1
CLAD2021	Soft skills 5C	1	1	1	1	1	1	1	1	1	1	1
CLAD2031	Soft skills 6A	1	1	1	1	1	1	1	1	1	1	1
CLAD2041	Soft skills 6B	1	1	1	1	1	1	1	1	1	1	1
CLAD2051	Soft skills 6C	1	1	1	1	1	1	1	1	1	1	1
DOSP1001	Sports 1 Badminton	1	1	1	1	1	1	1	1	1	1	1
DOSP1011	Sports 2 Chess	1	1	1	1	1	1	1	1	1	1	1
DOSP1021	Sports 2 Carrom	1	1	1	1	1	1	1	1	1	1	1
DOSP1031	Sports 3 Football	1	1	1	1	1	1	1	1	1	1	1
DOSP1041	Sports 4 Volleyball	1	1	1	1	1	1	1	1	1	1	1
DOSP1051	Sports 5 Kabaddi	1	1	1	1	1	1	1	1	1	1	1
DOSP1061	Sports 6 Kho Kho	1	1	1	1	1	1	1	1	1	1	1

DOSP1071	Sports 7 Table Tennis	1	1	1	1	1	1	1	1	1	1	1
DOSP1081	Sports 8 Handball	1	1	1	1	1	1	1	1	1	1	1
DOSP1091	Sports 9 Basketball	1	1	1	1	1	1	1	1	1	1	1
DOSP1101	Sports 10 Tennis	1	1	1	1	1	1	1	1	1	1	1
DOSP1111	Sports 11 Throwball	1	1	1	1	1	1	1	1	1	1	1
DOSL1001	Club Activity-Participant	1	1	1	1	1	1	1	1	1	1	1
DOSL1011	Club Activity – Member of the Club	1	1	1	1	1	1	1	1	1	1	1
DOSL1021	Club Activity – Leader of the Club	1	1	1	1	1	1	1	1	1	1	1
DOSL1031	Club Activity – Competitor	1	1	1	1	1	1	1	1	1	1	1
DOSL1041	Community Services - Volunteer	1	1	1	1	1	1	1	1	1	1	1
DOSL1051	Community Services - Mobilizer	1	1	1	1	1	1	1	1	1	1	1
ENVS1001	Environmental Studies^	2	1	1	1	1	1	1	1	1	1	1
FINA3001	Personal Financial Planning#	1	1	1	3	1	1	1	1	1	1	1

LANG1001	Communication Skills in English - Beginners	1	1	1	1	1	1	1	1	1	1	1
LANG1011	Communication Skills in English	1	1	1	1	1	1	1	1	1	1	1
LANG1021	Advanced Communication Skills in English	1	1	1	1	1	1	1	1	1	1	1
MFST1001	Health and Wellbeing#	1	1	1	1	1	1	1	1	1	1	1
POLS1001	Indian Constitution and History	1	1	1	1	1	3	1	1	1	1	1
PHPY1001	Gandhi for the 21st Century	1	1	1	1	1	1	1	1	1	1	3
VEDC1001	Venture Development	2	2	2	2	2	3	3	2	3	2	3
CHEM1011	Chemistry-I	2	2	3	3	2	2	1	2	2	2	2
CHEM1031	Chemistry-II	2	2	3	3	2	2	1	2	2	2	2
CSCI1001	Basics of Information Technology	2	2	3	3	2	2	1	2	2	2	2
CHEM1021	Chemistry- 1-LaB	2	2	2	1	1	2	1	2	1	2	1
CHEM1051	Chemistry-III	2	2	2	1	1	2	1	2	1	2	1
PHYS1091	Biophysics	2	2	2	1	1	2	1	2	1	2	1
CHEM1041	Chemistry-II Lab	2	2	2	2	3	2	1	2	1	2	3
PHYS1101	Biophysics Lab	2	2	2	1	1	2	1	2	1	2	1
MFST1051	Introductory Microbiology	3	3	3	2	2	2	3	2	1	1	3

MFST1061	Introductory Microbiology Practical	2	3	2	1	2	2	3	2	3	2	3
MFST1071	Microbial Genetics	2	2	2	1	3	2	2	2	3	3	3
MFST1081	Microbial Genetics Practical	2	2	3	2	3	1	2	2	3	3	2
MFST2061	Cell and Molecular Biology	1	2	2	2	3	1	2	2	3	2	2
MFST2071	Microbial Physiology and Biochemistry	2	2	2	3	2	3	2	1	2	3	2
MFST2081	Cell and Molecular Biology Practical	3	2	3	2	2	2	2	2	2	1	3
MFST2091	Microbial Physiology and Biochemistry Practical	3	2	3	2	2	2	2	3	2	3	2
MFST2101	Recombinant DNA Technology	3	2	3	2	2	1	2	2	2	3	2
MFST2111	Recombinant DNA Technology Practical	3	2	3	2	2	2	2	2	1	3	3
MFST3061	Immunology	3	3	2	3	2	3	3	3	1	3	3
MFST3071	Industrial Microbiology	1	2	2	3	2	3	2	3	2	3	1
MFST3081	Immunology Practical	3	2	3	2	2	2	2	3	2	3	2

MFST3091	Industrial Microbiology Practical	2	2	3	2	3	3	3	2	2	2	3
MFST3101	Medical Microbiology	3	2	2	3	2	3	2	2	3	2	2
MFST3111	Medical Microbiology Practical	3	2	2	2	2	3	2	2	3	2	2
MFST2301	Biofilms	3	3	3	2	2	3	2	2	3	2	1
MFST2321	Biofilms Practical	2	3	3	3	2	2	3	2	3	3	2
MFST2311	Microbes in Sustainable Agriculture	3	3	3	2	2	3	2	2	3	2	1
MFST2331	Microbes in Sustainable Agriculture Practical	3	2	2	2	2	3	2	2	3	2	2
MFST2341	Marine Microbiology	2	2	2	2	2	3	2	3	3	2	2
MFST2351	Food Microbiology	2	3	1	3	3	3	2	1	2	2	3
MFST2361	Bioenergy and Biofuels	3	2	3	3	2	3	2	3	3	2	3
MFST2371	Virology	2	2	3	2	2	2	3	2	2	3	2
MFST3221	Bioremediation	3	2	3	2	2	3	2	2	3	2	1
MFST3231	Instrumentation and Biotechniques	3	2	3	2	3	2	2	2	3	2	2
MFST3241	Microbial Biotechnology	3	3	2	2	2	3	2	2	1	2	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 theirown emotions as well as the emotions of others and relate better with both. Using better knowledgeof 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 andUnhealthy 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 awebsite 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 inteams effectively
4. Students will be able to solve questions based on non-verbal and analytical reasoning, datasufficiency 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 messageto 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 tocommunicate 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 solvequestions that often appear in various competitive examinations and admission tests.
- Apply different concepts for tackling questions based on data interpretation, progression and series thatare 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	5

	Listening, Asking Questions, Empathizing, Being Non-Judgmental, Being Open Minded, Mass Communication: Design of Posters, Advertisements, notices, writing formal and informal invitations	
2	Focus on Audience Needs, focus on the Core Message, Use Body Language andVoice, Start Strongly, Organizing Ideas & Using Visual Aids: SPAM Model, EffectiveOpening 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 RationalApproach to Problem Solving: Defining the Problem, Identifying the Root Causes, Generating Alternative Solutions, Evaluating and Selecting Solutions, Implementingand 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 makingin 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 basesystem (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 & WordOrder, 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 MeenakshiUpadhyay
2. Study material for CAT, SAT, GRE, GMAT by TIME, Career Launcher and IMSetc.
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, TextCompletion, 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 MeenakshiUpadhyay
2. Study material for CAT, SAT, GRE, GMAT by TIME, CareerLauncher and IMSetc.
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 testsas 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 andIMS 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 IMSetc.
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 theirhigher 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 MeenakshiUpadhyay
2. Study material for CAT, SAT, GRE, GMAT by TIME, CareerLauncher and IMSetc.
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 MeenakshiUpadhyay
2. Study material for CAT, SAT, GRE, GMAT by TIME, CareerLauncher and IMSetc.
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 aslisted 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 organizationsthrough 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 organizationsthrough 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 SherylWuDunn)
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 existfor 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 44nstagram 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 fellowstudents
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 buildingconcept.
- To make learners understand about the present population scenario, its impacts and role ofinformational 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 InternationalPublishers 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 andSolutions. 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 ofour 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

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

UNIT 2 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 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

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

UNIT 5 Tax Planning

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 variationsin 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. (

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 theirroles)
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 andfamily 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 issue. Individual oral presentation and feedback from peers andinstructor.	Note-making (group work), Discussion, Feedback

9	Follow the essentials of lectures, talks, discussions, reports and other forms of academicpresentations 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 givingrationalize 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 fellowspeakers/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 andgrammatical 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. FoundationBooks. 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 bySarah 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-specifictopics, 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 smallgroup discussions sharing experiences/views on familiar contemporary issues and give reasonsfor 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 subjectsof 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, responsesto 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 witha 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 theircomprehension 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 skillsand 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 longtext/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 themeof 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 of formal and polite speech, and managing bias	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 argumentativeessays).	3
6	Role-play (complex social and academic/professional situations): Focus on significant aspects of	Reading newspaper/ magazine articles/ blog posts on current social issues, listening to talks/	1

	delivery including clarity, tone, and use of contextually appropriate vocabulary and conventions, observation, reflective discussion, and self-reflective writing	discussions/ debates etc. and participating in role-plays using expressions appropriate to the context.	
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 currentinterest 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 fourjudges (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/ teacher)	2
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	Reading texts on abstract topics and	3

	topics beyond his/her own area of interest/field of study, using the language flexibly and effectively.	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.	
14	Self-relfection on own speech in context(recorded): tone, pitch, relevance, content; extending the reflections/ideas toothers	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 MartinHewings 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:

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/widelyaccepted 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

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

PROGRAMME CORE

MFST1051	INTRODUCTORY MICROBIOLOGY	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	Basic background in biology						
Co-requisite	none						
Preferable exposure							

Course Description:

This course introduces the students to the basic concepts of microbiology, history and development of microbiology. Additionally, they learn about isolation identification classification of microorganisms. Introducing the subject to all the applied aspects of microbiology.

Course Educational Objectives:

- To learn the subject of microbiology by its history, microscopy, aseptic techniques, sterilization, isolation of bacteria, study of morphological characters, identifying and classification of bacteria.
- To know the preservation of microbes, staining techniques, understanding nutritional types of bacteria.
- To learn the details of some clinically important bacteria
- To understand the importance of study of microbiology of water, milk and microbial interactions in nature.

UNIT 1 **8 hours**

History of Development of Microbiology, Spontaneous generation vs. biogenesis, Germ theory of disease, golden era of microbiology, Contributions of Antonvon Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Alexander Fleming, Edward Jenner

UNIT 2 **8 hours**

Binomial Nomenclature, Whittaker's five kingdom and Carl Woese's three kingdom classification systems and their utility. Difference between prokaryotic and eukaryotic microorganisms General characteristics of different groups: Acellular microorganisms (Viruses, Viroids, Prions) and Cellular microorganisms (Bacteria, Algae, Fungi and Protozoa) with emphasis on distribution and occurrence, morphology, nutrition, mode of reproduction and economic importance.

UNIT 3 **8 hours**

Morphology and ultrastructure of bacterial cell, endospore: Structure, formation, stages of sporulation. Introduction to Bergey's manual of systematic bacteriology.

UNIT 4 **8 hours**

Sterilization Physical methods of microbial control: heat, low temperature, high pressure, filtration, desiccation, osmotic pressure, radiation. Chemical methods of microbial control: disinfectants, types and mode of action. Isolation, cultivation, enumeration and preservation of microorganisms; Microscopic identification: staining methods- simple, differential, structural and special staining. Bacterial reproduction and growth. Synchronous, batch and continuous cultures.

UNIT 5 **8 hours**

Bright Field Microscope, Dark Field Microscope, Phase Contrast Microscope, Fluorescence Microscope, Scanning and Transmission Electron Microscope

Textbooks:

1. Microbiology 5th edition by Pelczar, Chan and Krieg.
2. General Microbiology, 5th edition by Stanier, Deudroff and Adelberg.

References:

1. Bergey's Manual of Systematic Bacteriology 9th edition, volumes I to VI.
2. Brock Biology of Microorganism 9th edition by Madigan, Martinko and Parker.

Course Outcomes:

By the end of the course students will

- Learn the history of Microbiology, microscopy, aseptic techniques, sterilization,
- Learn about the isolation of bacteria, study of morphological characters, identifying and classification of bacteria.
- Learn the preservation of microbes, staining techniques, understanding nutritional types of bacteria.
- Know the details of some clinically important bacteria
- Understand the importance of study of microbiology of water, milk and microbial interactions in nature.

CO-PO Mapping:

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

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.

MFST1061	INTRODUCTORY MICROBIOLOGY LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	MFST1051Introductory Microbiology						
Preferable exposure							

Course Description:

This course introduces the students to the basic concepts of microbiology, history and development of microbiology. Additionally, they learn about isolation identification classification of microorganisms. Introducing the subject to all the applied aspects of microbiology.

Course Educational Objectives:

- To learn the subject of microbiology by its history, microscopy, aseptic techniques, sterilization, isolation of bacteria, study of morphological characters, identifying and classification of bacteria.
- To know the preservation of microbes, staining techniques, understanding nutritional types of bacteria.
- To learn the details of some clinically important bacteria
- To understand the importance of study of microbiology of water, milk and microbial interactions in nature.

List of Experiments:

1. Microbiology Good Laboratory Practices and Biosafety.
2. To study the principle and applications of important instruments (biological safety cabinets, autoclave, incubator, BOD incubator, hot air oven, light microscope, pH meter used in the microbiology laboratory.
3. Morphological identification of bacteria.
4. Morphological identification of Fungi using permanent slides/wet mounts.
5. Morphological identification of algae using permanent slides/wet mounts.
6. Preparation of different media: synthetic media BG-11, Complex media-nutrient agar, McConkey agar, EMB agar.

7. Simple staining
8. Negative staining
9. Gram's staining
10. Acid fast staining-permanent slide only.
11. Capsule staining
12. Endospore staining.
13. Isolation of pure cultures of bacteria by streaking method.
14. Preservation of bacterial cultures by various techniques.
15. Estimation of CFU count by spread plate method/pour plate method.
16. Motility by hanging drop method.

Textbooks:

1. Atlas RM. (1997). Principles of Microbiology. 2nd edition. WM.T. Brown Publishers.
2. Black J G .(2008).Microbiology: Principles and Explorations. 7th edition. Prentice Hall
3. Madigan M T, and Martinko J M. (2014). Brock Biology of Micro-organisms.14thedition.ParkerJ. Prentice Hall International, Inc.
4. Pelczar Jr MJ, Chan ECS, and Krieg NR. (2004). Microbiology.5th edition Tata Mc Graw Hill.
5. Srivastava S and Srivastava PS. (2003).Understanding Bacteria. Kluwer Academic Publishers, Dordrecht

Course Outcomes:

After the completion of the above experiments the students will be able to perform

- Isolation of various microorganisms (bacteria, fungi) from different sources (water, soil, food)
- Identification of physiological characteristics such as gram, capsule, spore and flagella by microscopic techniques
- Identification of the biochemical characteristics of the bacteria
- Preparation of various types of media for culturing of microorganism
- Preservation of bacterial cultures by various techniques

CO-PO Mapping:

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

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.

MSFT1071	MICROBIAL GENETICS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	Basic background in biology						
Co-requisite	None						
Preferable exposure							

Course Description:

While Fidelity in genome replication allows for stability of a species, changes in genome are important for variability of individuals and evolution of species. The changes can be brought about through processes inherent to the cell or as an effect of outside factors. This course deals with the molecular mechanisms, such as mutation, recombination and transpositions, which allow for the incorporating variations in the genome.

Course Educational Objectives:

- To teach the students the types of mutations
- To elucidate the Plasmids structure, function and types
- To provide a detailed information on Recombination in bacteria
- To describe the Genetic mapping using recombination
- To teach the students about mobile genetic elements

UNIT 1 **Genome organization** **8 hours**

E. coli, Saccharomyces, Tetrahymena. Definition and types of Mutations; Physical and chemical mutagens; Molecular basis of mutations; Functional mutants (loss and gain of function mutants); Uses of mutations. Reversion and suppression: True revertants; Intra- and inter-genic suppression; Ames test; Mutator genes

UNIT 2 **8 hours**

Plasmids and their types, – F plasmid, R Plasmids, colicinogenic plasmids, Ti plasmids, linear plasmids, yeast-2µ plasmid, Plasmid replication and partitioning, Host range, plasmid-incompatibility, plasmid amplification, Regulation of copy number, curing of plasmids

UNIT 3 **8 hours**

Genetic exchange in prokaryotes, Transformation - Discovery, mechanism, Conjugation-Discovery, mechanism, Hfr and F' strains, Transduction-Generalized transduction, specialized transduction,

UNIT 4 **Phage Genetics** **8 hours**

Genetic Mapping- Interrupted mating technique and time of entry mapping, co-transduction of markers, Features of T4 genetics, Genetic basis of lytic versus lysogenic switch of phage lambda

UNIT 5 **8 hours**

Transposable elements: Prokaryotic transposable elements–Insertion Sequences, composite and non-Replicative transposition, Mu transposon. Eukaryotic transposable elements-Yeast (Ty1 transposon), Drosophila (P elements), Maize (Ac/Ds). Uses of transposons and transposition.

Textbooks:

1. Watson JD, Baker TA, Bell SP, Gann A, Levine M and LosickR (2008) Molecular Biology of the Gene, 6th edition, Cold Spring Harbour Lab. Press, Pearson Publication
2. Becker WM, Kleinsmith L.J, HardinJ and Bertoni GP (2009) The World of the Cell,7th edition, Pearson Benjamin Cummings Publishing, San Francisco
3. DeRobertis EDP and DeRobertis EMF(2006) Cell and Molecular Biology, 8th edition. Lippincott Williams and Wilkins, Philadelphia

References:

1. Krebs J, Goldstein E, Kilpatrick S (2013). Lewin's Essential Genes, 3rd Ed., Jones and Bartlett Learning
2. Gardner EJ, Simmons MJ, Snustad DP(2008).Principles of Genetics. 8th Ed.Wiley-India

Course Outcomes:

After completion of the course, students will:

- Learn about the types of mutations
- Elucidate the Plasmids structure, function, and types
- Gather detailed information on Recombination in bacteria
- Understand the process of genetic mapping using recombination
- Learn the concepts of mobile genetic elements

CO-PO Mapping:

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

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.

MSFT1081	MICROBIAL GENETICS LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	MFST1071 Microbial Genetics						
Preferable exposure							

Course Description:

While Fidelity in genome replication allows for stability of a species, changes in genome are important for variability of individuals and evolution of species. The changes can be brought about through processes inherent to the cell or as an effect of outside factors. This course deals with the molecular mechanisms, such as mutation, recombination and transpositions, which allow for the incorporating variations in the genome.

Course Educational Objectives:

- To teach the students the types of mutations
- To elucidate the plasmids isolation
- To provide a detailed information on Recombination in bacteria
- To describe the Genetic mapping using recombination

List of experiments:

1. Preparation of Master and Replica Plates
2. Study the effect of physical (UV) mutagens on bacterial cells
3. Study survival curve of bacteria after exposure to ultraviolet (UV) light
4. Isolation of Plasmid DNA from E.coli
5. Demonstration of Bacterial Conjugation
6. Demonstration of bacterial transformation/transduction
7. Demonstration of AMES test

Textbooks:

1. Karp G (2010) Cell and Molecular Biology: Concepts and Experiments, 6th edition, John Wiley& Sons. Inc.

2. Sambrook J and Russell DW.(2001). Molecular Cloning: A LaboratoryManual.4thEdition, Cold Spring Harbour Laboratory press.
3. Cell biology: Practical manual, 2018 by Renu Gupta et al
4. Cell And Molecular Biology: A Lab Manual, 2013, PHI learning India Limited.
5. Laboratory Manual of Microbiology and Biotechnology , 2014, K.R.Aneja. publisher Med. Tech.

Course Outcomes:

After the completion of the above experiments the students will be able to perform:

- Isolation of various microorganisms (bacteria, fungi) from different sources (water, soil, food)
- Identification of physiological characteristics such as gram, capsule, spore and flagella by microscopic techniques
- Identification of the biochemical characteristics of the bacteria
- Demonstrate of AMES test
- Preparation of various types of media for culturing of microorganism

CO-PO Mapping:

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

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

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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.

MSFT2061	CELL AND MOLECULAR BIOLOGY	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	Basic background in biology						
Co-requisite	none						
Preferable exposure							

Course Description:

The Cell and Molecular Biology course is designed to help understand how the cells are organized, in prokaryotes and eukaryotes. It helps the students grasp the correlation of the structure of the cell organelles to the function they carry out. They will learn the process of replication, transcription and translation in prokaryotes and Eukaryotes. The course provides understanding of how cells divide, while maintaining the genomic integrity, and how variations occur through meiosis.

Course Educational Objectives:

1. To understand the structures and purpose of basic components of prokaryotic and eukaryotic cells
2. To understand how the genetic material is faithfully replicated and transferred to the dughter cells yet allowing for variation in population
3. To learn the methods and importance of protein regulation and transport.

UNIT 1 Plasma membrane Structure 8 hours

Sandwich, fluid-mosaic models. Nutrient transport- passive and facilitated diffusion, active transport, group translocation. Cell Wall: Eukaryotic cell wall, Extra cellular matrix. Cell-Cell junctions and plasmodesmata (only structural aspects)

UNIT 2 Mitochondria, chloroplasts and peroxisomes; Cytoskeleton 8 hours

Structure and organization, Nucleolus, organization of Ribosomes, Endoplasmic Reticulum structure, and protein targeting. Golgi Apparatus, protein glycosylation, protein sorting and export from Golgi Apparatus, Lysosomes.

UNIT 3 DNA Structure 8 hours

Miescher to Watson and Crick- historic perspective. Salient features of double helix, Types of DNA. Types of genetic material. Denaturation and renaturation, cot curves. Organization of DNA Prokaryotes, Viruses, Eukaryotes. RNA Structure, Organelle DNA—mitochondria and chloroplast DNA.

UNIT 4 **8 hours**

Bidirectional and unidirectional replication, semi-conservative, semi-discontinuous replication Mechanism of DNA replication: Enzymes and proteins involved in DNA replication –DNA polymerases, DNA ligase, primase, telomerase, Various models of DNA replication-rolling circle, Θ(theta) mode. Mismatch and excision repair

UNIT 5 **Transcription** **8 hours**

Definition, promoter-concept and strength of promoter, transcription in prokaryotes and eukaryotes. Translational machinery, Charging of tRNA, aminoacyl tRNA synthetases, Mechanisms of initiation, elongation and termination of translation in prokaryotes.

Textbooks:

1. Molecular Biology of the Cell (5th edition) by B. Alberts et. al.
2. Molecular Cell Biology (6th edition) by H. Lodish et. al.

References:

1. Cell and Molecular Biology (8th edition) by E.D.P.DeRobertis
2. The Cell: A molecular approach (6th edition). by G.M Cooper

Course Outcomes:

By the end of the course, students will be able to

- To learn about types of cell organization
- To learn about Cell organelles and their function
- DNA replication and characters and function of enzymes of replication.
- Mechanism of translation in prokaryotes
- Mechanism of translation in eukaryotes

CO-PO Mapping:

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

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:

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MSFT2071	MICROBIAL PHYSIOLOGY AND BIOCHEMISTRY	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	Basic background in Chemistry						
Co-requisite	none						
Preferable exposure							

Course Description:

This course is familiarizes the student with various physiological aspects and metabolic pathways operating in microorganisms. The concept of microbial growth, factors that govern the growth and survival of microbes under various conditions shall be explained. The detailed mechanism of metabolism of carbohydrates, fats, and proteins shall be elucidated comprehensively. The diversity of metabolic pathways with special reference to microbial physiology shall be covered.

Course Educational Objectives:

- To understand mechanism of growth and survival strategies operating in microbes
- To learn the nutrient transport mechanisms in bacteria
- To understand types of heterotrophic metabolism viz. aerobic, anaerobic respiration and fermentation
- To appreciate the photosynthetic and nitrogen assimilation mechanism operating in microbes.

UNIT 1 **8 hours**

Microbial Growth and Effect of Environment on Microbial Growth

Nutritional classification of microorganisms. Definitions of growth, measurement of microbial growth, Batch culture, Continuous culture, generation time and specific growth rate, synchronous growth, diauxic growth curve, Factors affecting microbial growth- Temperature, pH, solute and water activity, Oxygen, atmospheric pressure.

UNIT 2 **8 hours**

Nutrient uptake and transport- passive and facilitated diffusion, primary and secondary active transport, concept of uniport, symport and antiport, group translocation, iron uptake.

UNIT 3 **8 hours**

Chemoheterotrophic Metabolism-Aerobic Respiration, Concept of aerobic respiration, anaerobic respiration and fermentation Glucose metabolism-viz. EMP, ED, Pentose phosphate pathway, TCA cycle, Electron transport chain. Anaerobic respiration with special reference to dissimilatory nitrate reduction. Fermentation–alcohol fermentation and Pasteur effect

UNIT 4 **8 hours**

Chemolithotrophic and Phototrophic Metabolism Introduction to aerobic and anaerobic chemolithotrophy with examples.Hydrogen oxidation (definition and reaction) and methanogenesis (definition and reaction) Phostosynthesis- Anoxygenic vs.oxygenic photosynthesis with reference to photosynthesisin greenbacteria, purple bacteria and cyanobacterial.

UNIT 5 **8 hours**

Bacterial Chemotaxis, Quorum sensing & biofilms. - Properties of nitrogenase, and ammonia assimilation. Genetics of nitrogen fixation and regulation of nitrogenase activity and synthesis.

Textbooks:

1. Cell biology: Practical manual, 2018 by Renu Gupta et al
2. Cell And Molecular Biology: A Lab Manual, 2013, PHI learning India Limited.
3. Watson JD, Baker TA, Bell SP, Gann A, Levine M and LosickR (2008) Molecular Biology of the Gene, 6th edition, Cold Spring Harbour Lab. Press, Pearson Publication
4. Becker WM, Kleinsmith LJ, HardinJ and Bertoni GP (2009) The World of the Cell,7th edition, Pearson Benjamin Cummings Publishing, San Francisco

References:

1. DeRobertis EDP and DeRobertis EMF(2006) Cell and Molecular Biology, 8th edition. Lippincott Williams and Wilkins, Philadelphia
2. Karp G (2010) Cell and Molecular Biology: Concepts and Experiments, 6th edition, John Wiley& Sons.Inc.
3. Sambrook J and Russell DW.(2001). Molecular Cloning: A LaboratoryManual.4thEdition, Cold Spring Harbour Laboratory press.

Course Outcomes:

By the end of the course, students will

- Understand the mechanism of growth and survival strategies operating in microbes
- Learn the nutrient transport mechanisms in bacteria
- Understand different types of heterotrophic metabolism viz. aerobic, anaerobic respiration and fermentation
- Appreciate the photosynthetic and nitrogen assimilation mechanism operating in microbes.
- Understand the mechanism of biological nitrogen fixation

CO-PO Mapping:

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

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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.

MSFT2081	CELL AND MOLECULAR BIOLOGY PRACTICAL	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	MFST2061 Cell and Molecular Biology						
Preferable exposure							

Course Description:

This course is familiarizes the student with various physiological aspects and metabolic pathways operating in microorganisms. The concept of microbial growth, factors that govern the growth and survival of microbes under various conditions shall be explained. The detailed mechanism of metabolism of carbohydrates, fats, and proteins shall be elucidated comprehensively. The diversity of metabolic pathways with special reference to microbial physiology shall be covered.

Course Educational Objectives:

- To understand mechanism of growth and survival strategies operating in microbes
- To learn the nutrient transport mechanisms in bacteria
- To understand types of heterotrophic metabolism viz. aerobic, anaerobic respiration and fermentation
- To understand about electrophoretic techniques of DNA/RNA

List of experiments:

1. Microscopic study of plant and animal cell
2. Study of the structure of cell organelles through electron micrographs
3. Study of different stages of Mitosis.
4. Study of different stages of Meiosis
5. Study of different types of DNA and RNA using micrographs and model/schematic representations
6. Isolation of genomic DNA from plant material.
7. Estimation of salmon sperm / calf thymus DNA using colorimeter (diphenylamine reagent) or UV spectrophotometer (A260 measurement)
8. Estimation of RNA using colorimeter (orcinol reagent) or UV spectrophotometer (A260 measurement)

9. Resolution and visualization of DNA by Agarose Gel Electrophoresis.
10. Resolution and visualization of proteins by Polyacrylamide Gel Electrophoresis (SDS-PAGE).

Textbooks:

4. Cell biology: Practical manual, 2018 by Renu Gupta et al
5. Cell And Molecular Biology: A Lab Manual, 2013, PHI learning India Limited.
6. Watson JD, Baker TA, Bell SP, Gann A, Levine M and LosickR (2008) Molecular Biology of the Gene, 6th edition, Cold Spring Harbour Lab. Press, Pearson Publication
7. Becker WM, Kleinsmith LJ, HardinJ and Bertoni GP (2009) The World of the Cell,7th edition, Pearson Benjamin Cummings Publishing, San Francisco
8. DeRobertis EDP and DeRobertis EMF(2006) Cell and Molecular Biology, 8th edition. Lippincott Williams and Wilkins, Philadelphia
9. Karp G (2010) Cell and Molecular Biology: Concepts and Experiments, 6th edition, John Wiley& Sons.Inc.
10. Sambrook J and Russell DW.(2001). Molecular Cloning: A LaboratoryManual.4thEdition, Cold Spring Harbour Laboratory press.

Course Outcomes:

By the end of practicals, students will be able to:

- Microscopic study of learn plant and animal cell
- Different stages of mitosis and meiosis
- Estimate the salmon sperm / calf thymus DNA using colorimeter (diphenylamine reagent) or UV spectrophotometer (A260 measurement)
- Understand the microscopic study of plant and animal cell
- Isolate the genomic DNA from plant material.

CO-PO Mapping:

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

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.

MSFT2091	MICROBIAL PHYSIOLOGY AND BIOCHEMISTRY PRACTICAL	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	MFST2071Microbial Physiology and Biochemistry						
Preferable exposure							

Course Description:

The Cell and Molecular Biology course is designed to help understand how the cells are organized, in prokaryotes and eukaryotes. It helps the students grasp the correlation of the structure of the cell organelles to the function they carry out. They will learn the process of replication, transcription and translation in prokaryotes and Eukaryotes. The course provides understanding of how cells divide, while maintaining the genomic integrity, and how variations occur through meiosis.

Course Educational Objectives:

1. To understand the structures and purpose of basic components of growth curve of bacteria

2. Effect of pH, temperature, carbon, and nitrogen on the growth of *E. coli.*

List of experiments:

1. Study and plot the growth curve of *E.coli* by turbidometric and standard plate count methods.
2. Calculations of generation time and specific growth rate of bacteria from the graph plotted with the given data
3. Effect of temperature on growth of *E.coli*
4. Effect of pH on growth of *E.coli*
5. Effect of carbon and nitrogen sources on growth of *E.coli*
6. Effect of salt on growth of *E.coli*
7. Demonstration of alcoholic fermentation
8. Demonstration of the thermal death time and decimal reduction time of *E.coli*

Textbooks:

1. Madigan MT, and Martinko JM (2014). Brock Biology of Microorganisms. 14th edition. Prentice Hall International Inc.
2. Reddy S R and Reddy S M.(2005).Microbial Physiology. Scientific Publishers India.
3. Gottschalk G. (1986). Bacterial Metabolism. 2nd edition. Springer Verlag
4. Willey JM, Sherwood LM, and Woolverton CJ. (2013). Prescott's Microbiology.9th edition. McGraw Hill Higher Education.

Course Outcomes:

By the end of practicals, students will be able to:

- Understand the importance of bacterial growth curve
- Demonstrate the role of temperature, pH, salt, carbon and nitrogen sources on the growth of E coli
- Demonstrate of the thermal death time and decimal reduction time of E.coli
- Calculate the generation time and specific growth rate of bacteria
- Demonstrate of alcoholic fermentation

CO-PO Mapping:

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

MFST2101	RDNA TECHNOLOGY	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	MFST1071 Microbial Genetics						
Co-requisite	none						
Preferable exposure							

Course Description:

The discovery of restriction endonucleases, brought on a never ending advent and improvement of the molecular biological techniques and their application in day to day life. This course aims to enhance the understanding of the various tool and methodologies involved in molecular cloning. The course starts with enzymes, cloning vectors, and DNA manipulation, through the amplification of DNA, screening methods, finger printing etc., leading to the microarray techniques

Course Educational Objectives:

- To teach the students the types of enzymes important in Recombinant DNA technology, with mechanism and applications.
- To make them understand the various types of cloning vectors, and their usage
- Let the students learn of various analysis methods, for screening of clones
- Make the students appreciate the importance of microarray methods

UNIT 1 Restriction modification systems 8 hours

TypesI, II and III. Modification, nomenclature, applications; Function and application of DNA polymerases. Terminal deoxynucleotidyl transferase, kinases and phosphatases, and DNA ligases. Use of linkers and adaptors

UNIT 2 Cloning Vectors 8 hours

Definition and Properties Plasmid vectors: pBR and pUC series Bacteriophage lambda and M13 based vectors Cosmids, BACs, YACs, , SV40-based expression vectors

UNIT 3 Transformation of DNA 8 hours

Chemical method, Electroporation, Gene delivery: Microinjection, electroporation, biolistic method (gene gun), liposome and viral- mediated delivery, Agrobacterium - mediated delivery. DNA, RNA and Protein analysis: Agarose gel electrophoresis, Southern - and Northern - blotting techniques, dot blot, SDS-PAGE and Western blotting.

UNIT 4 DNA Amplification and DNAsequencing, PCR 8 hours

Basics of PCR, RT-PCR, Real-Time PCR, Sanger's method of DNA Sequencing: traditional and automated sequencing Primer walking and shot gun sequencing

UNIT 5 Genomic and c DNAlibraries 8 hours

Preparation and uses, Screening of libraries: Colony hybridization and colony PCR, Chromosome walking and chromosome jumping, Applications of Recombinant DNA Technology, microarray technology

Textbooks:

1. Genetic Engineering: Principles and Practice (2015) by S. Mitra
2. Molecular Cloning (1989) J. Sambrook et. al.

References:

1. Microbiology – A Laboratory Manual (10th edition) by J.G. Cappuccinoand Sherman.
2. Methods in Molecular Biotechnology: Experimental Analysis (2010) by V. Gomase et. al.

Course Outcomes:

By the end of the course, students will

1. Learn about the types of enzymes important in Recombinant DNA technology, with mechanism and applications.
2. Understand the various types of cloning vectors, and their usage
3. Learn of various analysis methods, for screening of clones
4. Appreciate the importance of microarray methods
5. Know about types of DNA libraries

CO-PO Mapping:

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

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.

MFST2111	RDNA TECHNOLOGY LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	MFST2101Recombinant DNA Technology						
Preferable exposure							

Course Description:

The discovery of restriction endonucleases, brought on a never ending advent and improvement of the molecular biological techniques and their application in day to day life. This course aims to enhance the understanding of the various tool and methodologies involved in molecular cloning. The course starts with enzymes, cloning vectors, and DNA manipulation, through the amplification of DNA, screening methods, finger printing etc., leading to the microarray techniques

Course Educational Objectives:

- To perform recombinant DNA technology experiments-cloning, ligation, transformation etc.
- To learn PCR and southern blotting.

List of experiments

1. Preparation of competent cells for transformation
2. Demonstration of Bacterial Transformation
3. Digestion of DNA using restriction enzymes and analysis by agarose gel electrophoresis
4. Ligation of DNA fragments
5. Cloning of DNA insert and Blue white screening of recombinants.
6. Interpretation of sequencing gel electropherograms
7. Designing of primers for DNA amplification
8. Amplification of DNA by PCR
9. Demonstration of Southern blotting

Textbooks:

1. Karp G (2010) Cell and Molecular Biology: Concepts and Experiments, 6th edition, John Wiley& Sons.Inc.
2. Sambrook J and Russell DW. (2001). Molecular Cloning: A Laboratory Manual. 4th Edition, Cold Spring Harbour Laboratory press.
3. Cell biology: Practical manual, 2018 by Renu Gupta et al
4. Cell And Molecular Biology: A Lab Manual, 2013, PHI learning India Limited.
5. Laboratory Manual of Microbiology and Biotechnology, 2014, K.R.Aneja. publisher Medtech

Course Outcomes:

By the end of the lab, student will be able to:

- Prepare competent cells Bacterial transformation
- Perform PCR and southern blotting
- Cloning of DNA insert and Blue white screening of recombinants.
- Demonstrate of Southern blotting

CO-PO Mapping:

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

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.

MFST3061	IMMUNOLOGY	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	MFST1051Introductory Microbiology/basics in biology						
Co-requisite	None						
Preferable exposure							

Course Description:

Immunology course provides the knowledge about structure and function of immune system. This course provides the basic fundamentals of Antigens, antibodies, antigen and antibody interactions along with complement activation and MHC.

Course Educational Objectives:

- To provide ground knowledge about the immune system and its functions
- To provide key components of the innate and adaptive immune responses
- To Provide fundamental working knowledge of the basic principles of immunology and diagnostic immunology
- To provide mechanism of complement system activation pathways and structure and functions of Major Histo Compatable complex ,
- To provide Basic principles of immunization.

UNIT 1 **8 hours**

Concepts and Types of immunity- Innate immunity, Adaptive immunity, immunological response, contributions of Scientists in the field of immunology- Edward Jenner, Karl Landsteiner, Robert Koch, Paul Ehrlich, Elie Metchinikoff

UNIT 2 **8 hours**

Structure, Functions and Properties of organs involved in immune system- Primary lymphoid organs and secondary lymphoid organs, Structure and functions of Immune Cells – T cell, B cell, NK cell, Macrophages, Neutrophils, Esinophil, Basophil, Mast Cell, Dendritic cells

UNIT 3 **8 hours**

Characteristics and nature of of antigen- epitopes, haptens, Stucture and characteristics and types of antibodies- Ig G, Ig A, Ig M, Ig E, Ig D. Monocolonal antibodies and polyclona antibodies, Hybridoma technology

UNIT 4 **8 hours**

Antigen- antibody reactions: principles and applications of precipitation, agglutination, Immunodiffussion, Immunofloruesence, Immunoelectrophoresis, ELISA, RIA, Western blotting, Complement system-Compliment activation pathways- classical, alternative and lectin pathways, biological consequences of complement action

UNIT 5 **8 hours**

Major histocompatibility comples, Structure and functions of Class I MHC and Class II MHC, Antigen processing and antigen presentation by cytosolic and endocytic pathways, Principles of Immunization

Textbooks:

1. Abbas AK, Lichtman AH, Pillai S.(2007).Cellular and Molecular Immunology. 6th edition Saunders Publication ,Philadelphia.
2. Delves P, Martin S, Burton D, Roitt I M. (2006). Roitt's Essential Immunology.11th edition Wiley- Blackwell Scientific Publication, Oxford.

References:

1. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.

Course Outcomes:

By the end of the course, students will

- Study normal flora of human body, host-pathogen interaction and pathogenicity
- Gain knowledge on the pathogenic bacteria and their detailed study
- Study medically important viruses.
- Learn about fungal and protozoan diseases.
- Understand the mechanism of antimicrobial and antibacterial agents

CO-PO Mapping:

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

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.

MFST3071	INDUSTRIAL MICROBIOLOGY	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	MFST2071 Microbial physiology and Biochemistry						
Co-requisite	None						
Preferable exposure	MFST2071 Microbial physiology and Biochemistry						

Course Description:

This course provides an overview about the study of range of fermentation processes, design of fermentors and types of fermentors, fermentation economics, and production of valuable products by fermentation technology such as antibiotics, beverages and organic acids and enzymes including downstream processing methods.

Course Educational Objectives:

- To familiarize students with the range of fermentation processes
- To provide knowledge on fermentor design and types of bioreactors
- To give knowledge about fermentation medium selection, importance of growth kinetics
- To make students understand about the production of ethanol, organic acids, vitamins, enzymes and immobilization technique

UNIT 1 **8 hours**

Significance of industrial microbiology in various fields, Industrially important microorganism and their source, Screening and strain development methods, Isolation and preservation methods of industrially important microbial strains, Media formulation for industrial fermentations, crude and synthetic media

UNIT 2 **8 hours**

Types of fermentation process, solid state and liquid state fermentations, Growth kinitics, batch, fed batch, continuous fermentations, dual and multiple fermentation process, scale-up and fermentation economics

UNIT 3 **8 hours**

Design and components of typical bioreactor, Types of bioreactors-Laboratory, pilot-scale and production fermenters, stirred tank and air lift bioreactor, control of fermentation parameters-pH, temperature, dissolved oxygen and foaming and aeration

UNIT 4 **8 hours**

Microbial production of industrial products (micro-organisms involved, media, fermentation conditions, downstream processing and applications)-Citric acid, ethanol, penicillin, glutamic acid, VitaminB12 Enzymes (amylase, protease, lipase) Wine, beer

UNIT 5 **8 hours**

Down-stream processing- cell disruption, filtration, centrifugation, solvent extraction, precipitation, lyophilization and spray drying, enzyme immobilization method and their advantages and limitations

Textbooks:

1. Patel A.H. (1996). Industrial Microbiology. 1st edition, Macmillan India Limited
2. Okafor N. (2007).Modern Industrial Microbiology and Biotechnology.1 sedition. Bioscientific Publishers Limited. USA

References:

1. Waites M.J., Morgan N.L., Rockey J.S. and Higton G. (2001).Industrial Microbiology: An Introduction. 1st edition. Wiley –Blackwell

Course Outcomes:

By the end of the course, students will

1. Be familiarized with the range of fermentation processes
2. Gain knowledge on fermentor design and types of bioreactors
3. Develop concepts on fermentation medium selection, importance of growth kinetics
4. Understand about the production of ethanol, organic acids,vitamins, enzymes and immobilization technique.
5. Understand basic concepts of immobilization technology and their types

CO-PO Mapping:

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

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.

MFST3081	IMMUNOLOGY LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	MFST3071 Industrial Microbiology						
Preferable exposure							

Course Description:

Immunology course provides the knowledge about structure and function of immune system. This course provides the basic fundamentals of Antigens, antibodies, antigen and antibody interactions along with complement activation and MHC.

Course Educational Objectives:

- To provide ground knowledge about the immune system and its functions
- To provide fundamental working knowledge of the basic principles of immunology and diagnostic immunology

List of experiments:

1. Identification of human blood groups.
2. Perform Total Leukocyte Count of the given blood sample.
3. Perform Differential Leukocyte Count of the given blood sample.
4. Separate serum from the blood sample(demonstration).
5. Perform immunodiffusion by Ouchterlony method.
6. Perform DOTELISA.
7. Perform immunoelectrophoresis.

Textbooks:

1. Abbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6th edition Saunders Publication, Philadelphia.
2. Delves P, Martin S, Burton D, Roitt I M. (2006). Roitt's Essential Immunology.11th edition Wiley- Blackwell Scientific Publication, Oxford.
3. Golds by RA, Kindt TJ, Osborne BA.(2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
4. Murphy K, Travers P, Walport M. (2008). Janeway's Immuno biology.7th edition Garland Science Publishers, New York.

5. Peakman M, and Vergani D.(2009). Basic and ClinicalI mmunology.2nd edition Churchill Livingstone Publishers, Edinberg.
6. Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication.

Course Outcomes:

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

- Learn about blood groups.
- Separate serum from blood sample.
- Perform Total Leukocyte Count of the given blood sample.
- Perform Differential Leukocyte Count of the given blood sample.
- Separate serum from the blood sample(demonstration).

CO-PO Mapping:

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

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.

MFST3091	INDUSTRIAL MICROBIOLOGY LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	MFST3071 Industrial Microbiology						
Preferable exposure							

Course Description:

This course provides an overview about the study of range of fermentation processes, design of fermentors and types of fermentors, fermentation economics, and production of valuable products by fermentation technology such as antibiotics, beverages and organic acids and enzymes including downstream processing methods.

Course Educational Objectives:

- To familiarize students with fermentation processes
- To provide knowledge on fermentor design and types of bioreactors
- To give knowledge about fermentation medium selection, importance of growth kinetics
- To make students understand about the production of ethanol, organic acids, vitamins, enzymes and immobilization technique

List of experiments

1. Study different parts of fermenter
2. Microbial fermentations for the production and estimation (qualitative and quantitative) of:Enzymes: Amylase and Protease
3. Amino acid: Glutamic acid
4. Organic acid: Citric acid
5. Alcohol: Ethanol
6. A visit to any educational institute/ industry to see an industrial fermenter, and other downstream processing operations.

Textbooks:

1.GlazeA.N. and NikaidoH. (1995). Microbial Biotechnology: Fundamentals f Applied Microbiology. 1st edition. W.H. Freeman and Company

2. Casida LE. (1991). Industrial Microbiology. 1st edition. Wiley Eastern Limited.

3. Rrueger W and Crueger A. (2000). Biotechnology: A text book of Industrial Microbiology. 2nd edition. Panima Publishing Co. New Delhi.

4. Stanbury PF, Whitaker A and Hall SJ.(2006).Principles of FermentationTechnology.2nd edition, Elsevier Science Ltd.

Course Outcomes:

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

- Learn about different fermenters used in the industry
- Production and estimation of amylases, glutamic acid and citric acid
- Gain knowledge about an industrial fermenter
- Gain knowledge about downstream processing
- Exposure to industrial fermenters

CO-PO Mapping:

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

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.

MFST3101	MEDICAL MICROBIOLOGY	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	MFST1051Introductory Microbiology						
Co-requisite	None						
Preferable exposure							

Course Description:

To teach the concepts related to the pathogenesis of microbes belonging to bacteria, viruses, fungi and protozoa. Laboratory diagnosis, epidemiology of the diseases caused due to these pathogens

Course Educational Objectives:

- To study normal flora of human body, host-pathogen interaction and pathogenicity
- To gain knowledge on the pathogenic bacteria and their detailed study
- To provide access to study of medically important viruses.
- To learn about fungal and protozoan diseases.

UNIT 1 Normal microflora of the human body and host pathogen interaction 8 hours

Normal microflora of the human body: Importance of normal microflora, normal microflora of skin, throat, gastrointestinal tract, urogenital tract.

Host pathogen interaction: Definitions - Infection, Invasion, Pathogen, Pathogenicity, Virulence, Toxigenicity, Carriers and their types, Opportunistic infections, Nosocomial infections. Transmission of infection, Pathophysiologic effects of LPS

UNIT 2 Bacterial diseases 8 hours

Symptoms, mode of transmission, prophylaxis and control

Respiratory Diseases: *Streptococcus pneumonia*, *Mycobacterium tuberculosis, Neisseria meningitis, Corynebacterium diphtheria*, *Mycobacterium tuberculosis* Gastrointestinal Diseases*: Escherichia coli*, *Salmonella typhi*, *Vibrio cholerae*, *Helicobacter pylori,* Others: *Staphylococcus aureus*, *Clostridium tetani*, *Treponema pallidum*.

UNIT 3 **Viral diseases** **8 hours**

List of diseases of various organ systems and their causative agents. The following diseases in detail with Symptoms, mode of transmission, prophylaxis and control

Polio, Herpes, Hepatitis, Rabies, Dengue, AIDS, Influenza with brief description of swine flu, Ebola, Chikun gunya, Japanese Encephalitis

UNIT 4 **Fungal and Protozoan diseases** **8 hours**

Brief description of each of the following types of mycoses and one representative disease to be studied with respect to transmission, symptoms and prevention. Cutaneous mycoses: *Tinea pedis* (Athlete's foot) Systemic mycoses: Histoplasmosis Opportunistic mycoses: Candidiasis.

Protozooan diseases: Symptoms, mode of transmission, prophylaxis and control of Malaria, Kala-azar

UNIT 5 **Antimicrobial agents** **8 hours**

General characteristics and mode of action. Antibacterial agents: Mechanism of action Penicillin, Streptomycin, Imipenem, Gentamycin, Moxifloxacin, Antifungal agents: Mechanism of action of Amphotericin B, Griseofulvin, Antiviral agents: Mechanism of action of Amantadine, Acyclovir, Azidothymidine, Antibiotic resistance, MDR, XDR, MRSA, NDM-1.

Textbooks:

1. Textbook of Microbiology (6th edition) by Ananthanarayan and C. K. J.Paniker.
2. Textbook of Medical Parasitology (2013) by S. C. Panija.
3. Textbook of Medical Parasitology (6th edition) by C.K.JPaniker.

References:

1. Medical Microbiology (26th edition) by Jawetz et. al.
2. Medical Microbiology (26th edition) by Melnick and Adelberg
3. Medical Microbiology (16th edition) by D. Greenwood et.al.
4. Medical Microbiology (7th edition) by P. R.Murray et.al.

Course Outcomes:

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

- Study normal flora of human body, host-pathogen interaction and pathogenicity
- Gain knowledge on the pathogenic bacteria and their detailed study
- Study medically important viruses.
- Learn about fungal and protozoan diseases.
- Understand the mechanism of antimicrobial and antibacterial agents

CO-PO Mapping:

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

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.

MFST3111	MEDICAL MICROBIOLOGY LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	MFST3101 Medical Microbiology						
Preferable exposure							

Course Description:

To teach the concepts related to the pathogenesis of microbes belonging to bacteria, viruses, fungi and protozoa. Laboratory diagnosis, epidemiology of the diseases caused due to these pathogens

Course Educational Objectives:

- To study identification of bacteria by microbiological investigative methods
- To study antibacterial sensitivity by Kirby-Bauer method
- To gain knowledge on the pathogenic bacteria and their detailed study

List of experiments

1. Identify bacteria (any three of *E.coli, Pseudomonas, Staphylococcus, and Bacillus*) using laboratory strains on the basis of cultural, morphological and biochemical characteristics: IMViC, TSI, nitrate reduction, urease production and catalase tests.
2. Study of composition and use of important differential media for identification of bacteria: EMB Agar, McConkey agar, Mannitol salt agar, Deoxycholate citrate agar, TCBS.
3. Study of bacterial flora of skin by swab method.
4. Perform antibacterial sensitivity by Kirby-Bauer method.
5. Determination of minimal inhibitory concentration (MIC) of antibiotic.
6. Study symptoms of the diseases with the help of photographs: Polio, anthrax, herpes, chickenpox, HPV warts, AIDS (candidiasis), dermatomycoses (ringworms).
7. Study of various stages of malarial parasite in RBCs using permanent mounts.

Textbooks:

1. Ananthanarayan R. and Paniker C.K.J. (2009) Text book of Microbiology. 8th edition, University Press Publication
2. Brooks G.F., CarrollK. C., ButelJ.S.,Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnickand Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication
3. GoeringR.,DockrellH.,ZuckermanM.andWakelinD.(2007)Mims'MedicalMicrobiology.4th edition. Elsevier
4. WilleyJM,Sherwood LM, and Woolverton CJ.(2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education
5. Madigan MT, Martinko JM, Dunlap PV and Clark DP. (2014).Brock Biology of Microorganisms. 14th edition. Pearson International Edition.

Course Outcomes:

By the end of the lab, students will be able to:

- Identify and screen bacteria using different media
- Study symptoms of the diseases
- Determine the minimal inhibitory concentration (MIC) of antibiotic
- Gain knowledge about bacterial flora of skin
- Perform antibacterial sensitivity by Kirby-Bauer method

CO-PO Mapping:

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

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.

MFST2301	BIOFILMS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	MFST2071Microbial Physiology and Biochemistry/Basics in Biology						
Co-requisite	None						
Preferable exposure							

Course Description:

This course will examine the microbial quorum Sensing and biofilm, a ubiquitous form of life thriving in a wide range of environments wherever interfaces are found on earth. The broad utilization of biofilm knowledge in engineering includes applications in bioreactors for degradation of pollutant substances, in bioenergy production systems for advantageous surface reactions, in heat exchangers or cooling water towers and on reverse osmosis membranes or ships' hauls for preventing additional heating transfer, mass transfer and frictional resistances. Biofilms also cause contamination problems in food processing industry and on teeth, implants and prosthetic devices, leading to serious or even fatal consequences. This course will provide students better understanding of science and technologies associated with biofilms behind these applications. This course is aimed to meet deeper learning needs of MS and PhD students from Environmental Engineering, Biosystems Engineering, Food Science and Technology, Ocean Engineering, and Biomedical Engineering, etc., that share the same knowledge basis related to biofilms.

Course Educational Objectives:

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

- Evaluate the benefits of bacterial communication and the risks of biofilms.
- Utilize mathematical models for describing the quorum sensing biofilm growth kinetics.
- Restate biofilm formation mechanism.
- Design basic biofilm reactors for wastewater treatment or bioenergy production.
- Relate biofilm formation knowledge to appropriate control measures used in medicine and food processing.

UNIT 1 **Bacterial communication** **8 hours**

Quorum sensing (QS); signalling molecules - HSLs, AI-2, Pheromones, AIP. Role of QS in promoting microbial virulence and resistance to drugs.

UNIT 2 **QS in Gram positive bacteria** **8 hours**

Staphylococcus, Streptococcus, Bacillus; QS in Gram negative bacteria - Chromobacterium, Agrobacterium, Pseudomonas, Serratia, Vibrio; Virulence traits regulated by QS in bacteria.

UNIT 3 **Biofilm** **8 hours**

Definition, Composition, Structural organization and mechanism of biofilm formation. Importance of biofilm on environmental, industrial and medical perspectives. Resistance development in biofilm inhabitants. Characteristics of biofilm in clinical devices. The role of biofilm in the dissemination of bacterial virulence. Impact of biofilm in aquaculture. Industrial importance of biofilm prevention. Consequences of biofilm in environment – biofouling and biocorrosion.

UNIT 4 **Biosensor strains used for QS based study** **8 hours**

Chromobacterium violaceum, Agrobacterium tumefaciens, Pseudomonas aeruginosa and its mutants. Role of QS on biofilm. Assays to measure the QS regulated virulence traits - Violacein production, LasA protease, LasB elastase, Pyocyanin, Pyoverdine, Prodigiosin, Serratia total protease, Lipase, Bioluminescence, Swarming and Swimming motility.

UNIT 5 **In vitro biofilm formation** **8 hours**

Quantification of in vitro and in vivo formed biofilms; Microscopical analysis of biofilm architecture - EPS, proteins, e-DNA; Fluorophores used for staining biofilms; Live-dead staining; Confocal microscopy for biofilm studies - Z-stack analysis, Optical sectioning.

Textbooks:

1. Kievit, TR & Iglewski BH. Bacterial Quorum Sensing in Pathogenic Relationships. Infect. Immun. 68(9): 4839 (2000).
2. Stoodley, LH et al. Bacterial Biofilms: From the Natural Environment to Infectious Diseases. Microbiology.2 (2004).
3. Choi et al., Implication of Quorum Sensing in Salmonella enteric Serovar Typhimurium Virulence: the luxS Gene Is Necessary for Expression of Genes in Pathogenicity Island. 75, p. 4885–4890 (2007).

References:

1. Rasmussen TB, Givskov M, Quorum-sensing inhibitors as anti-pathogenic drugs, International Journal of Medical Microbiology, 296, Pages 149-161, 2006.
2. Di Cagno R, De Angelis M, Calasso M, Gobbetti M. Proteomics of the bacterial crosstalk by quorum sensing. J Proteomics. 74(1):19-34. 2011.

Course Outcomes:

With the completion of this course, students will

- Evaluate the benefits of bacterial communication and the risks of biofilms.
- Utilize mathematical models for describing the quorum sensing biofilm growth kinetics.
- Restate biofilm formation mechanism.
- Design basic biofilm reactors for wastewater treatment or bioenergy production.
- Relate biofilm formation knowledge to appropriate control measures used in medicine and food processing.

CO-PO Mapping:

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

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.

MFST2321	BIOFILMS LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	MFST2301 Biofilms						
Preferable exposure							

Course Description:

This course will examine the microbial quorum Sensing and biofilm, a ubiquitous form of life thriving in a wide range of environments wherever interfaces are found on earth. The broad utilization of biofilm knowledge in engineering includes applications in bioreactors for degradation of pollutant substances, in bioenergy production systems for advantageous surface reactions, in heat exchangers or cooling water towers and on reverse osmosis membranes or ships' hauls for preventing additional heating transfer, mass transfer and frictional resistances. Biofilms also cause contamination problems in food processing industry and on teeth, implants and prosthetic devices, leading to serious or even fatal consequences.

Course Educational Objectives:

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

- Estimate biofilm formation.
- Design basic biofilm reactors for wastewater treatment or bioenergy production.

List of experiments

1. Kirby-Bauyer method (disc-diffusion method) to study antibiotic sensitivity of a bacterial culture
2. Demonstrate the Quorum Sensing Experiment
3. Detection of Biofilm by Congo red method
4. Detection of biofilm by crystal violet tube test method
5. Spectroscopic evaluation of biofilm in a microtitre plate
6. Detection of biofilm on different surface- food, industrial equipment, medical device etc.
7. Antimicrobial Susceptibility of Monoculture Biofilms of a Clinical Isolate.

Textbooks:

1. Kievit, TR & Iglewski BH. Bacterial Quorum Sensing in Pathogenic Relationships. Infect. Immun. 68(9): 4839 (2000).
2. Stoodley, LH et al. Bacterial Biofilms: From the Natural Environment to Infectious Diseases. Microbiology.2 (2004).
3. Choi et al., Implication of Quorum Sensing in Salmonella enteric Serovar Typhimurium Virulence: the luxS Gene Is Necessary for Expression of Genes in Pathogenicity Island. 75, p. 4885–4890 (2007).

References:

1. Rasmussen TB, Givskov M, Quorum-sensing inhibitors as anti-pathogenic drugs, International Journal of Medical Microbiology, 296, Pages 149-161, 2006.
2. Di Cagno R, De Angelis M, Calasso M, Gobbetti M. Proteomics of the bacterial crosstalk by quorum sensing. J Proteomics. 74(1):19-34. 2011.

Course Outcomes:

By the end of practicals, students will be able to:

- Understand the importance of quorum sensing method
- Perform antimicrobial Susceptibility of Monoculture Biofilms of a Clinical Isolate.
- Demonstrate the Quorum Sensing Experiment
- Detect the biofilm by Congo red method
- Detect the biofilm by crystal violet tube test method

CO-PO Mapping:

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

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:

MFST2311	MICROBES IN SUSTAINABLE AGRICULTURE	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	MFST1051Introductory Microbiology/basics in microbiology						
Co-requisite	None						
Preferable exposure							

Course Description:

This course is designed to explore the role of microorganisms in the maintenance of soil and agriculture. It discusses the soil structure and its relation to the microbial distribution. Sustainable methods of biocontrol and biofertilizers to overcome chemical burden and and explains the pivotal role of microorganisms in degradation and nutrient release.

Course Educational Objectives:

For the student to learn about

- The soil properties, and its microbial population
- To teach students about problems with agro-chemicals and to impart knowledge of biological alternatives
- To make them know of symbiotic and non symbiotic biofertilizers
- To divulge the biocontrol phenomenon and modes

UNIT 1 **8 hours**

Soil as Microbial Habitat, Soil profile and properties, Soil formation, Diversity and distribution of microorganisms in soil. Rhizosphere microorganisms, PGPR. Mineralization of cellulose, hemicelluloses, lignocelluloses, lignin and humus, phosphate, nitrate,

silica, potassium

UNIT 2 **8 hours**

Biofertilizers-General account, advantages over chemical fertilizers. Symbiotic N2 fixers: Rhizobium- Isolation, characteristics, types, inoculum production and field application, Frankia. Cyanobacteria- Azolla, characteristics, types, inoculum production

UNIT 3 **8 hours**

Non - Symbiotic N2 fixers Free living Azospirillum, Azotobacter – free living cyanobacteria, isolation, characteristics, mass inoculum production and field application. Phosphate solubilizers

UNIT 4 **8 hours**

Mycorrhizal biofertilizers-Importance of mycorrhizal inoculum, types of mycorrhizae and associated plants, Mass inoculum production of VAM, field applications of Ectomycorrhizae and VAM.

UNIT 5 **8 hours**

Biocontrol definition, advantages over chemical control, Microorganisms used as biocontrol agents - Bacillus thuringiensis, production, Field applications; Beauveria sp., Trichoderma species- characters, uses and mass production, Viruses – cultivation and field applications

Textbooks:

1. Agrios GN. (2006). Plant Pathology. 5th edition. Academic press, San Diego,
2. Singh RS. (2017). Introduction to principles of plant pathology. Oxford & IBH, New Delhi.
3. Atlas RM and Bartha R. (2000). Microbial Ecology: Fundamentals & Applications. 4th edition. Benjamin/Cummings Science Publishing, USA

References:

1. Campbell RE. (1983). Microbial Ecology. Blackwell Scientific Publication, Oxford,England.

Course Outcomes:

At the end of the course, students will

- Learn about the soil properties, and its microbial population
- Learn about problems with agro-chemicals and to impart knowledge of biological alternatives
- Know about symbiotic and non-symbiotic biofertilizers
- Divulge the biocontrol phenomenon and modes
- Understand Biocontrol concept

CO-PO Mapping:

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

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:

MFST2331	MICROBES IN SUSTAINABLE AGRICULTURE LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	MFST2311 Microbes in sustainable Agriculture						
Preferable exposure							

Course Description:

This course is designed to explore the role of microorganisms in the maintenance of soil and agriculture. It discusses the soil structure and its relation to the microbial distribution. Sustainable methods of biocontrol and biofertilizers to overcome chemical burden and and explains the pivotal role of microorganisms in degradation and nutrient release.

Course Educational Objectives:

For the student to learn about

- To study soil properties, and its microbial population
- To learn isolation of biodegradation microbes

List of experiments

1. Study soil profile
2. Study microflora of different types of soils
3 Isolation of symbionts from Azolla
4. *Rhizobium* isolation and culture characterization
5. *Cyanobacteria*- soil isolation and culture characterization
6. Isolation of cellulose degrading organisms

Textbooks:

1. Laboratory manual of Microbiology, 2009. AK Roy, MM Prasad. New India Publishing Agency.
2. Laboratory manual in Microbiology, 2007, Gunasekaran.New age International Publishers
3. Laboratory Manual of Microbiology and Biotechnology , 2014, K.R.Aneja. publisher Medtech

Course Outcomes:

By the end of practicals, students will be able to:

- Analyze the profile of the soil
- Isolate cellulose degrading organisms
- Isolate and characterise Cyanobacteria
- Isolate symbionts from Azolla
- Gain knowledge about microflora of different types of soils

CO-PO Mapping:

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

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.

MFST2341	MARINE MICROBIOLOGY	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	MFST1051Introductory Microbiology/basics in microbiology						
Co-requisite	None						
Preferable exposure							

Course Description:

This course will make the students familiar with the profile of marine environment, its composition and diversity of microbial communities inhabiting marine ecosystems. The students will also learn the strategies adopted by microbes surviving in extreme marine environments and economic importance of marine microbial products.

Course Educational Objectives:

- To learn the stratification of marine ecosystems and understand marine microbial diversity
- To appreciate the marine metabolic diversity underlying survival of marine extremophiles
- To study the importance of marine pathogens and their control
- To appreciate the economic importance of marine microbial products

UNIT 1 **8 hours**

Marine environment–properties of seawater, chemical and physical factors of marine environment. Marine habitat- zonation of marine ecosystems. Significance of Marine micro flora

UNIT 2 **8 hours**

Metabolic diversity of microbial communities. Methods of studying marine microorganisms- sample collection- isolation and identification: Cultural, Morphological, physiological, biochemical and Molecular characteristics- Preservation methods of marine microbes.

UNIT 3 **8 hours**

Survival at extreme environments – starvation – adaptive mechanisms in thermophilic, alkalophilic, osmophilic and barophilic, psychrophilic microorganisms – hyperthermophiles, halophiles and their importance.

UNIT 4 **8 hours**

Pathogenic microorganisms, distribution, indicator organisms, prevention and control of water pollution. Microbiology of processed finfish and shellfish products.

UNIT 5 **8 hours**

Marine microbial products – Carrageenan, agar-agar, sea weed fertilizers – Astaxanthin, β carotene , antibiotics, polysaccharides, biosurfactants and pigments. Preservation methods of sea foods.

Textbooks:

1. Microbiology (2005) L.M. Prescott et.al.
2. Marine Microbiology: Ecology and Applications (2nd edition) by C.Munn.
3. Marine Microbiology (2005) by J. H. Paul.

References:

1. Microbiology: Principles and Explorations (7thedition) by J. G. Black.
2. Ocean and Health: Pathogens in the marine environment (2006) by S. Belkin and R. R. Colwell
3. Bioactive Marine Natural Products (2005) D.S. Bhakuni and D.S.Rawat.

Course Outcomes:

With the end of the course, students will

- Learn the stratification of marine ecosystems and understand marine microbial diversity
- Appreciate the marine metabolic diversity underlying survival of marine extremophiles
- Study the importance of marine pathogens and their control
- Appreciate the economic importance of marine microbial products
- Understand seafood preservation methods

CO-PO Mapping:

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

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.

MFST2351	FOOD MICROBIOLOGY	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	MFST1051Introductory Microbiology/basics in microbiology						
Co-requisite	None						
Preferable exposure							

Course Description:

Food microbiology is the scientific study of microorganisms, both in food and used for the production of food. This includes microorganisms that contaminate food, as well as those used in its production; for example to produce yoghurt, cheese, beer and wine.

Course Educational Objectives:

- To know the important genera of microorganisms associated with food and their characteristics.
- To understand the role of microbes in fermentation, spoilage and food borne diseases.

UNIT 1 **8 hours**

Food microbiology- definition and importance, Microbial growth in food- intrinsic and extrinsic factors affecting the growth of microorganisms in food, bacterial growth curve. Beneficial role of microorganisms in food. Probiotics, prebiotics and synbiotics.

UNIT 2 **8 hours**

Microorganisms associated with food- Bacteria, molds, yeast, virus- General characteristics, structure, morphological characteristics, growth, and cultural characteristics. Endospore - structure and significance in food microbiology

UNIT 3 **8 hours**

Classification of foods by ease of spoilage, Factors affecting food spoilage, sources of microorganisms in foods, spoilage of different food groups- milk and dairy products, eggs, meat, fish, cereal and cereal products, canned products, fruits, and vegetables.

UNIT 4 **8 hours**

Importance of food preservation, Classification of Food preservation methods, Food preservation methods – High temperature, (Pasteurization, canning), low temperature, (refrigeration, freezing), dehydration, irradiation, biopreservation.

UNIT 5 **8 hours**

Food infection and food intoxication. Food and water borne diseases by – Salmonella, E. coli, Clostridium, Listeria, Shigella, Bacillus, Campylobacter, Vibrio. Trends in Food Microbiology-rapid methods of detection, recent Advances

Textbooks:

1. Jay J M, Loessner M J and Golden D A. (2005). Modern Food Microbiology. 7thedition, C B S Publishers and Distributors, Delhi, India.

2. Lund BM, Baird Parker AC, and Gould GW.(2000).The Microbiological Safety and Q uality of Foods. Vol. 1-2, ASPEN Publication, Gaithers berg, MD.

3. TortoraGJ,FunkeBR,andCaseCL.(2008).Microbiology:AnIntroduction.9thedition.

Course Outcomes:

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

1. Learn about the morphological characteristics important in food bacteriology.
2. Understand about spoilage, contamination sources, types, effect of cereals, sugar, vegetables and fruits, meat, milk, and canned foods.
3. Learn about sterilization methods, pure culture techniques, methods of isolation
4. Understand about control of microorganisms in foods, and preservation and maintenance of microbial cultures.
5. Know procedures of identification of microorganisms

CO-PO Mapping:

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

MFST2361	BIOENERGY AND BIOFUELS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	MFST2071Microbial Physiology and Biochemistry// basics in biochemistry						
Co-requisite	None						
Preferable exposure							

Course Description:

This course aims to provide an overview of the fundamental concepts of biofuels, bioenergy. Biofuel production by biomass conversion process. Biodiesel production using oil seeds and algae.

Course Educational Objectives:

- To provide a thorough understanding of various renewable feed stocks and their availability and attributes for biofuels
- To provide a thorough understanding of the broad concept alternative biofuel production from biomass and other low-cost agri-residues and biowastes.
- To provide students with tools and knowledge about advantages and limitations of biofuels facility operations.
- To teach our students to analyze and design processes for biofuel production**.**

UNIT 1 **8 hours**

Fundamental concepts of biofuels, bioenergy, renewable feedstocks, current energy consumption, Microbial Fuel Cells. Applications and limitations of biofuels, bioenergy and biogas

UNIT 2 **8 hours**

Raw material stocks availability, Properties of biomass- calorific value, density, moisture content, types of biomass: lignocellulosic, starchy, sugar, oilseeds, and Municipal residual waste, organic waste, sewage sludge, manure.

UNIT 3 **8 hours**

Conversion of biomass-Preprocessing or pretreatment of biomass: drying and size reduction, Biochemical conversion to ethanol: biomass pretreatment, Different enzymes, enzyme hydrolysis, and their applications in ethanol production and enzymatic hydrolysis, Detoxification methods

UNIT 4 **8 hours**

Biomass conversion to heat and power, Thermal gasification of biomass, chemical hydrolysis of biomass-pyrolysis, biological process by anaerobic digestion and fermentation, Biodiesel production from oil seeds waste oils and algae.

UNIT 5 **8 hours**

Market demand, economics, Energy balance and life-cycle analysis of biodiesel, Environmental impacts of biofuel and biodiesel production, Value added processing of biofuel residues and co-products

Textbooks:

1. Biofuel and Bioenergy, Edited by John Love and John A Bryant, wiley Black well publishers
2. Handbook of biofuel production, Process and Technologies, Edited by Rafael Luque, Juan Champelo and James Clark, Woodhead publishers
3. Biofuel Technologies, recent developments, edited by Vijai Kumar Gupta, Maria G Tuohy, Springer publishers

References:

1. Bioenergy, biomass to biofuel, edited by Anju Dhahia , Elsevier
2. Advances in Biofuel, Edited by Ravindra Pogaku, Rosalam Hj. Sarbately, Springer

Course Outcomes:

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

1. Understand the market demand of alternative fuels
2. Understand the economics and life-cycle analysis of biofuel production
3. Learn the production of value-added processing of biofuel residues and co-products
4. Learn the thermochemical, process for biomass conversion
5. Know the biological conversion process of biomass conversion

CO-PO Mapping:

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

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.

MFST2371	VIROLOGY	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	MFST1051Introductory Microbiology/ basics in microbiology						
Co-requisite	None						
Preferable exposure							

Course Description:

This course makes the student to understand about the structure and life cycle of viruses as well as cultivation methods of viruses. Additionally, it details of epidemiology and emerging viral infection and preventive measures.

Course Educational Objectives:

- To provide knowledge about distinctive characteristics of viruses.
- To provide the knowledge about principles of viral taxonomy.
- To provide the basic knowledge about replication cycles of bacteriophages.
- To provide basic knowledge regarding viral nucleic acids and viral cultivation methods
- To provide basic concepts of epidemiological concepts and emerging viral infections

UNIT 1 **Introduction** **8 hours**

Structure and general properties of viruses, Viral taxonomy: Classification and nomenclature of viruses. Concept of viroids, virusoids, satellite viruses and Prions.

UNIT 2 **8 hours**

Bacteriophages-structure, lytic and lysogenic phages (lambda phage) concept of early and late proteins, regulation of transcription in lambda phage. Applications of virology- Use of viral vectors in cloning and expression, Phage therapy

UNIT 3 **8 hours**

Salient features of viral Nucleic acids- Unusual bases,overlapping genes, alternate splicing, terminal redundancy, terminal cohesive ends, partial double stranded genomes,long terminal repeats, segmented and non-segmented. Outline on Replication strategies of DNA and RNA virus.

UNIT 4 **8 hours**

Isolation and cultivation methods of animal viruses, cell cultures, animal incolucaltion and embryonated eggs, Cellular cytopathic effects (CPE), purification of viruses and inactivation of viruses

UNIT 5 **8 hours**

Epidemiological concepts of viral infections, Epidemics, endemics, pandamics, new emerging viral infections, Viral transmission, prevention and control of emerging viral infections, Influenza, SARS, COVID 19, Viral vaccines, antiviral drugs.

Textbooks:

1. Basic Virology (3rd edition) by Wagner and Hewelett.
2. Microbiology (5th edition) Pelczar, Chan and Krieg.
3. Principles of Virology (3rd edition) by S.J. Flint et. Al.

References:

1. Introduction to Modern Virology (6th edition) Dimmock et. Al.
2. Principles of Molecular Virology (5th edition) by A. Cann.
3. Medical Virology (4th edition) by D.O. White and F.J.Fenner.
4. Plant Virology (5th edition) by R. Hull..
5. Fundamental Virology (6th edition) by D.M. Knipe and P.M.Howley

Course Outcomes:

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

- By the end of the course the student will be able to:
- Understand the structure and general properties of viruses
- Learn about salient features of viral nucleic acids
- Learn about epidemiological concepts of viral infections
- Gain knowledge about Cultivation methods of viruses
- Learn about isolation methods of viruses

CO-PO Mapping:

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

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:

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MFST3221	BIOREMEDIATION	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	MFST2071Microbial Physiology and Biochemistry/basics in microbiology						
Co-requisite	None						
Preferable exposure							

Course Description:

Bioremediation utilizes microorganisms to improve environmental quality. These improvements include treatment of contaminated waters and wastewaters, cleanup of industrial waste streams, and remediation of soils contaminated with hazardous and toxic chemicals.

Course Educational Objectives:

- To understand the Concept of environment and importance of its preservation.
- To understand the Concept of pollution and methods to control it.
- To understand the Concept of Bioremediation and its applications.
- To understand many types of energy sources.

UNIT 1 **8 hours**

Environment and its importance. Ground water contamination. Bacterial metabolism in waste water treatment systems, industrial waste water sources and treatment strategies, overview of waste water treatment process

UNIT 2 **Biotechnology and waste** **8 hours**

Composting of Organic Waste, Anaerobic Fermentation of Wet and Semidry Garbage Waste Fractions, Process Engineering of biological waste gas Purification, Commercial Applications of biological waste gas Purification, Perspectives of waste water,waste, off-gas and soil treatment.

UNIT 3 **Cleaner Technologies** **8 hours**

fermentation technology, paper industry and plastic industry, ISO14000 and Environment Management System, Reducing environment impact of industrial effluents.

UNIT 4 **8 hours**

Bioremediation using naturally occurring microorganism, Removal of spilled oil and grease deposits (Use of oleophilic fertilizers, Use of a mixture of bacterial strains, Use of genetically engineered microbes) Biosensor to detect environmental pollutants (In situ bioremediation of both soil and ground water.

UNIT 5 **8 hours**

Bioremediation of contaminated soil, contaminated surface waters (pits, ponds and lagoons) Treatment of toxic wastes before they reach environment, Bioremediation using Genetically Engineered Microbes (GEM) Phytoremediation, Naturally occurring plants for Phytoremediation.

Textbooks:

1. Environmental Biotechnology: Principles and Applications, Rittmann, B. E., and McCarty, P. L., McGraw Hill, 2001
2. Applied Environmental Microbiology and Case Studies, prepared by M. Pirbazari, 2002.

References:

1. Prescott, L. M., Harley, 3. P., and Klein, D. A., Microbiology, Second Edition, Wm. C. Brown Publishers, Dubuque, Iowa, 1993

Course Outcomes:

With the end of the course, students will

- Develop fundamental understanding of Applications of Biotechnology in Environment science and Environmental related problems
- Understand the Concept of environment and importance of its preservation.
- Understand the Concept of pollution and methods to control it.
- Understand the Concept of Bioremediation and its applications.
- Understand many types of energy sources.

CO-PO Mapping:

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

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

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MFST3231	INSTRUMENTATION AND BIOTECHNIQUES	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	MFST2101 Recombinant DNA Technology/basics in biology						
Co-requisite	None						
Preferable exposure							

Course Description:

This paper gives student an idea about principles of microscopy, centrifuges, and procedures in performing different chromatographic techniques like in purifying the proteins to homogeneity, testing the purity levels by different electrophoretic techniques, and quantitating the same by spectrophotometric methods.

Course Educational Objectives:

- To understand the detailed principles, procedures and applications of various chromatographic techniques for example in learning the purification of proteins by using ion exchange and affinity chromatography, and molecular weight determination by size exclusion chromatography.
- To learn the principles, procedures and applications of various electrophoretic techniques, importantly knowing the difference between SDS and native PAGE, and isoelectric focussing in analyzing the proteins.
- To study the principles, procedures and applications of various spectrophotometric methods especially in quantitation of desired compound in the given solutions.

UNIT 1 **8 hours**

Microscopy- Brightfield and darkfield microscopy, Fluorescence Microscopy, Phase contrast Microscopy, Confocal Microscopy, Electron Microscopy (Scanning and Transmission Electron Microscopy) and Micrometry.

UNIT 2 **8 hours**

Chromatography-Principles and applications of paper chromatography, thin layer chromatography. Column packing and fraction collection. Gel filtration chromatography, ion- exchange chromatography and affinity chromatography, GLC, HPLC.

UNIT 3 **8 hours**

Electrophoresis-Principle and applications of native polyacrylamide gel electrophoresis, SDS- polyacrylamide gel electrophoresis, 2D gel electrophoresis, Isoelectric focusing, Zymogram preparation and Agarose gel electrophoresis.

UNIT 4 **8 hours**

Spectrophotometry-Principle and use of study of absorption spectra of biomolecules.Analysis of biomolecules using UV and visible range.Colorimetry and turbidometry.

UNIT 5 **8 hours**

Centrifugation-Preparative and analytical centrifugation, fixed angle and swinging bucket rotors.RCF and sedimentation coefficient, differential centrifugation, density gradient centrifugation and ultracentrifugation

Textbooks:

1. Wilson K and Walker J. (2010). Principles and Techniques of Biochemistry and Molecular Biology. 7th Ed., Cambridge University Press.
2. Nelson DL and Cox MM. (2008). Lehninger Principles of Biochemistry, 5th Ed., W.H. Freeman and Company.
3. Willey MJ, Sherwood LM &Woolverton C J. (2013). Prescott, Harley and Klein's Microbiology. 9thEd., McGraw Hill.

References:

1. Karp G. (2010) Cell and Molecular Biology: Concepts and Experiments. 6th edition. John Wiley & Sons. Inc.
2. De Robertis EDP and De Robertis EMF. (2006). Cell and Molecular Biology. 8th edition. Lipincott Williams and Wilkins, Philadelphia.

Course Outcomes:

By the completion of the course, students will

1. Understand the detailed principles, procedures and applications of various chromatographic techniques
2. Learn the principles, procedures and applications of various electrophoretic techniques.
3. Understand the principles, procedures and applications of various spectrophotometric methods especially in quantitation of desired compound in the given solutions.
4. Apply the utilization of UV-visible spectrophotometer to know the concentrations of the different solutions.
5. Know the importance of method of separating molecules having different densities and molecular weights at high speed centrifuge

CO-PO Mapping:

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

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

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MFST3241	MICROBIAL BIOTECHNOLOGY	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	MFST2071Microbial Physiology and Biochemistry/basics in microbiology						
Co-requisite	None						
Preferable exposure							

Course Description:

Microbial biotechnology course provides applications of microbiology in various fields using biotechnological concepts. Applications in agricultural fields as Biofertilizers and Biopesticides. Microbial biotechnological production of biofuels using microorganisms. Microorganisms used as food and applied as bioremediation purpose.

Course Educational Objectives:

- To Provide knowledge of
- Concepts of role and applications of microbial metabolites
- Concepts and production of metabolites
- Basic principles and production strategies of biofuels using microorganism
- Role of microorganisms in food industry and used as food
- Bioremediation strategies using microbial biotechnology

UNIT 1 **8 hours**

Introduction and history of industrial microbiology. Isolation and selection of Industrially important microbes. Over production of microbial metabolites. Preservation and maintenance of microbial cultures.

UNIT 2 **8 hours**

Microbial substrates, Media composition and growth conditions. Components of microbial fermentation. Types of fermentation processes. Design of bioreactor. Types of Bioreactor.

UNIT 3 **8 hours**

Production of baker's Yeast, Mushroom and their applications. Production of fermented foods, Alcoholic beverages. Production of ethanol, citric acid, amino acids, vitamins, Application of microbial enzymes for food, detergent and pharma industry.

UNIT 4 **8 hours**

Production of penicillin and pigments. production of insulin, interluekin, growth hormones, using recombinant DNA technology.

UNIT 5 **8 hours**

Biopesticides and biofertilizers, Bio-weapons and Bioshields, Single Cell Protein (SCP) production from spirulina, Microbial toxins and mycoparasitism. Microbial leaching of ores.

Textbooks:

1. Microbial Biotechnology: Fundamentals of Applied Microbiology (2nd edition) A. Glazer. and H. Nikaido
2. Basic Biotechnology (3rd edition) by C. Ratledge and B. Kristiansen.
3. Manual of Industrial Microbiology and Biotechnology (2010) by R. H. Baltz et. al.
4. Molecular Biotechnology (2004) by B. R. Glick and J. J. Pasternak.

References:

1. Applied Microbiology (2015) by S. Saxena.
2. Basic and Applied Aspects of Biopesticides (2014) by K. S. Raj. 71
3. Handbook of Microbial Biofertilizers (2006) by M. Rai.

Course Outcomes:

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

- Know the importance of Industrial Microbiology
- Microbial fermentation process
- The production of penicillin
- Know about biopesticides and biofertilizers
- Gain knowledge about SCP and microbial toxins

CO-PO Mapping:

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

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

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