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

Accredited by NAAC with A^{++} Grade

CURRICULUM AND SYLLABUS

OF

UMATH03 B.Sc. Mathematics

w.e.f. 2021-22 admitted batch

(Updated up to May 2024)

Academic Regulations

Applicable for the Undergraduate Programmes in the Schools of Business, Humanities & Social Sciences, Science, Technology

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.

UMATH03 B.Sc. Mathematics

VISION AND MISSION OF THE SCHOOL

VISION

To nurture outstanding science education and to build a vibrant, world class research & innovation ecosystem.

MISSION

1. To provide a flexible and adaptive curriculum that emphasizes experiential learning to allow students to realize their full potential.

2. Develop high impact research knowledge and solutions to improve communities in which we live.

3. To promote a culture of healthy curiosity, enterprising mindset, and keen desire to contribute to society.

4. To inculcate empathy, integrity, trust with a strong commitment towards society and environment among the GITAM fraternity.

UMATH03 B.Sc. Mathematics

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

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO 1 To apply basic knowledge of mathematics and science to understand the real world problems.

PEO 2 To develop complexity problem solving techniques using mathematical tools.

PEO 3 To establish the methodologies for core mathematical problems.

PEO 4 To implement computer solution methods for large systems.

PEO 5 To imbibe professional and ethical responsibility towards the society

Mapping of the Mission of the School with the PEOs

	PEO1	PEO2	PEO3	PEO 4	PEO 5
M1	H	M	H	L	M
M2	M	M	M	L	M
M3	M	M	M	L	M
M4	H	H	H	M	M

H – High, M – Medium, L – Low

PROGRAMME OUTCOMES (POs)
&
PROGRAMME SPECIFIC OUTCOMES (PSOs)

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

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

PO1 **Critical Thinking:** Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO2 **Effective Communication:** Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO3 **Social Interaction:** Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO4 **Effective Citizenship:** Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO5 **Ethics:** Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO6 **Environment and Sustainability:** Understand the issues of environmental contexts and sustainable development.

PO7 **Self-directed and Life-long Learning:** Acquire the ability to engage in independent and life-long learning in the broadest context of socio-technological changes.

PSO1 Create Mathematical Models (along with solution) for various physical needs.

PSO2 Use Mathematics, not only in the discipline of Mathematics, but also in other disciplines and in their future endeavors

PSO3 Develop the computer programming skill for solving various physical problems.

PSO4 Acquire good knowledge and understanding in advanced areas of mathematics and statistics, chosen by the student from the given courses.

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**
MATH1171	1	Descriptive Statistics and Probability Theory	3	0	0	0	0	3
MATH1191	1	Statistical Methods	3	0	0	0	0	3
CSCI1011	1	Programming with C	3	0	0	0	0	3
CSCI1021	1	Programming with C Lab	0	0	2	0	0	1
MATH1211	1	Mathematical Expectation and Probability Distributions	3	0	0	0	0	3
CSCI1281	1	Fundamentals of Object-Oriented Programming with C++	3	0	0	0	0	3
MATH1221	1	Probability Distributions Lab	0	0	2	0	0	1
CSCI1291	1	C++ Programming Lab	0	0	2	0	0	1

PROGRAM CORE(PC)								
Course code	**Level**	**Course Title**	**L**	**T**	**P**	**J**	**S**	**C**
MATH1151	1	Differential Calculus	3	0	0	0	0	3
MATH1161	1	Differential Calculus Lab	0	0	2	0	0	1
MATH1231	1	Differential Equations	3	0	0	0	0	3
MATH1241	1	Differential Equations Lab	0	0	2	0	0	1
MATH2001	2	Real Analysis	3	0	0	0	0	3
MATH2011	2	Algebra	3	0	0	0	0	3
MATH2021	2	Real Analysis Lab	0	0	2	0	0	1
MATH2031	2	Algebra Lab	0	0	2	0	0	1
MATH2041	2	Linear Algebra	3	0	0	0	0	3
MATH2051	2	Linear Algebra Lab	0	0	2	0	0	1
MATH3001	3	Numerical Methods	3	0	0	0	0	3
MATH3011	3	Vector Calculus	3	0	0	0	0	3
MATH3021	3	Numerical Methods using MATLAB	0	0	2	0	0	1
MATH3031	3	Vector Calculus Lab	0	0	2	0	0	1
MATH3041	3	Discrete Mathematics	3	0	0	0	0	3
MATH3051	3	Discrete Mathematics Lab	0	0	2	0	0	1

PROGRAM ELECTIVE(PE)								
Course code	**Level**	**Course Title**	**L**	**T**	**P**	**J**	**S**	**C**
MATH2121	2	Linear Programming	3	0	0	0	0	3
MATH2131	2	Transportation and Game Theory	3	0	0	0	0	3
MATH2141	2	Linear Programming Lab	0	0	2	0	0	1
MATH2151	2	Transportation and Game Theory Lab	0	0	2	0	0	1
MATH2161	2	Complex Analysis	3	0	0	0	0	3
MATH2171	2	Functional Analysis	3	0	0	0	0	3
MATH2181	2	Number Theory	3	0	0	0	0	3
MATH2191	2	Graph Theory	3	0	0	0	0	3
MATH3121	3	Classical Mechanics	3	0	0	0	0	3
MATH3131	3	Theory of Computation	3	0	0	0	0	3
MATH3141	3	Fluid Dynamics	3	0	0	0	0	3
MATH3151	3	Transform Techniques and Tensor Analysis	3	0	0	0	0	3
Students should acquire a minimum of 16 credits from the program elective courses Theory and corresponding lab course are co-requisites (For example if a student opts to study MATH2121 then he/she has to study MATH2141 in the same semester)								

MINOR courses		
Stream	**Major course**	**Minor course (Select one)**
Mathematical Science	Mathematics	Physics
		Electronics
		Chemistry
		Data Science
		Bioinformatics

Students pursuing 4th year of the B.Sc. Mathematics 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
MATH4391	400	# Advanced Algebra	4	0	0	0	0	4
MATH4401	400	# Advanced Real Analysis	4	0	0	0	0	4
MATH4481	400	# Measure Theory and Integration	4	0	0	0	0	4
MATH4031	400	# Advanced Graph Theory	4	0	0	0	0	4
MATH4491	400	# Partial Differential Equations and Applications	4	0	0	0	0	4
DIST4888	400	Dissertation - I	0	0	0	8	0	4
MATH4501	400	* Fundamentals of Topology	4	0	0	0	0	4
MATH4041	400	* Advanced Linear Algebra	4	0	0	0	0	4
MATH4511	400	* Mathematical Finance	3	1	0	0	0	4
DIST4999	400	Dissertation - II	0	0	0	16	0	8
		Total						**32**

Opt Any 3 out of 5 Courses

* Opt Any 2 out of 3 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

Allocation of credits for 3-year and 4-year B.Sc. Program				
	3-year B.Sc. Program		4-year B.Sc. Program	
Type of Course	Credits	% Of Program (in credits)	Credits	% Of Program (in credits)
University Core	12	10%	12	7.50%
Faculty Core	18	15%	30	18.75%
Major Core	32	26%	52	32.50%
Major Electives	16	14%	16	10%
Program Minor	24	20%	32	20%
Open elective	18	15%	18	11.25%
Total	**120**	**100%**	**160**	**100%**

Course PO Mapping

Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
MATH1171: Descriptive Statistics and Probability Theory	H	L	L	L	L	L	M	M	M	L	H
MATH1191: Statistical Methods	H	L	L	L	L	L	M	M	M	L	H
CSCI1011: Programming with C	H	L	M	L	L	L	M	L	M	H	M
CSCI1021: Programming with C Lab	H	L	M	L	L	L	M	L	M	H	M
MATH1211: Mathematical Expectation and Probability Distributions	H	L	L	L	L	L	M	M	M	L	H
CSCI1281: Fundamentals of Object-Oriented Programming with C++	H	L	M	L	L	L	M	L	M	H	M
MATH1221: Probability Distributions Lab	H	L	L	L	L	L	M	M	M	L	H

CSCI1291: C++ Programming Lab	H	L	M	L	L	L	M	L	M	H	M
MATH1151: Differential Calculus	M	L	L	L	L	L	M	H	H	L	H
MATH1161: Differential Calculus Lab	M	L	L	L	L	L	M	H	H	L	H
MATH1231: Differential Equations	M	L	L	L	L	L	M	H	H	M	M
MATH1241: Differential Equations Lab	M	L	L	L	L	L	M	H	H	M	M
MATH2001: Real Analysis	M	L	L	L	L	L	M	M	H	L	M
MATH2011: Algebra	M	L	L	L	L	L	M	H	H	L	M
MATH2021: Real Analysis Lab	M	L	L	L	L	L	M	M	H	L	M
MATH2031: Algebra Lab	M	L	L	L	L	L	M	H	H	L	M
MATH2041: Linear Algebra	M	L	L	L	L	L	M	H	H	H	H
MATH2051: Linear Algebra Lab	M	L	L	L	L	L	M	H	H	H	H
MATH3001: Numerical Methods	M	L	L	L	L	L	M	H	H	H	H
MATH3011: Vector Calculus	M	L	L	L	L	L	M	H	H	H	H
MATH3021: Numerical Methods using MATLAB	M	L	L	L	L	L	M	H	H	H	H
MATH3031: Vector Calculus Lab	M	L	L	L	L	L	M	H	H	H	H
MATH3041: Discrete Mathematics	H	L	L	L	L	L	M	M	H	H	M
MATH3051: Discrete Mathematics Lab	H	L	L	L	L	L	M	M	H	H	M

MATH2121: Linear Programming	H	L	L	L	L	L	M	H	H	M	H
MATH2131: Transportation and Game Theory	H	L	L	L	L	L	M	H	H	M	H
MATH2141: Linear Programming Lab	H	L	L	L	L	L	M	H	H	M	H
MATH2151: Transportation and Game Theory Lab	H	L	L	L	L	L	M	H	H	M	H
MATH2161: Complex Analysis	M	L	L	L	L	L	M	H	H	M	M
MATH2171: Functional Analysis	M	L	L	L	L	L	M	H	H	M	M
MATH2181: Number Theory	M	L	L	L	L	L	M	M	H	H	M
MATH2191: Graph Theory	H	L	L	L	L	L	M	H	H	H	M
MATH3121: Classical Mechanics	M	L	L	L	L	L	M	H	H	M	M
MATH3131: Theory of Computation	H	L	L	L	L	L	M	H	H	H	M
MATH3141: Fluid Dynamics	M	L	L	L	L	L	M	H	H	M	M
MATH3151: Transform Techniques and Tensor Analysis	M	L	L	L	L	L	M	H	H	M	M

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.

List of Experiments: **10 hours**

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						
CO2					2						
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: 21st AC(September 17, 2021**

SDG No. & Statement:4 Quality Education

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

SDG Justification:

The students can perform simple document preparation to complex calculations in isolated mode and collaborative mode that are useful throughout their career.

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 Listening, Asking Questions, Empathizing, Being Non-Judgmental, Being	5

	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

PPROVED 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, CareerLauncher 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 behavior 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 instagram 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	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.

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: 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. (Bloom's Taxonomy Level/s: 2 & 3)

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	Making power point presentation aided with images, audio, video, etc. with a small group by listening to academic lectures/talks/ discussions,etc.

	presentations aided with images, audio, video, tabular data, 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 delivery including clarity, tone, and use of contextually appropriate vocabulary and conventions, observation, reflective discussion,	Reading newspaper/ magazine articles/ blog posts on current social issues, listening to talks/ discussions/ debates etc. and participating in role-plays using expressions appropriate to the context.	1

	and self-reflective writing		
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 topics beyond his/her own area of interest/field of study, using the language flexibly and effectively.	Reading texts on abstract topics and comprehending the author's perspectives. Similarly, listening to talks and discussions on an abstract topic of other discipline and making short oral presentation by sharing views and opinions.	3

14	Self-relfection on own speech in context(recorded): tone, pitch, relevance, content; extending the reflections/ideas 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: CUP.

Online Resources:

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

Course Outcomes:

1. Listen to extended lectures, presentations, and discussions on a wide range of contemporary issues and demonstrate understanding of relatively complex lines of argument. (Bloom's Taxonomy Level/s: 2)
2. Make presentations using suitable AV aids and engage in formal group discussions on a wide range of topics of contemporary interest, demonstrating awareness of standard/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 toexercise, 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 :01-02-2022 **ACADEMIC COUNCIL: 01-04-2022**

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 analyse the role of Gandhi in India's national movement
- To apply Gandhian Ethics while analysing the contemporary social/political issues
- To appreciate the conflict resolution techniques put forward by Gandhi and its significance in thecurrent 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-touchability - 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 PublishingHouse
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 environmentalissues, 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 : 01-02-2022 **ACADEMIC COUNCIL: 01-04-2022**

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 analyzes 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 SouthAsian 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 andPolitics*, New Delhi: Sage Publications. pp. 35-53.

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

Agrawal, Pankhuri (2020): "COVID-19 and dwindling Indian Federalism," *Economic and PoliticalWeekly,* 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: EasternBook Company.

Rajeev Bhargava (ed), *Ethics and Politics of the Indian Constitution*, Oxford University Press, NewDelhi, 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 iscarried out in India
2. Interpret knowledge of the Fundamental Rights and Duties of the Citizens as well as theObligation of the state towards its citizens
3. Correlate familiarity with key political developments that have shaped the Constitution andamended it from time to time.
4. Equip themselves to take up other courses in law after having done a foundation course on IndianConstitution

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

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

Define Company Impact, Create Value, Tell Your Story

L – 15; Total Hours – 30

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

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

MATH1171	DESCRIPTIVE STATISTICS AND PROBABILITY THEORY	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

Probability theory is important when it comes to evaluating statistics. This course treats the most common discrete and continuous distributions, showing how they find use in decision and estimation problems, and constructs computer algorithms for generating observations from the various distributions.

Course Educational Objectives:

- To understand the collection, analysis, interpretation, and presentation of data.
- To understand the difference between discrete and continuous random variables and probability
- To evaluate problems on discrete and continuous probability distributions
- To understand the concept of mathematical expectation
- Ability to explore certain statistical concepts in expectation and generating functions

UNIT 1 Introduction to Statistics 8 hours

Concepts of Primary and Secondary data. Methods of collection and editing of primary data, Secondary data. Designing a questionnaire and a schedule. Measures of Central Tendency - Mean, Median, Mode, Geometric Mean and Harmonic Mean.

UNIT 2 Measures of dispersion 8 hours

Range, Quartile Deviation, Mean Deviation and Standard Deviation. Descriptive Statistics - Central and Non-Central moments and their interrelationship. Sheppard's correction for moments. Skewness and kurtosis.

UNIT 3 Introduction to Probability 8 hours

Basic Concepts of Probability, random experiments, trial, outcome, sample space, event, mutually exclusive and exhaustive events, equally likely and favourable outcomes. Mathematical, Statistical, axiomatic definitions of probability. Conditional Probability and independence of events.

UNIT 4 Probability theorems 8 hours

Addition and multiplication theorems of probability for two and for n events. Boole's inequality and Bayee's theorems and problems based on Bayee's theorem.

UNIT 5 Random variable: 8 hours

Definition of random variable, discrete and continuous random variables, functions of random variable. Probability mass function. Probability density function, Distribution function and its properties. Bivariate random variable - meaning, joint, marginal and conditional Distributions, independence of random variables.

Textbooks:

1. V.K.Kapoor and S.C.Gupta: Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
2. BA/BSc I year statistics - descriptive statistics, probability distribution - Telugu Academy - DrM.JaganmohanRao,DrN.Srinivasa Rao, DrP.Tirupathi Rao, Smt.D.Vijayalakshmi
3. K.V.S. Sarma: Statistics Made Simple: Do it yourself on PC. PHI.

References:

1. WillamFeller : Introduction to Probability theory and its applications. Volume –I, Wiley
2. Modern Mathematical Statistics with Applications Jay L. Devore, Kenneth N. Berk Springer Second edition.
3. Goon AM, Gupta MK,Das Gupta B : Fundamentals of Statistics , Vol-I, the World Press Pvt.Ltd., Kolakota.
4. Hoel P.G: Introduction to mathematical statistics, Asia Publishing house.
5. Sanjay Arora and BansiLal:.New Mathematical Statistics : Satya Prakashan , New Delhi.
6. Hogg.Tanis.Rao: Probability and Statistical Inference. 7th edition. Pearson.

Course Outcomes:

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

1. Explain the diagrammatic and graphic representation of data
2. Describe the basic concepts of Measures of central tendency
3. Describe the basic concepts of central and non-central moments
4. Describe the difference between central and non-central moments
5. Concept of conditional probability and problems

CO-PO Mapping:

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

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

APPROVED IN:

BOS :13-09-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

Ensuing an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities

SDG Justification:

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

MATH1191	STATISTICAL METHODS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**MATH1171: Descriptive Statistics and Probability Theory**						
Co-requisite	**MATH1171: Descriptive Statistics and Probability Theory**						
Preferable exposure	**None**						

Course Description:

This course covers the concepts on Correlation and Regression Analysis, curve fitting, attributes, and exact sampling distributions.

Course Educational Objectives:

- Compute correlation coefficient for ungrouped data
- Compute rank correlation coefficient, regression lines and correlation ratio
- Fitting of curves
- Obtain co-efficient of association
- Obtain properties of χ^2, t, F distributions

UNIT 1 Correlation 8 hours

Definition, scatter diagram its coefficient and its properties. , scatter diagram, computation of correlation coefficient for ungrouped data. spearman's rank correlation coefficient, properties of spearman's correlation coefficients and problem.

UNIT 2 Regression 8 hours

simple linear regression, properties of regression coefficients. Regression lines, Concept of Correlation ratio, partial and multiple correlation coefficients, correlation verses regression and their problems.

UNIT 3 Curve fitting 8 hours

Method of least square - Fitting of linear, quadratic, Exponential and power curves and their problems.

UNIT 4 Attributes 8 hours

Introduction, Nature, and consistency and mention its conditions. Independence and association of attributes, co-efficient of association, coefficients of contingency and their problems.

UNIT 5 Exact sampling distributions 8 hours

Concept of population, Parameter, random sample, statistic, sampling distribution, standard error. Statement and Properties of c2, t, F distributions and their inter relationships.

Textbooks:

1. V.K.Kapoor and S.C.Gupta: Fundamentals of Mathematical Statistics, Sultan Cahnd& Sons, New Delhi
2. BA/BSc II year statistics - statistical methods and inference - Telugu Academy by A. Mohanrao, N.Srinivasa Rao, DrR.Sudhakar Reddy, Dr T.C. Ravichandra Kum.
3. K.V.S. Sarma: Statistics Made Simple: Do it yourself on PC. PHI.

References:

1. Goon.A.M, Gupta.M.K, Das Gupta B: Outlines of Statistics, Vol-II, the World Press Pvt.Ltd.,Kolakota
2. Hoel P.G.: Introduction to matechematical statistics, Asia Publishing house.

Course Outcomes:

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

1. Explain coefficient of correlation
2. Evaluate rank correlation coefficient
3. Explain linear regression and its properties
4. Evaluate association of attributes
5. Explain the properties of χ^2, t, F distributions

CO-PO Mapping:

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

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

APPROVED IN:
BOS :13-09-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:
Ensuing an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities
SDG Justification:
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

CSCI1011	PROGRAMMING WITH C	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

C is a general-purpose programming language. It is basis for Java and C++. This course deals with the same objects that are manipulated by computers: single characters, numbers and memory addresses. Any other type of object is created, by the programmer, by combining those objects (e.g., character strings, arrays, records, fields, etc.).

Course Educational Objectives:

- To understand the difference between different data types
- To learn the basic concept, applications of control statements
- To identify and practice the functions and program structures
- Ability to process arrays, multi-dimensional arrays and character arrays.
- To understand the concept of pointers and functions.

UNIT 1 **8 hours**

Data types, operators and some statements, Identifiers and key words, constants, C operators, Type conversion. Writing a program in C: Variable declaration, statements, simple C programs, simple input statement, simple output statement, feature of stdio.h.
Control statements: conditional expressions, If statement, If –else statement, switch statement, Loop statements, for loop, while loop, do- while loop, Breaking, control statements, Break statement, continue statement, Goto statement.

UNIT 2 **8 hours**

Functions and Program structures: Introduction, Defining a function, Return statement, Types of functions, Actual and formal arguments, Local Global variables, Automatic variables, register variables, static variables, External variables, Recursive functions.

UNIT 3 **8 hours**

Arrays: Array Notation, Array declaration, Array initialization, Processing with arrays, Arrays and functions, Multidimensional array, Character array.

UNIT 4 **8 hours**

Pointers: Pointer declaration, Pointer operator, address operator, pointer expressions, pointer arithmetic, pointers and functions, call by value. Call by reference, pointers and arrays, pointer and one-dimensional array, pointer and multidimensional array, pointer and strings, array of pointers, pointers to pointers.

UNIT 5 **8 hours**

Structures, Unions: Declaration of structure, Initializing a structure, Functions and structures, Arrays of structures, arrays within a structure, structure within a structure, Flow charts and structures, Unions.

Textbooks:

1. Programming in C by D.Ravi Chandran, New Age international Publishers,2006.

References:

2. Let Us C by Yashwant Kanetkar, 13th Edition, Bpb Publications, 2012.
3. Programming in ANSI C by E. Balaguruswamy, 6th Edition, McGraw Hill Education, 2012.
4. Programming in C by Smarajit Ghosh, Prentice Hall India Pvt.Ltd(2004).

Course Outcomes:

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

1. describe the basic concepts of control statements in C
2. explain the concepts of Loop statements in C
3. explain difference between Local and Global variables
4. explain multidimensional arrays and character arrays
5. explain the concept of arrays of structures, structures within a structure and flowcharts and structures in C

CO-PO Mapping:

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

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

APPROVED IN:
BOS :13-09-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:
Ensuing an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities

SDG Justification:
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

CSCI1021	PROGRAMMING WITH C LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description: *C is a general-purpose programming language. It is basis for Java and C++. This course deals with the same objects that are manipulated by computers: single characters, numbers and memory addresses. Any other type of object is created, by the programmer, by combining those objects (e.g., character strings, arrays, records, fields, etc.).*

Course Educational Objectives:

- To understand the difference between different data types
- To learn the basic concept, applications of control statements
- To identify and practice the functions and program structures
- Ability to process arrays, multi-dimensional arrays and character arrays.
- To understand the concept of pointers and functions.

1. Program to convert a given decimal number to octal number
2. Program to solve quadratic equation using switch case structure
3. Program to check a given integer is a palindrome
4. Program to check a given integer is a prime number
5. Sorting of numbers
6. Multiplication of two matrices
7. Inverse of a matrix
8. Finding norm of a matrix using fuction
9. Program to check a given string is a palindrome or not
10. Using pointers copying a string to another string
11. Using pointers and functions sorting of number
12. Computer binomial coefficients using recursive function for factorial

Course Outcomes:

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

- describe the basic concepts of control statements in C
- explain the concepts of Loop statements in C
- explain difference between Local and Global variables
- explain multidimensional arrays and character arrays
- explain the concept of arrays of structures, structures within a structure and flowcharts and structures in C

CO-PO Mapping:

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

APPROVED IN:

BOS : 13-09-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4

Ensuing an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities

SDG Justification:

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

MATH1211	MATHEMATICAL EXPECTATION AND PROBABILITY DISTRIBUTIONS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	MATH1171: Descriptive Statistics and Probability Theory						
Co-requisite	MATH1171: Descriptive Statistics and Probability Theory						
Preferable exposure	None						

Course Description:

This course covers the concepts on Mathematical expectations, discrete and continuous probability distributions

Course Educational Objectives:

- To understand mathematical expectations
- To learn the basic concepts on moments
- To identify and practice the difference between discrete distribution and continuous distribution
- To explain moment generating function and cumulative generating function for continuous distributions
- To discuss the properties of Normal distribution

UNIT 1 Mathematical expectation 8 hours

Mathematical expectation (ME) of a random variable and function of a random variable. Moments and covariance using mathematical expectation with examples. Addition and Multiplication theorems on expectation. Definitions of M.G.F, C.G.F, P.G.F, C.F its properties. Chebyshev and Cauchy - Schwartz inequalities.

UNIT 2 Discrete Distributions 8 hours

Binomial and Poisson distributions, their definitions, 1st to 4 central moments, M.G.F, C.F, C.G.F, P.G.F, mean, variance, additive property if exists. poission approximation to Binomial distribution.

UNIT 3 Negative Binomial, geometric, hyper geometric distributions 8 hours

- Definitions, means, variances, M.G.F, C.F, C.G.F, P.G.F, reproductive property if exists. Binomial approximation to Hyper Geometric Distribution, Poisson approximation to Negative binomial distribution

UNIT 4 Continuous Distributions 8 hours

Rectangular, Exponential, Gamma, Beta Distributions of two kinds. Other properties such as mean, variance, M.G.F, C.G.F, C.F, reproductive property.

UNIT 5 Normal Distribution 8 hours

Definition, Importance, Properties, M.G.F, additive properties, Interrelation between Normal and Binomial, Normal &Poisson distribution. Cauchy Distribution.

Textbooks:

1. V.K.Kapoor and S.C.Gupta: Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
2. BA/BSc I year statistics - descriptive statistics, probability distribution - Telugu Academy - DrM.Jaganmohan Rao ,DrN.Srinivasa Rao, DrP.Tirupathi Rao, Smt.D.Vijayalakshmi

References:

1. WillamFeller : Introduction to Probability theory and its applications. Volume –I, Wiley
2. Modern Mathematical Statistics with Applications Jay L. Devore, Kenneth N. Berk Springer Second edition.
3. Goon AM, Gupta MK,Das Gupta B : Fundamentals of Statistics , Vol-I, the World Press Pvt.Ltd., Kolakota.
4. Hoel P.G: Introduction to mathematical statistics, Asia Publishing house.
5. Sanjay Arora and BansiLal:.New Mathematical Statistics : Satya Prakashan , New Delhi.
6. Hogg.Tanis.Rao: Probability and Statistical Inference. 7th edition. Pearson.
7. K.V.S. Sarma: statistics Made Simple: do it yourself on PC. PHI
8. Gerald Keller: Applied Statistics with Microsoft excel. Duxbury, Thomson Learning.
9. Levine, Stephen, Krehbiel, Berenson: Statistics for Managers using Microsoft Excel 4th edition. Pearson Publication

Course Outcomes:

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

1. Distinguish between mathematical expectation of a random variable and function of a random variable
2. Recognize and solve problems on addition and multiplication theorems on expections
3. Evaluate central moments for binomial distribution and poission distribution
4. Discuss properties of normal distribution
5. Explain interrelation between normal and binomial distribute

CO-PO Mapping:

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

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

APPROVED IN:

BOS :13-09-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

Ensuing an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities

SDG Justification:

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

CSCI1281	FUNDAMENTALS OF OBJECT-ORIENTED PROGRAMMING WITH C++	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

C++ is a general-purpose programming language and widely used now a days for competitive programming. It has imperative, object-oriented, and generic programming features. C++ runs on lots of platform like Windows, Linux, Unix, Mac etc.

Course Educational Objectives:

- To develop logic through algorithms and flowcharts.
- To understand the difference between procedure oriented programming and object oriented programming.
- To learn the basic concepts , applications of OOPS and practice of object oriented analysis and design in the construction of robust, maintainable programs which satisfy their requirements;
- To develop the ability to implement features of object oriented programming
- To solve real world problems using Inheritance, data abstraction, encapsulation and Polymorphism.

UNIT 1 Introduction 8 hours

Algorithm and its characteristics, pseudo code / flow chart symbols - Assignment statement, input/output statements, if, if then else statements.
Data types- simple data types, floating data types, character data types, arithmetic operators and operator precedence, variables and constant declarations, expressions, Relational operators, Logical Operators, Bitwise Operators.

UNIT 2 Control Structures 8 hours

Input/output statements, Expressions, if and if … else statement, switch and break statements. For, while and do – while, break and continue statement, nested control statements.

UNIT 3 Functions and Arrays 8 hours

Local and global variables, static and automatic variables, enumeration type, Function Prototyping, Function Definition, Function Overloading, one dimensional array, two-dimensional array, character array.

UNIT 4 Object Oriented Concepts 8 hours

Abstraction, Encapsulation, Classes, Objects, methods, constructors, Destructor, constructor overloading, Function Overloading, Unary Operators, Rules for Operator Overloading.

UNIT 5 8 hours

Inheritance – Single, Multiple, Multi-Level, Hierarchical, Hybrid Inheritance, static and dynamic binding, Function Overriding, Pointers, Virtual Functions and Polymorphism.

Textbooks:

1. The Complete Reference C++ by Herbert schidlt Tata MC GrawHill, 4th edition, 2003.[Unit-1,2,3]
2. Object Oriented Programming with C++ by E.Balagurusamy, Tata MC GrawHill, 6th edition, 2013.[Unit- 4, 5]

References:

1. Mastering C++ by Venugopal K R, Rajkumar Buyya , Tata Mc Graw Hill, 2nd edition, 2013
2. Object Oriented Programming using C++ by B.Chandra, Narosa Publications, 2005.

Course Outcomes:

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

1. Emphasize the special features of the C++ language. (L4)
2. Examine the working of Control structures in C++ programs.(L4)
3. Understand the concepts of functions and arrays in C++ programs(L2)
4. Develop and implement classes and objects, overloading. (L3)
5. Understand various Inheritance mechanisms, operator overloading, polymorphism and apply in applications. (L2)

CO-PO Mapping:

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

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

APPROVED IN:

BOS :13-09-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4

Ensuing an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities

SDG Justification:

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

MATH1221	PROBABILITY DISTRIBUTIONS LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	**MATH1211: Mathematical Expectation and Probability Distributions**						
Co-requisite	**MATH1171: Descriptive Statistics and Probability Theory**						
Preferable exposure	**None**						

Course Description:

This course covers the concepts on Mathematical expectations, discrete and continuous probability distributions

Course Educational Objectives:

- To understand mathematical expectations
- To learn the basic concepts on moments
- To identify and practice the difference between discrete distribution and continuous distribution
- To explain moment generating function and cumulative generating function for continuous distributions
- To discuss the properties of Normal distribution

1. Fitting of Binomial distribution – Direct method.
2. Fitting of Binomial distribution – Direct method using MS Excel.
3. Fitting of binomial distribution – Recurrence relation Method.
4. Fitting of Poisson distribution – Direct method.
5. Fitting of Poisson distribution – Direct method using MS Excel.
6. Fitting of Poisson distribution - Recurrence relation Method.
7. Fitting of Normal distribution – Areas method.
8. Fitting of Normal distribution – Ordinates method.

Course Outcomes:

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

1. evaluate mathematical expectations
2. learn the basic concepts on moments
3. identify and practice the difference between discrete distribution and continuous distribution
4. evaluate moment generating function and cumulative generating function for continuous distributions
5. discuss the properties of Normal distribution

CO-PO Mapping:

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

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

APPROVED IN:

BOS : 13-09-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4

Ensuing an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities

SDG Justification:

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

CSCI1291	C++ PROGRAMMING LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

C++ is a general-purpose programming language and widely used now a days for competitive programming. It has imperative, object-oriented, and generic programming features. C++ runs on lots of platform like Windows, Linux, Unix, Mac etc.

Course Educational Objectives:

- To develop logic through algorithms and flowcharts.
- To understand the difference between procedure oriented programming and object oriented programming.
- To learn the basic concepts , applications of OOPS and practice of object oriented analysis and design in the construction of robust, maintainable programs which satisfy their requirements;
- To develop the ability to implement features of object oriented programming
- To solve real world problems using Inheritance, data abstraction, encapsulation and Polymorphism.

1. Write a C++ program to demonstrate the usage of data types & operators.
2. Write a C++ program to demonstrate Control structures.
3. Write a C++ program to demonstrate Class and Object.
4. Write a C++ program to demonstrate function overloading
5. Write C++ programs to demonstrate Single dimensional and two-dimensional arrays
6. Write a C++ program to demonstrate Constructors and Constructor overloading.
7. Write a C++ program to demonstrate Single Inheritance, Multiple Inheritance.
8. Write a C++ program to demonstrate Multi level Inheritance, Hierarchal Inheritance.
9. Write a C++ program to demonstrate function overrding.
10. Write a C++ program to demonstrate operator overloading.
11. Write a C++ program to demonstrate Polymorphism.

Course Outcomes:

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

- Emphasize the special features of the C++ language. (L4)
- Examine the working of Control structures in C++ programs.(L4)
- Understand the concepts of functions and arrays in C++ programs(L2)
- Develop and implement classes and objects, overloading. (L3)
- Understand various Inheritance mechanisms, operator overloading, polymorphism and apply in applications. (L2)

CO-PO Mapping:

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

APPROVED IN:

BOS : 13-09-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:
Ensuing an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities
SDG Justification:
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

PROGRAM CORE

MATH1151	DIFFERENTIAL CALCULUS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

Differential Calculus provides information about limits, continuity, differentiation, and partial differentiation. The focus of the course is to study the limits and continuity, applications of partial differentiation, tracing of curves in Cartesian coordinates and Polar coordinates and mean value theorem on differentiation.

Course Educational Objectives:

- To introduce Basic properties of continuity and differentiation
- Partial differentiation and application of theorem
- Tracing of curves and to find tangents and normal
- Rolle's theorem and mean value theorem
- Expansion of the function using series and series

UNIT 1 **8 hours**

Limit and Continuity (ε and δ definition), Types of discontinuities, Differentiability of functions, Successive differentiation, Leibnitz's theorem.

UNIT 2 **8 hours**

Partial differentiation, theorem on homogeneous functions.

UNIT 3 **8 hours**

Tangents and normals, Curvature, Asymptotes, Singular points, Tracing of curves, Parametric representation of curves and tracing of parametric curves, Polar coordinates, and tracing of curves in polar coordinates.

UNIT 4 **8 hours**

Rolle's theorem, Mean Value theorems, Taylor's theorem with Lagrange's and Cauchy's forms of remainder

UNIT 5 **8 hours**

Taylor's series, Maclaurin's series of sin x, cos x, e^x, log(l+x), $(l+x)^m$, Maxima and Minima, Indeterminate forms

Textbooks:

1. Elements of Real Analysis" by Shanthi Narayan and Dr. M.D. Raisinghania, published by S. Chand& Company Ltd., New Delhi
2. "A Textbook of B.Sc. Mathematics Volume-II" by P. Venkateswara Rao, N Krishna Murthy, B.V.S.S. Sarma and S. Anjaneya Sastry, published by S. Chand& Company Ltd., New Delhi.

References:

1. Calculus Single Variable" by Howard Anton, Irl Bivens and Stephen Davis, published by John Wiley and Sons, Inc., 2002.
2. Calculus and Analytic Geometry" by George B. Thomas, Jr. and Ross L. Finney, published by Pearson Education, 2007, 9th edition.

Course Outcomes:

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

1. Define the basic properties of limits and continuity
2. Explain different types of discontinuities
3. Trace the parametric curves
4. Evaluate Taylor's theorem with Lagrange's and Cauchy's forms of remainder
5. Evaluate Maxima and minima of a function

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	1	1	1	1	1	2	2	1	1	1
CO2	3	1	1	1	1	1	2	2	1	1	1
CO3	3	1	1	1	1	1	2	2	1	1	1
CO4	3	1	1	1	1	1	2	2	1	1	1
CO5	3	1	1	1	1	1	2	2	1	1	1

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

APPROVED IN:

BOS : 13-09-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4

Ensuing an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities

SDG Justification:

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

MATH1161	DIFFERENTIAL CALCULUS LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	**MATH1151: Differential Calculus**						
Co-requisite	**MATH1151: Differential Calculus**						
Preferable exposure	**None**						

Course Description:

Differential Calculus provides information about limits, continuity, differentiation, and partial differentiation. The focus of the course is to study the limits and continuity, applications of partial differentiation, tracing of curves in Cartesian coordinates and Polar coordinates and mean value theorem on differentiation.

Course Educational Objectives:

- To introduce Basic properties of continuity and differentiation
- Partial differentiation and application of theorem
- Tracing of curves and to find tangents and normal
- Rolle's theorem and mean value theorem
- Expansion of the function using series and series

1. Problems on Limits and Continuity
2. Problems on Partial differentiation
3. Problems on Euler's theorem
4. Problems on Tangents and normals
5. Tracing of curves
6. Problems on Rolle's theorem
7. Problems on Mean value theorems
8. Problems on Taylor's theorem
9. Problems on Taylor's and Maclaurin's series
10. Problems on Maxima and Minima

Course Outcomes:

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

1. Define the basic properties of limits and continuity
2. Explain different types of discontinuities
3. Trace the parametric curves
4. Evaluate Taylor's theorem with Lagrange's and Cauchy's forms of remainder
5. Evaluate Maxima and minima of a function

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	1	1	1	1	1	2	2	1	1	1
CO2	3	1	1	1	1	1	2	2	1	1	1
CO3	3	1	1	1	1	1	2	2	1	1	1
CO4	3	1	1	1	1	1	2	2	1	1	1
CO5	3	1	1	1	1	1	2	2	1	1	1

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

APPROVED IN:

BOS : 13-09-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4

Ensuing an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities

SDG Justification:

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

MATH1231	DIFFERENTIAL EQUATIONS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**MATH1151: Differential Calculus**						
Co-requisite	**MATH1151: Differential Calculus**						
Preferable exposure	**None**						

Course Description:

Many physical laws and relations can be expressed mathematically in the form of differential equations. Thus, it is natural that this course opens with the study of differential equations and their solutions. Indeed, many engineering problems appear as differential equations. The main objectives of this course are twofold: the study of ordinary differential equations and their most important methods for solving them and the study of modeling.

Course Educational Objectives:

- To Identify the type of a given differential equation and apply the appropriate analytical technique for finding the solution of first order and higher degree ordinary differential equations.
- To Solve second order and higher order linear differential equations.
- To solve the non-linear first order Partial differential equation by Charpit's method
- To classify second order partial differential equations into elliptic, parabolic and hyperbolic
- To transform the second order partial differential equations to Normal forms

UNIT 1 **8 hours**

First order exact differential equations. Integrating factors, rules to find an integrating factor. First order higher degree equations solvable for x, y, p. Methods for solving higher-order differential equations.

UNIT 2 **8 hours**

Basic theory of linear differential equations, Wronskian, and its properties. Solving a differential equation by reducing its order. Linear homogenous equations with constant coefficients, Linear non-homogenous equations, The method of variation of parameters, The Cauchy-Euler equation, Simultaneous differential equations, Total differential equations.

UNIT 3 **8 hours**

Order and degree of partial differential equations, Concept of linear and non-linear partial differential equations, Formation of first order partial differential equations

UNIT 4 **8 hours**

Classification of second order partial differential equations into elliptic, parabolic, and hyperbolic through illustrations only

UNIT 5 **8 hours**

Classification of second order partial differential equations into elliptic, parabolic, and hyperbolic through illustrations only.

Textbooks:

1. N. Krishna Murthy & others "A textbook of Mathematics for BA/B.Sc. Vol. 1 S. Chand& Company, New Delhi.
2. Shepley L. Ross, *Differential Equations*, 3rd Ed., John Wiley, and Sons, 1984

References:

1. I. Sneddon, *Elements of Partial Differential Equations*, McGraw-Hill, International Edition, 1967.

Course Outcomes:

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

1. Recognize and solve an exact differential equation.
2. Recognize and solve First order higher degree equations solvable for x, y, p
3. Recognize and solve first order nonlinear partial differential equation by Charpit's method.
4. Construct the different example for elliptic, parabolic and hyperbolic
5. Transform the second order partial differential equations into normal form

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	1	1	1	1	1	2	3	3	2	2
CO2	2	1	1	1	1	1	2	3	3	2	2
CO3	2	1	1	1	1	1	2	3	3	2	2
CO4	2	1	1	1	1	1	2	3	3	2	2
CO5	2	1	1	1	1	1	2	3	3	2	2

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

APPROVED IN:

BOS : 13-09-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4

Ensuing an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities

SDG Justification:

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

MATH1241	DIFFERENTIAL EQUATIONS LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	**MATH1151: Differential Calculus**						
Co-requisite	**MATH1151: Differential Calculus**						
Preferable exposure	**None**						

Course Description:

Many physical laws and relations can be expressed mathematically in the form of differential equations. Thus, it is natural that this course opens with the study of differential equations and their solutions. Indeed, many engineering problems appear as differential equations. The main objectives of this course are twofold: the study of ordinary differential equations and their most important methods for solving them and the study of modeling.

Course Educational Objectives:

- To Identify the type of a given differential equation and apply the appropriate analytical technique for finding the solution of first order and higher degree ordinary differential equations.
- To Solve second order and higher order linear differential equations.
- To solve the non-linear first order Partial differential equation by Charpit's method
- To classify second order partial differential equations into elliptic, parabolic and hyperbolic
- To transform the second order partial differential equations to Normal forms

1. Solving first order and first-degree differential equations
2. Solving first order and higher degree differential equations
3. Solving linear differential equations with constant coefficients
4. Solving differential equations with variation of parameters
5. Solving Cauchy-Euler equation
6. Solving Simultaneous differential equations
7. Solving total differential equations
8. Formation of first order partial differential equations
9. Problems using Lagrange's method
10. Problems using Charpit's method

11. Classification of second order partial differential equations

Course Outcomes:

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

1. Recognize and solve an exact differential equation.
2. Recognize and solve First order higher degree equations solvable for x, y, p
3. Recognize and solve first order nonlinear partial differential equation by Charpit's method.
4. Construct the different example for elliptic, parabolic and hyperbolic
5. Transform the second order partial differential equations into normal form

CO-PO Mapping:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
CO 1	2	1	1	1	1	1	2	3	3	2	2
CO 2	2	1	1	1	1	1	2	3	3	2	2
CO 3	2	1	1	1	1	1	2	3	3	2	2
CO 4	2	1	1	1	1	1	2	3	3	2	2
CO 5	2	1	1	1	1	1	2	3	3	2	2

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

APPROVED IN:

BOS : 13-09-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

Ensuing an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities

SDG Justification:

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

MATH2001	REAL ANALYSIS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

Real Analysis studies the behavior of real numbers, functions, sequences, series and sets on the real line. The focus of the course is to study the properties of fields of real numbers, convergence/divergence of sequences, series of numbers and functions

Course Educational Objectives:

- To introduce basic properties of fields of real numbers
- To study sequences and discuss about their convergence infinite series and the tests of convergence
- To evaluate Alternating series, absolute and conditional convergence of infinite series
- To evaluate Point wise convergence of sequence and series of functions
- To evaluate uniform convergence of sequence and series of functions

UNIT 1 **8 hours**

Finite and infinite sets, examples of countable and uncountable sets, Real line, bounded sets, suprema and infima, completeness property of R, Archimedean property of R, intervals. Concept of cluster points and statement of Bolzano-Weierstrass theorem.

UNIT 2 **8 hours**

Real Sequence, Bounded sequence, Cauchy convergence criterion for sequences. Cauchy's theorem on limits, order preservation and squeeze theorem, monotone sequences and their convergence (monotone convergence theorem without proof).

UNIT 3 **8 hours**

Infinite series. Cauchy convergence criterion for series, positive term series, geometric series, comparison test, convergence of p-series

UNIT 4 **8 hours**

Root test, Ratio test, alternating series, Leibnitz's test (Tests of Convergence without proof). Definition and examples of absolute and conditional convergence

UNIT 5 **8 hours**

Sequences and series of functions, Pointwise and uniform convergence. M -test, Statements of the results about uniform convergence and integrability and differentiability of functions, Power series and radius of convergence.

Textbooks:

1. T. M. Apostol, *Calculus* (Vol. I), John Wiley and Sons (Asia) P. Ltd., 2002.
2. R.G. Bartle and D. R Sherbert, *Introduction to Real Analysis,* John Wiley, and Sons (Asia) P. Ltd., 2000.

References:

1. E. Fischer, *Intermediate Real Analysis*, Springer Verlag, 1983.
2. K.A. Ross, *Elementary Analysis- The Theory of Calculus Series*- Undergraduate Texts in Mathematics, Springer Verlag, 2003.

Course Outcomes:

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

1. Write precise proofs
2. Recognize convergent, divergent, bounded, Cauchy and monotone sequences and their properties
3. Calculate the infima, suprema and limit points of a set Recognize alternating, conditionally and convergent series
4. Apply the ratio, root, Leibnitz's test
5. Test the pointwise and uniform convergence of sequences and series of functions

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	1	1	1	1	1	2	2	3	1	2
CO2	2	1	1	1	1	1	2	3	3	2	2
CO3	2	1	1	1	1	1	2	3	3	2	2
CO4	2	1	1	1	1	1	2	3	3	2	2
CO5	2	1	1	1	1	1	2	3	3	2	2

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

APPROVED IN:

BOS : 13-09-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4

Ensuing an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities

SDG Justification:

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

MATH2021	REAL ANALYSIS LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	**MATH2001:Real Analysis**						
Co-requisite	**MATH2001:Real Analysis**						
Preferable exposure	**None**						

Course Description:

Real Analysis studies the behaviour of real numbers, functions, sequences, series and sets on the real line. The focus of the course is to study the properties of fields of real numbers, convergence/divergence of sequences, series of numbers and functions

Course Educational Objectives:

- To introduce basic properties of fields of real numbers
- To study sequences and discuss about their convergence infinite series and the tests of convergence
- To evaluate Alternating series, absolute and conditional convergence of infinite series
- To evaluate Point wise convergence of sequence and series of functions
- To evaluate uniform convergence of sequence and series of functions

1. Finding supremum and infimum of a set
2. Finding limit points of a set
3. Problems on sequences
4. Problems on Cauchy convergence
5. Problems on monotonic sequence
6. Problems on infinite series
7. Convergence or divergence of Geometric series
8. Convergence or divergence using comparison test
9. Convergence or divergence of p-series
10. Problems on root test
11. Problems on Ratio test
12. Problems on alternating series

Course Outcomes:

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

1. Write precise proofs
2. Recognize convergent, divergent, bounded, Cauchy and monotone sequences and their properties
3. Calculate the infima, suprema and limit points of a set Recognize alternating, conditionally and convergent series
4. Apply the ratio, root, Leibnitz's test
5. Test the pointwise and uniform convergence of sequences and series of functions

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	1	1	1	1	1	2	2	3	1	2
CO2	2	1	1	1	1	1	2	3	3	2	2
CO3	2	1	1	1	1	1	2	3	3	2	2
CO4	2	1	1	1	1	1	2	3	3	2	2
CO5	2	1	1	1	1	1	2	3	3	2	2

APPROVED IN:

BOS : 13-09-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4

Ensuing an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities

SDG Justification:

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

MATH2011	ALGEBRA	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 aims to provide basic concepts of Abstract algebra. The focus of the course is to study the fundamental properties of Groups and its kind.

Course Educational Objectives:

- To introduce groups, subgroups, permutation, and cyclic groups with examples
- To discuss the fundamental properties of Groups, subgroups etc.
- To study the structure preserving mappings, homomorphism and isomorphism, its properties.
- To increase mathematical maturity, including writing their own proofs
- To define quotient groups and criteria for the existence of a quotient group

UNIT 1 GROUPS 8 hours

Binary Operation – Algebraic structure – semi group-monoid – Group definition and elementary properties Finite and Infinite groups – examples – order of a group. Composition tables with examples.

UNIT 2 SUBGROUPS and Lagrange's Theorem 8 hours

Subgroups :Complex Definition – Multiplication of two complexes Inverse of a complex-Subgroup definition – examples-criterion for a complex to be a subgroup. Criterion for the product of two subgroups to be a subgroup-union and Intersection of subgroups.**Co-sets and Lagrange's Theorem:** Cosets Definition – properties of Cosets–Index of a subgroups of a finite group–Lagrange's Theorem.

UNIT 3 Normal subgroups 8 hours

Definition of normal subgroup – proper and improper normal subgroup–Hamilton group – criterion for a subgroup to be a normal subgroup – intersection of two normal subgroups –

Subgroup of index 2 is a normal subgroup – simple group – quotient group – criteria for the existence of a quotient group.

UNIT 4 Homomorphism 8 hours

Definition of homomorphism – Image of homomorphism elementary properties of homomorphism – Isomorphism – aultomorphism definitions and elementary properties– kernel of a homomorphism – fundamental theorem on Homomorphism and applications.

UNIT 5 PERMUTATIONS AND CYCLIC GROUPS 8 hours

PERMUTATIONS AND CYCLIC GROUPS:

Definition of permutation – permutation multiplication – Inverse of a permutation – cyclic permutations – transposition – even and odd permutations – Cayley's theorem.

Cyclic Groups: Definition of cyclic group – elementary properties – classification of cyclic groups.

Textbooks:

1. A textbook of Mathematics for B.A. / B.Sc. by B.V.S.S. SARMA and others Published S. Chand& Company New Delhi.
2. A First course in Abstract Algebra, by J.B. Fraleigh Published by Narosa Publishing house.

References:

1. Modern Algebra by M.L. Khanna.
2. John B. Fraleigh, *A First Course in Abstract Algebra*, 7th Ed., Pearson, 2002**.**
3. M. Artin, *Abstract Algebra*, 2nd Ed., Pearson, 2011.

Course Outcomes:

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

1. Write abstract mathematical proofs in logical manner
2. Verify group properties for the given algebraic structure
3. Prove fundamental theorems of group theory

4. Explain the use of order of an element and group in finding generators of the group
5. Discuss the structure preserving mappings and its importance

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	1	1	1	1	1	2	3	3	1	2
CO2	2	1	1	1	1	1	2	3	3	1	2
CO3	2	1	1	1	1	1	2	3	3	1	2
CO4	2	1	1	1	1	1	2	3	3	1	2
CO5	2	1	1	1	1	1	2	3	3	1	2

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

APPROVED IN:

BOS : 13-09-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4

Ensuing an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities

SDG Justification:

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

MATH2031	ALGEBRA LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	**MATH2011:Algebra**						
Co-requisite	**MATH2011:Algebra**						
Preferable exposure	**None**						

Course Description:
This course aims to provide basic concepts of Abstract algebra. The focus of the course is to study the fundamental properties of Groups and its kind.

Course Educational Objectives:

- To introduce groups, subgroups, permutation, and cyclic groups with examples
- To discuss the fundamental properties of Groups, subgroups etc.
- To study the structure preserving mappings, homomorphism and isomorphism, its properties.
- To increase mathematical maturity, including writing their own proofs
- To define quotient groups and criteria for the existence of a quotient group

1. Problems on Groups
2. Problems on subgroups
3. Problems on co-sets and Lagrange's theorem
4. Problems on normal subgroups
5. Problems on quotient group
6. Problems on homomorphism of groups
7. Problems on isomorphism of groups
8. Problems on permutation multiplication
9. Problems to find inverse of a permutation
10. Problems on cyclic permutation and transposition

11. Problems on Cayley's theorem
12. Problems on cyclic groups

Course Outcomes:

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

1. Write abstract mathematical proofs in logical manner
2. Verify group properties for the given algebraic structure
3. Prove fundamental theorems of group theory
4. Explain the use of order of an element and group in finding generators of the group
5. Discuss the structure preserving mappings and its importance

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	1	1	1	1	1	2	3	3	1	2
CO2	2	1	1	1	1	1	2	3	3	1	2
CO3	2	1	1	1	1	1	2	3	3	1	2
CO4	2	1	1	1	1	1	2	3	3	1	2
CO5	2	1	1	1	1	1	2	3	3	1	2

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

APPROVED IN:

BOS : 13-09-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4

Ensuing an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities

SDG Justification:

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

MATH2041	LINEAR ALGEBRA	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

Linear algebra applies to several branches of science, as well as different mathematical disciplines. This course aims to provide basic concepts of matrices, rank of a matrix and consistency of matrices. The focus of the course is to study the fundamental properties of matrices, applications of matrices, vector spaces and inner product spaces

Course Educational Objectives:

- To define rank of a matrix and its applications
- To evaluate eigen values and eigen vectors of a matrix
- To study vector spaces, subspaces, basis of a vector spaces and dimension of a vector space
- To know the linear transformations of a vector space, product of linear transformations
- To define inner product space

UNIT 1 **Matrices I** **8 hours**

Rank of a matrix, Elementary transformations, normal form, Echelon form, Rank of product of matrices, System of homogeneous equations, Linear equations, Null space and nullity of matrices

UNIT 2 **Matrices II** **8 hours**

Condition for consistency, Crammers' rule, Characteristic values and characteristic vectors, Cayley- Hamilton theorem, Inverse of a matrix using Cayley- Hamilton theorem, Minimal polynomial of a matrix.

UNIT 3 Linear Algebra -I 8 hours

Vector spaces, General properties of vector spaces, Vector subspaces, Algebra of subspaces, linear combination of vectors. Linear span, linear sum of two subspaces, Linear independence and dependence of vectors, Basis of vector space, Finite dimensional vector spaces, Dimension of a vector space, Dimension of a subspace.

UNIT 4 Linear Algebra – II 8 hours

Linear transformations, linear operators, Range and null space of linear transformation, Rank and nullity of linear transformations, Linear transformations as vectors, Product of linear transformations, Invertible linear transformation.

UNIT 5 Inner product spaces 8 hours

Inner product spaces, Euclidean and unitary spaces, Norm or length of a vector, Schwartz inequality, Orthogonality, Orthonormal al set, complete orthonormal set, Gram - Schmidt orthogonalization process.

Textbooks:

1. "A Text Book of B.Sc. Mathematics Volume-III" by V. Venkateswara Rao , N Krishna Murthy, B.V.S.S. Sarma and S. Anjaneya Sastry, published by S.Chand& Company Ltd., New Delhi.
2. "Linear Algebra" by A.R. Vasishtha and J.N. Sharma published by Krishna Prakash an Media (P) Ltd.

References:

1. "Linear Algebra" by Kenneth Hoffman and Ray Alden Kunze published by Pearson Education (low priced edition), New Delhi.
2. "Linear Algebra" by Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, published by Prentice Hall of India Pvt. Ltd., 4th edition New Delhi, 2007.
3. "Rings and Linear Algebra" by Pundir, Pundir published by PragathiPrakashan

Course Outcomes:

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

1. define rank of a matrix and its applications
2. evaluate eigen values and eigen vectors of a matrix

3. study vector spaces, subspaces, basis of a vector spaces and dimension of a vector space
4. know the linear transformations of a vector space, product of linear transformations
5. define inner product space

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	1	1	1	1	1	2	3	3	3	3
CO2	2	1	1	1	1	1	2	3	3	3	3
CO3	2	1	1	1	1	1	2	3	3	3	3
CO4	2	1	1	1	1	1	2	3	3	3	3
CO5	2	1	1	1	1	1	2	3	3	3	3

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

APPROVED IN:

BOS : 13-09-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4

Ensuing an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities

SDG Justification:

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

MATH2051	LINEAR ALGEBRA LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	**MATH2041: Linear Algebra**						
Co-requisite	**MATH2041: Linear Algebra**						
Preferable exposure	**None**						

Course Description:

Linear algebra applies to several branches of science, as well as different mathematical disciplines. This course aims to provide basic concepts of matrices, rank of a matrix and consistency of matrices. The focus of the course is to study the fundamental properties of matrices, applications of matrices, vector spaces and inner product spaces

Course Educational Objectives:

- To define rank of a matrix and its applications
- To evaluate eigen values and eigen vectors of a matrix
- To study vector spaces, subspaces, basis of a vector spaces and dimension of a vector space
- To know the linear transformations of a vector space, product of linear transformations
- To define inner product space

1. Find rank of a matrix Reduction to normal form and Echelon form
2. Problems on eigen values and eigen vectors
3. Problems on Cayley-Hamilton theorem
4. Find inverse of a matrix using Cayley-Hamilton theorem
5. Problems on Vector spaces
6. Problems on subspaces
7. Problems on Linear independence and dependence of vectors
8. Problems on Basis of vector space
9. Problems on dimension of a vector space
10. Problems on linear transformations Problems on inner product spaces

Course Outcomes:

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

1. define rank of a matrix and its applications
2. evaluate eigen values and eigen vectors of a matrix
3. study vector spaces, subspaces, basis of a vector spaces and dimension of a vector space
4. know the linear transformations of a vector space, product of linear transformations
5. define inner product space

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	1	1	1	1	1	2	3	3	3	3
CO2	2	1	1	1	1	1	2	3	3	3	3
CO3	2	1	1	1	1	1	2	3	3	3	3
CO4	2	1	1	1	1	1	2	3	3	3	3
CO5	2	1	1	1	1	1	2	3	3	3	3

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

APPROVED IN:

BOS : 13-09-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4

Ensuing an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities

SDG Justification:

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

MATH3001	NUMERICAL METHODS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

Numerical analysis is the study of algorithms that use numerical approximation for the problems of mathematical analysis. Numerical analysis naturally finds application in all fields of engineering and the physical sciences. Numerical analysis can only be applied to real-world measurements by translation into digits; it gives approximate solutions within specified error bounds.

Course Educational Objectives:

- To solve various categories of problems.
- To understand the usage of intermediate value theorem in locating the roots of an equation
- To understand the iterative techniques such as Gauss-Jacobi, Gauss-Siedel and SOR iterative methods to solve the given system of equations numerically
- To Know the interpolation techniques when the nodes are unevenly spaced
- To Know the techniques for numerical differentiation with finite difference operators

UNIT 1 Errors in Numerical computations 8 hours

Errors and their Accuracy, Mathematical Preliminaries, Errors and their Analysis, Absolute, Relative and Percentage Errors, A general error formula, Error in a series approximation.

UNIT 2 Solution of Algebraic and Transcendental Equations 8 hours

The bisection method, the iteration method, the method of false position, Newton Raphson method, Generalized.

UNIT 3 System of Simultaneous Equations 8 hours

Direct methods, Gauss Elimination Method, LU decomposition,

Iterative Methods**:** Gauss-Jacobi, Gauss-Siedel and SOR iterative methods.

UNIT 4 **8 hours**

Lagrange and Newton Divided difference interpolation: linear and higher order,

Finite difference Operators: Newton forward and backward Interpolations, Central Difference Interpolation Formulae, Gauss's central difference formulae, Stirling's central difference formula, Bessel's Formula

UNIT 5 **Numerical differentiation** **8 hours**

forward difference, backward difference, and central Differences. Integration: Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule

Textbooks:

1. "Introductory Methods of Numerical Analysis" by S.S. Sastry published by Prentice Hall of India Pvt. Ltd., New Delhi. (Latest Edition)
2. "Higher Engineering Mathematics" by B.S. Grewal published by Khanna Publishers
3. "Mathematical Methods" by G. Shanker Rao published by I.K. International Publishing House Pvt. Ltd.

References:

1. "Finite Differences and Numerical Analysis" by H.C Saxena published by S. Chand and Company, Pvt. Ltd., New Delhi.

Course Outcomes:

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

1. understand the numerical techniques for various category of problems
2. develop algorithms for approximation techniques
3. Understand the problem of interpolation Know the interpolation techniques when the nodes are evenly spaced
4. Know the interpolation techniques when the nodes are unevenly spaced
5. Understand the iterative techniques such as Gauss-Jacobi, Gauss-Siedel and SOR iterative methods to solve the given system of equations numerically

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	1	1	1	1	1	2	3	3	3	3
CO2	2	1	1	1	1	1	2	3	3	3	3
CO3	2	1	1	1	1	1	2	3	3	3	3
CO4	2	1	1	1	1	1	2	3	3	3	3
CO5	2	1	1	1	1	1	2	3	3	3	3

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

APPROVED IN:

BOS : 13-09-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4

Ensuing an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities

SDG Justification:

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

MATH3011	VECTOR CALCULUS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

Vector calculus is used to solve engineering and science *problems* that involve vectors that not only need to be defined by both its magnitudes and directions.

Course Educational Objectives:

- To define limit of vector function, demonstrate the vector differentiation with examples
- To define gradient of a scalar function, divergence, and curl of a vector function
- To explain line, surface, and volume integrals
- To evaluate applications on Stokes theorem,
- To evaluate Gauss divergence theorem, and green's theorem

UNIT 1 **Limits of vector point functions** **8 hours**

Scalar valued and vector valued point functions, limits, Directional derivatives along co-ordinate axis, along any line

UNIT 2 **Vector differentiation** **8 hours**

Vector Differentiation, Ordinary derivatives of vectors, Differentiability, Tangent vector of a curve, Unit tangent vector, Principle normal, curvature, Binormal, Torsion, Frenet -Serret formulae and applications

UNIT 3 **Vector identities** **8 hours**

Gradient, Divergence, Cur, their geometrical interpretations, and Successive operations

UNIT 4 **Line, surface and Volume integrals** **8 hours**

Line Integral, Surface Integral, Volume Integral

UNIT 5 **8 hours**

Stokes theorem, Gauss divergence theorem and applications, Greens Theorem and applications.

Textbooks:

1. Vector Calculus by Santhi Narayana Published by S. Chand & Company Pvt. Ltd., New Delhi.
2. Vector Calculus by R. Gupta Published by Laxmi Publications.
3. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.

References:

1. H. Anton, I. Bivens and S. Davis, *Calculus*, John Wiley and Sons (Asia) P. Ltd. 2002.
2. P.C. Matthew's, *Vector Calculus*, Springer Verlag London Limited, 1998.

Course Outcomes:

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

1. define limit of vector function demonstrate the vector differentiation with examples
2. define gradient of a scalar function, divergence, and curl of a vector function
3. explain line, surface, and volume integrals
4. evaluate applications on Stokes theorem,
5. evaluate Gauss divergence theorem, and Green's theorem

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	1	1	1	1	1	2	3	3	2	2
CO2	2	1	1	1	1	1	2	3	3	2	2
CO3	2	1	1	1	1	1	2	3	3	2	2
CO4	2	1	1	1	1	1	2	3	3	2	2
CO5	2	1	1	1	1	1	2	3	3	2	2

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

APPROVED IN:

BOS : 13-09-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4

Ensuing an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities

SDG Justification:

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

MATH3021	NUMERICAL METHODS USING MATLAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	**MATH3001: Numerical Methods**						
Co-requisite	**MATH3001: Numerical Methods**						
Preferable exposure	**None**						

Course Description:

Numerical analysis is the study of algorithms that use numerical approximation for the problems of mathematical analysis. Numerical analysis naturally finds application in all fields of engineering and the physical sciences. Numerical analysis can only be applied to real-world measurements by translation into digits; it gives approximate solutions within specified error bounds.

Course Educational Objectives:

1. To solve various categories of problems.
2. To understand the usage of intermediate value theorem in locating the roots of an equation
3. To understand the iterative techniques such as Gauss-Jacobi, Gauss-Siedel and SOR iterative methods to solve the given system of equations numerically
4. To Know the interpolation techniques when the nodes are unevenly spaced
5. To Know the techniques for numerical differentiation with finite difference operators

1. Problems on absolute, relative and percentage errors
2. Find a root of an equation using bisection method
3. Find a root of an equation using the iteration method
4. Find a root of an equation using the method of false position
5. Find a root of an equation using Newton Raphson method
6. Solving system of simultaneous equations using Gauss elimination method
7. Solving system of simultaneous equations using LU decomposition method
8. Solving system of simultaneous equations using Gauss-Jacobi method
9. Solving system of simultaneous equations using Gauss-Siedel method
10. Problems using Newton's forward and backward interpolation formulae
11. Problems using divided difference and Lagrange's interpolation formulae
12. Problems using Stirling's and Bessel's formulae
13. Problems on Trapezoidal and Simpson's rules for Numerical integration

Course Outcomes:

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

1. understand the numerical techniques for various category of problems
2. develop algorithms for approximation techniques
3. Understand the problem of interpolation Know the interpolation techniques when the nodes are evenly spaced
4. Know the interpolation techniques when the nodes are unevenly spaced
5. Understand the iterative techniques such as Gauss-Jacobi, Gauss-Siedel and SOR iterative methods to solve the given system of equations numerically

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	1	1	1	1	1	2	3	3	3	3
CO2	2	1	1	1	1	1	2	3	3	3	3
CO3	2	1	1	1	1	1	2	3	3	3	3
CO4	2	1	1	1	1	1	2	3	3	3	3
CO5	2	1	1	1	1	1	2	3	3	3	3

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

APPROVED IN:

BOS : 13-09-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

Ensuing an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities

SDG Justification:

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

MATH3031	VECTOR CALCULUS LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	**MATH3011: Vector Calculus**						
Co-requisite	**MATH3011: Vector Calculus**						
Preferable exposure	**None**						

Course Description:

Vector calculus is used to solve engineering and science *problems* that involve vectors that not only need to be defined by both its magnitudes and directions.

Course Educational Objectives:

- To define limit of vector function, demonstrate the vector differentiation with examples
- To define gradient of a scalar function, divergence, and curl of a vector function
- To explain line, surface, and volume integrals
- To evaluate applications on Stokes theorem,
- To evaluate Gauss divergence theorem, and green's theorem

1. Problems on directional derivatives
2. Problems on Vector differentiation
3. Problems on Vector identities
4. Problems online integrals
5. Problems on surface integrals
6. Problems on Volume integrals
7. Problems on Gauss divergence theorem
8. Problems on Stokes theorem
9. Problems on Greens theorem

Course Outcomes:

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

1. define limit of vector function demonstrate the vector differentiation with examples
2. define gradient of a scalar function, divergence, and curl of a vector function
3. explain line, surface, and volume integrals
4. evaluate applications on Stokes theorem,
5. evaluate Gauss divergence theorem, and Green's theorem

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	1	1	1	1	1	2	3	3	2	2
CO2	2	1	1	1	1	1	2	3	3	2	2
CO3	2	1	1	1	1	1	2	3	3	2	2
CO4	2	1	1	1	1	1	2	3	3	2	2
CO5	2	1	1	1	1	1	2	3	3	2	2

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

APPROVED IN:

BOS : 13-09-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4

Ensuing an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities

SDG Justification:

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

MATH3041	DISCRETE MATHEMATICS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

Discrete Mathematics introduces students to the mathematics of networks, social choice, and decision making. This course provides students with a hands-on exploration of the relevancy of mathematics in the real world. Applications and modeling are essential to discrete mathematical structures course. Proper technology should be used frequently for instruction and assessment. This course reflects the rigor taught in many entry-level mathematics courses.

Course Educational Objectives:

- To introduce the statements and different types of connectives
- To discuss the relation between statement calculus and predicate calculus
- To learn theory of recursive functions
- To illustrate the applications of set theory and relations
- To discuss about lattices and Boolean algebra

UNIT 1 **Mathematical logic** **8 hours**

statements, structures and notation, connectives, well-formed formulas, tautologies, equivalences, implications, normal forms- disjunctive and conjunctive, principal disjunctive, and conjunctive normal forms. Theory of Inference: Theory of inferences for statement calculus, validity using truth tables, values of inference.

UNIT 2 **Predicate calculus** **8 hours**

predicates, predicates formulas, quantifiers, free and bound variables, inference theory of predicate calculus. Theory of recursion: Recursive functions, primitive recursive functions, partial recursive functions and Ackerman's functions.

UNIT 3 **Set Theory** **8 hours**

Basic concepts of Set Theory, Notation, Inclusion and Equality of sets, The power set, some operations on sets, Venn diagrams, some basic set identities, The principle of specification, ordered pairs and n-tuples, Cartesian products. **Relations and ordering**: partially ordered relations, partially ordered sets, representation and associated terminology.

UNIT 4 **Lattices** **8 hours**

Lattices as partially ordered sets, some properties of Lattices, Lattices as algebraic systems, sub-lattices, direct product and homomorphism, some special Lattices.

UNIT 5 **Boolean algebra** **8 hours**

Definition and Examples, sub-algebra, direct product and Homomorphism, Boolean Functions, Boolean forms and free Boolean Algebras, values of Boolean expressions and Boolean functions, Representation and Minimization of Boolean functions

Textbooks:

1. Discrete Mathematical structures with applications to computer science by J.P. Trembly and R. Manohar, Tata Mc. Graw Hill edition, 2008.
2. Discrete Mathematical Structures by Kolman, Busby and Ross, Pearson Education, Asia, Fourth Edition, 2002.

References:

1. Discrete Mathematical Structures by Prism, 4th Edition, Prism Books Pvt Limited, 2011.
2. Elements of Discrete Mathematics by CL Liu, Tata Mc Graw –Hill, Publishing company (second edition), 2010.

Course Outcomes:

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

1. discuss connectives and well-formed formulas
2. evaluate normal forms and illustrate theory of inference for statement calculus
3. explain sub-lattices, direct product and homomorphism of lattices
4. explain Boolean functions and free Boolean algebras
5. explain representation and minimization of Boolean functions

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	1	1	1	1	1	2	2	3	3	2
CO2	3	1	1	1	1	1	2	2	3	3	2
CO3	3	1	1	1	1	1	2	2	3	3	2
CO4	3	1	1	1	1	1	2	2	3	3	2
CO5	3	1	1	1	1	1	2	2	3	3	2

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

APPROVED IN:

BOS : 13-09-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4

Ensuing an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities

SDG Justification:

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

MATH3051	DISCRETE MATHEMATICS LAB	L	T	P	S	J	C
		0	0	0	0	0	3
Pre-requisite	**MATH3041: Discrete Mathematics**						
Co-requisite	**MATH3041: Discrete Mathematics**						
Preferable exposure	**None**						

Course Description:

Discrete Mathematics introduces students to the mathematics of networks, social choice, and decision making. This course provides students with a hands-on exploration of the relevancy of mathematics in the real world. Applications and modeling are essential to discrete mathematical structures course. Proper technology should be used frequently for instruction and assessment. This course reflects the rigor taught in many entry-level mathematics courses.

Course Educational Objectives:

- To introduce the statements and different types of connectives
- To discuss the relation between statement calculus and predicate calculus
- To learn theory of recursive functions
- To illustrate the applications of set theory and relations
- To discuss about lattices and Boolean algebra

1. Problems on equivalence and implications
2. Problems on PDNF and PCNF
3. Problems on validity of the statements using truth tables
4. Problems on validity of the statements using direct method
5. Problems on validity using indirect method of proof
6. Problems on predicate calculus
7. Problems on set theory
8. Problems on relations
9. Problems on lattice theory
10. Problems on Boolean algebra

Course Outcomes:

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

1. discuss connectives and well-formed formulas
2. evaluate normal forms and illustrate theory of inference for statement calculus
3. explain sub-lattices, direct product and homomorphism of lattices
4. explain Boolean functions and free Boolean algebras
5. explain representation and minimization of Boolean functions

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	1	1	1	1	1	2	2	3	3	2
CO2	3	1	1	1	1	1	2	2	3	3	2
CO3	3	1	1	1	1	1	2	2	3	3	2
CO4	3	1	1	1	1	1	2	2	3	3	2
CO5	3	1	1	1	1	1	2	2	3	3	2

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

APPROVED IN:

BOS : 13-09-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4

Ensuing an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities

SDG Justification:

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

MATH2121	LINEAR PROGRAMMING	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

Linear programming is a mathematical technique for maximizing or minimizing a linear function of several variables, such as output. Linear programming is a part of operations research. Linear programming finds application in all fields of engineering, physical sciences, and life sciences. Linear programming can be applied to solve real world problems.

Course Educational Objectives:

- To introduce formulation of linear programming model
- To discuss the methods to solve linear programming problems
- To study the optimality
- To study unboundedness in a linear programming problem
- To know the applications of sensitivity analysis

UNIT 1 **8 hours**

Linear Programming Problems, Graphical Approach for Solving some Linear Programs. Convex Sets, Supporting and Separating Hyperplanes.

UNIT 2 **8 hours**

Theory of simplex method, optimality and unboundedness, the simplex algorithm, simplex method in tableau format

UNIT 3 **8 hours**

Introduction to artificial variables, two-phase method, Big-M method, and their comparison.

UNIT 4 **8 hours**

Duality, formulation of the dual problem, primal- dual relationships, economic interpretation of the dual

UNIT 5 **8 hours**

Sensitivity analysis.

Textbooks:

1. "Operations Research" by S.D. Sharma published by Kedarnath and Ramnath Co.
2. "Linear Programming and Network Flows" by Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali published by John Wiley and Sons, India, 2004, 2nd edition.

References:

1. "Introduction to Operations Research" by Frederick S. Hiller and Gerald J. Lieberman published by Tata McGraw Hill, Singapore, 2004, 8th edition.
2. "Operations Research: An Introduction" by Hamdy A. Taha published byPrentice-HallIndia, 2006, 8th edition.

Course Outcomes:

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

1. Formulate linear programming model for a business problem
2. Compare two phase method and Big-M method
3. Explain duality and formulation of the dual problem
4. Differentiate primal- dual problems
5. Provide examples using sensitivity analysis

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	1	1	1	1	1	2	3	3	2	3
CO2	3	1	1	1	1	1	2	3	3	2	3
CO3	3	1	1	1	1	1	2	3	3	2	3
CO4	3	1	1	1	1	1	2	3	3	2	3
CO5	3	1	1	1	1	1	2	3	3	2	3

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

APPROVED IN:

BOS : 13-09-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4

Ensuing an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities

SDG Justification:

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

MATH2131	TRANSPORTATION AND GAME THEORY	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

In the transportation field, game theory approaches have been used to address different problems, including traffic assignment, matching riders and drivers in ride-sharing, and congestion pricing.

Course Educational Objectives:

- To state transportation and assignment problem as a linear programming problem
- To determine optimality conditions by using Simplex method.
- To explain travelling salesman problem
- To explain game theory
- To explain mixed strategies using linear programming techniques and algebraic methods

UNIT 1 **8 hours**

Transportation problem and its mathematical formulation, northwest-corner method, Least cost method and Vogel approximation method for determination of starting basic solution, algorithm for solving transportation problem

UNIT 2 **8 hours**

Non- Degeneracy and Degeneracy in transportation Problems

UNIT 3 **8 hours**

Assignment problem and its mathematical formulation, Hungarian method for solving assignment problem, Travelling Salesman Problem

UNIT 4 **8 hours**

Game theory 1: formulation of two-person zero sum games, solving two person zero

sum games, games with mixed strategies, Dominance principle, Graphical solution procedure

UNIT 5 **8 hours**

Game theory 2: Mixed strategies using Linear Programming techniques, Algebraic Methods, Matrix method and short cut method

Textbooks:

1. "Linear Programming and Network Flows" by Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali published by John Wiley and Sons, India, 2004, 2nd edition.
2. "Introduction to Operations Research" by Frederick S. Hiller and Gerald J. Lieberman published by Tata McGraw Hill, Singapore, 2009, 9th edition.

References:

1. "Operations Research: An Introduction" by Hamdy A. Taha published byPrentice-HallIndia, 2006, 8th edition.

Course Outcomes:

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

1. state transportation and assignment problem as a linear programming problem
2. determine optimality conditions by using Simplex method.
3. explain travelling salesman problem
4. explain game theory
5. explain mixed strategies using linear programming techniques and algebraic methods

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	1	1	1	1	1	2	3	3	2	3
CO2	3	1	1	1	1	1	2	3	3	2	3
CO3	3	1	1	1	1	1	2	3	3	2	3
CO4	3	1	1	1	1	1	2	3	3	2	3
CO5	3	1	1	1	1	1	2	3	3	2	3

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

APPROVED IN:

BOS : 13-09-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4

Ensuing an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities

SDG Justification:

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

MATH2141	LINEAR PROGRAMMING LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	**MATH2121: Linear Programming**						
Co-requisite	**MATH2121: Linear Programming**						
Preferable exposure	**None**						

Course Description:

Linear programming is a mathematical technique for maximizing or minimizing a linear function of several variables, such as output. Linear programming is a part of operations research. Linear programming finds application in all fields of engineering, physical sciences, and life sciences. Linear programming can be applied to solve real world problems.

Course Educational Objectives:

- To introduce formulation of linear programming model
- To discuss the methods to solve linear programming problems
- To study the optimality
- To study unboundedness in a linear programming problem
- To know the applications of sensitivity analysis

1. Problems on simplex method
2. Problems on Two Phase simplex method
3. Problems on Big-M method
4. Problems on Artificial variable techniques
5. Problems on Duality
6. Sensitivity Analysis

Course Outcomes:

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

1. Formulate linear programming model for a business problem
2. Compare two phase method and Big-M method
3. Explain duality and formulation of the dual problem
4. Differentiate primal- dual problems
5. Provide examples using sensitivity analysis

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	1	1	1	1	1	2	3	3	2	3
CO2	3	1	1	1	1	1	2	3	3	2	3
CO3	3	1	1	1	1	1	2	3	3	2	3
CO4	3	1	1	1	1	1	2	3	3	2	3
CO5	3	1	1	1	1	1	2	3	3	2	3

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

APPROVED IN:

BOS : 13-09-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4

Ensuing an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities

SDG Justification:

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

MATH2151	TRANSPORTATION AND GAME THEORY LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	MATH2131: Transportation and Game Theory						
Co-requisite	MATH2131: Transportation and Game Theory						
Preferable exposure	None						

Course Description:

In the transportation field, game theory approaches have been used to address different problems, including traffic assignment, matching riders and drivers in ride-sharing, and congestion pricing.

Course Educational Objectives:

- To state transportation and assignment problem as a linear programming problem
- To determine optimality conditions by using Simplex method.
- To explain travelling salesman problem
- To explain game theory
- To explain mixed strategies using linear programming techniques and algebraic methods

1. Problems on initial basic feasible solution to a transportation problem
2. Problems on optimal solution to a transportation problem
3. Problems on Non-Degeneracy and Degeneracy in transportation
4. Problems on Assignment problems
5. Problems on Travelling salesman problem
6. Problems on Games
7. Mixed strategies games using Linear Programming techniques
8. Algebraic methods in games

Course Outcomes:

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

1. state transportation and assignment problem as a linear programming problem
2. determine optimality conditions by using Simplex method.
3. explain travelling salesman problem
4. explain game theory
5. explain mixed strategies using linear programming techniques and algebraic methods

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	1	1	1	1	1	2	3	3	2	3
CO2	3	1	1	1	1	1	2	3	3	2	3
CO3	3	1	1	1	1	1	2	3	3	2	3
CO4	3	1	1	1	1	1	2	3	3	2	3
CO5	3	1	1	1	1	1	2	3	3	2	3

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

APPROVED IN:

BOS : 13-09-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4

Ensuing an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities

SDG Justification:

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

MATH2161	COMPLEX ANALYSIS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**MATH2001:Real Analysis**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

Complex analysis is the branch of mathematical analysis that investigates functions of complex numbers, and it is known as the theory of functions of a complex variable. Complex analysis naturally finds application in all fields of engineering and the physical sciences. Complex analysis can be applied to real-world problems

Course Educational Objectives:

- Basic properties of complex numbers
- Cauchy-Riemann equations
- Analytical functions
- Contours and their properties
- Expansion of the function using Taylor's series

UNIT 1 **8 hours**

Limits, Limits involving the point at infinity, continuity. Properties of complex numbers, regions in the complex plane, functions of complex variable, mappings. Derivatives, differentiation formulas, Cauchy-Riemann equations, sufficient conditions for differentiability.

UNIT 2 **8 hours**

Analytic functions, examples of analytic functions, exponential function, Logarithmic function, trigonometric function, derivatives of functions.

UNIT 3 **8 hours**

Definite integrals of functions. Contours, Contour integrals and its examples, upper bounds for moduli of contour integrals.

UNIT 4 **8 hours**

Cauchy-Goursat theorem, Cauchy integral formula. Liouville's theorem and the fundamental theorem of algebra. Convergence of sequences and series, Taylor series and its examples.

UNIT 5 **8 hours**

Laurent series and its examples, absolute and uniform convergence of power series.

Textbooks:

1. "Complex Analysis for Mathematics and Engineering" by John H. Mathews and Russell W. Howell published by Jones and Bartlett publishers, 5th edition.
2. "Complex Variables and Applications" by James Ward Brown and Ruel Vance Churchill published by Mc Graw-Hill Higher Education, 8th edition.

References:

1. "Complex Analysis" by Joseph Bak and Donald J. Newman published by Springer-Verlag New York, Inc., New York, 1997,2nd edition.

Course Outcomes:

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

1. discuss the basic properties of complex numbers
2. determine Cauchy-Riemann equations
3. evaluate problems on Analytical functions
4. discuss Contours and their properties
5. demonstrate the expansion of the function using Taylor's series

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	1	1	1	1	1	2	3	3	2	2
CO2	2	1	1	1	1	1	2	3	3	2	2
CO3	2	1	1	1	1	1	2	3	3	2	2
CO4	2	1	1	1	1	1	2	3	3	2	2
CO5	2	1	1	1	1	1	2	3	3	2	2

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

APPROVED IN:

BOS : 13-09-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4

Ensuing an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities

SDG Justification:

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

MATH2171	FUNCTIONAL ANALYSIS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	MATH2001: Real Analysis						
Co-requisite	None						
Preferable exposure	None						

Course Description:

Functional analysis is the study of certain topological-algebraic structures and the properties of bounded linear maps on these structures. The aim of this course is to study the topological spaces, Banach spaces, Hilbert spaces and spectral theory.

Course Educational Objectives:

- To introduce the fundamentals of topology to meet the needs of modern mathematics
- To show the use of abstract algebraic/topological structures in studying spaces of functions
- To give a working knowledge on basic properties of Banach, Hilbert spaces and bounded linear operators
- To introduce the ideas behind some fundamental theorems
- To present the notions of duals and adjoints

UNIT 1 Topological spaces 8 hours

The definition and some examples, Elementary concepts, open bases and open subbases, weak topologies, The function algebras C(X, R) and C(X,C).

UNIT 2 Compactness 8 hours

compact spaces, products of spaces, Tychonoff's theorem and locally compact spaces, compactness for metric spaces.

UNIT 3 Banach spaces 8 hours

The definition and some examples, continuous linear transformations, The Hahn-Banach theorem, The natural imbedding of N in N^{**} , The open mapping theorem, The conjugate of an operator.

UNIT 4 **Hilbert spaces** **8 hours**

The definition and some simple properties, orthogonal complements, orthonormal sets, the conjugate space H^*, the adjoint of an operator, self-adjoint operators.

UNIT 5 **8 hours**

Normal and Unitary operators, Projections, the spectrum of an operator, the spectral theorem.

Textbook:

1. Introduction to Topology and Modern Analysis by G.F. Simons, Mc Graw Hill, 2004

References:

1. Functional Analysis by B.V.Limaye, Wiley Eastern Ltd, 1981
2. Functional Analysis by J.N.Sharma & A. Vasishta, 31st edition, Krishna Prakashan, 2010.

Course Outcomes :

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

- understand how functional analysis uses and unifies the ideas from vector spaces, the theory of matrices and complex analysis
- understand the notions of dot product and Hilbert space.
- use properly the specific techniques for bounded operators over normed and Hilbert spaces.
- recognize the fundamental properties of Banach spacesspacesand Hilbert spaces
- acquainted with the statement of the Hahn-Banach theorem and its corollaries, the open mapping theorem and the closed graph theorem

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	1	1	1	1	1	2	3	3	2	2
CO2	2	1	1	1	1	1	2	3	3	2	2

CO3	2	1	1	1	1	1	2	3	3	2	2
CO4	2	1	1	1	1	1	2	3	3	2	2
CO5	2	1	1	1	1	1	2	3	3	2	2

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

APPROVED IN:

BOS : 13-09-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4

Ensuing an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities

SDG Justification:

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

MATH2181	NUMBER THEORY	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

This course is designed to explain the basics and applications of number theory for the students of Computer Science. The core courses of these branches encounter with concepts like prime factorization, modular arithmetic, and quadratic reciprocities in number theory. The first unit of the course provide a strong platform for such encounters and the other units focuses on applications of number theory.

Course Educational Objectives:

- To define division algorithm
- To demonstrate the fundamental theorem of arithmetic
- To explain prime number theorem
- To explain complete set of residues
- To evaluate problems using Möbius inversion formula

UNIT 1 **8 hours**

Division algorithm, Lame's theorem, linear Diophantine equation, fundamental theorem of arithmetic

UNIT 2 **8 hours**

Prime counting function, statement of prime number theorem, Goldbach conjecture

UNIT 3 **8 hours**

Binary and decimal representation of integers, linear congruences, complete set of residues.

UNIT 4 **8 hours**

Number theoretic functions, sum and number of divisors, totally multiplicative functions, definition and properties of the Dirichlet product.

UNIT 5 **8 hours**

The Möbius inversion formula, the greatest integer function, Euler's phi-function.

Textbooks:

1. David M. Burton, *Elementary Number Theory* 6th Ed., Tata McGraw-Hill Edition, \Indian reprint, 2007.
2. Richard E. Klima, Neil Sigmon, Ernest Stitzinger, *Applications of Abstract Algebra with Maple*, CRC Press, Boca Raton, 2000.

References:

1. Neville Robinns, *Beginning Number Theory,* 2nd Ed., Narosa Publishing House Pvt. Limited, Delhi, 2007.

Course Outcomes:

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

1. Define division algorithm
2. Demonstrate the fundamental theorem of arithmetic
3. Explain prime number theorem
4. Explain complete set of residues
5. Evaluate problems using Möbius inversion formula

CO-PO Mapping:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
CO1	2	1	1	1	1	1	2	2	3	3	2
CO2	2	1	1	1	1	1	2	2	3	3	2
CO3	2	1	1	1	1	1	2	2	3	3	2

CO4	2	1	1	1	1	1	2	2	3	3	2
CO5	2	1	1	1	1	1	2	2	3	3	2

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

APPROVED IN:

BOS : 13-09-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4

Ensuing an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities

SDG Justification:

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

MATH2191	GRAPH THEORY	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

Graph theory is an introductory course to the basic concepts of graphs. This includes definition of graphs, vertex degrees, directed graphs, connectivity, trees, optimization involving trees, paths, and shortest paths.

Course Educational Objectives:

- To understand different types of graphs and their properties
- To learn the basic concept and applications of graphs
- To learn the basic concept and applications of paths and circuits using connectivity
- To learn spanning trees
- To identify and practice the difference between Eulerian and Hamiltonian graphs

UNIT 1 **Graphs and digraphs** **8 hours**

Introduction, Graph Isomorphism, Subgraphs, Degrees, Indegrees, and Outdegrees, Adjacency Matrices and Incidence Matrices, Degree Vectors of Simple Graphs

UNIT 2 **Connectivity** **8 hours**

Paths, Circuits, and Cycles, Connected Graphs and Digraphs, Trees and Spanning Trees, Strong Orientations of Graphs

UNIT 3 **Eulerian and hamiltonian graphs** **8 hours**

Eulerian Graphs and Digraphs, Hamiltonian Graphs and Digraphs, Tournaments

UNIT 4 Optimization involving trees 8 hours

Minimum Weight Spanning Trees, Maximum Weight Branching's, Minimum Weight Arborescence's, Matroids and the Greedy Algorithm

UNIT 5 Shortest path problems 8 hours

Two Shortest Path Algorithms, The Steiner Network Problem, Facility Location Problems

Textbooks:

1. Graph Theory by V.K. Balakrishnan**,** Schaum's Outline Series, Tata Mc Graw – Hill edition.,2007

References:

1. Discrete Mathematics, Schaum's outlineserie, by Seymour Lipschutz and Marc Lipson Tata Mc Graw Hill, 2nd Edition.
2. Discrete Mathematical Structures by Prism, 4th Edition, Prism Books Pvt Limited, 2011.
3. Graph theory with applications to engineering and computer science by Narsingh Deo, Prentice-Hall of India Pvt.ltd, 2014

Course Outcomes:

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

1. define graph, subgraph, degree of a vertex
2. explain trees and spanning trees
3. explain Hamiltonian graphs
4. explain about minimum weight spanning trees
5. explain the Steiner Network Problem

CO-PO Mapping:

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	1	1	1	1	1	2	3	3	3	2
CO2	3	1	1	1	1	1	2	3	3	3	2
CO3	3	1	1	1	1	1	2	3	3	3	2
CO4	3	1	1	1	1	1	2	3	3	3	2
CO5	3	1	1	1	1	1	2	3	3	3	2

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

APPROVED IN:

BOS : 13-09-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4

Ensuing an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities

SDG Justification:

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

MATH3121	CLASSICAL MECHANICS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

Classical mechanics is important backbone of physics which deals with understanding the motion of particles. This course covers Newtonian Mechanics, Lagrangian and Hamiltonian dynamics, canonical transformations, and theory of relativity

Course Educational Objectives:

- To know the concepts of Newtonian mechanics
- To differentiate holonomic and non-holonomic constraints
- To explain D Alembert's principle
- To understand the concept of Hamilton's principle
- To identify the difference between Euler's and Hamiltonian

UNIT 1 Introductory Concepts of Newtonian Mechanics 8 hours

Mechanics of particle-law of conservation of Linear Momentum, Angular Momentum and conservation of Energy. Mechanics of System of Particles-Conservation of linear and Angular Momentum and conservation of energy.

UNIT 2 Lagrangian Dynamics 8 hours

Constraints-Types of Constraints-Holonomic and Non holonomic. Generalized coordinates, principle of virtual work, D Alemberts Principle, Lagrange's Equation from D Alemberts Principle.Hamiltons principle -Lagrange's equation from Hamiltons principle, Superiority of Lagrangian mechanics over Newtonian approach.

UNIT 3 Hamiltonian Dynamics and Variational Principles 8 hours

Generalized Momentum and Cyclic coordinates, Conservation of Linear Momentum, Conservation of Angular Momentum and Jacobi Integral. Hamiltons Equation. Calculus of variation and Euler- Lagranges Equation, Deduction of Hamiltons principle from D Alemberts principle. Modified Hamiltons principle and Principle of Least action

UNIT 4 **Canonical Transformations** **8 hours**

Legendre Transformations, Generating Functions, Condition for canonical Transformations, Poisson Brackets, Lagrange's Brackets and their relation, Invariance of Poisson Brackets with canonical Transformations. Hamiltons Jacobi Method- Application of Harmonic Oscillator.

UNIT 5 **Special Theory of Relativity** **8 hours**

Galelian Transformations, principle of relativity, Postulates of special theory of relativity, Lorentz transformations and Inverse Lorentz transformations, Consequences of Lorentz Transformations-Length contraction, simultaneity, and time dilation.

Textbooks:

1. Classical Mechanics by J.C. Upadhya, Himalaya Publishers

References:

1. Classical mechanics by H. Goldstein, 2nd edition, Narosa publishing House, 2001.
2. Relevant topics from special relativity by W. Rindler, Oliver & Boyd, 2005
3. Classical Mechanics by Aruldhas, 1st Edition, PHI Learning Pvt. Ltd., 2009
4. N.C.Rane and P.S.C. Joag, Classical Mechanics, Tata Mc Graw-Hill ,1991.

Course Outcomes:

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

1. explain conservation of linear momentum
2. explain concept of conservation of energy
3. use mechanics of system of particles
4. explain difference between Lagrangian mechanic's over Newtonian approach
5. explain conservation of angular momentum and Jacobi integral

CO-PO Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	1	1	1	1	1	2	3	3	2	2
CO2	2	1	1	1	1	1	2	3	3	2	2
CO3	2	1	1	1	1	1	2	3	3	2	2
CO4	2	1	1	1	1	1	2	3	3	2	2
CO5	2	1	1	1	1	1	2	3	3	2	2

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

APPROVED IN:

BOS : 13-09-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

Ensuing an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities

SDG Justification:

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

MATH3131	THEORY OF COMPUTATION	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

Theory of computation helps the learners to know the models of computation, along with their variants in the context of formal languages and their recognizers. This course can be applied in designing compilers and pattern recognition system.

Course Educational Objectives:

- To understand the concept of non-deterministic finite state machines
- To establish equivalences of DFA and NDFA
- To classify Chomsky type of languages
- To discuss the ambiguity in context-free grammars
- To design Turing machines

UNIT 1 **The Theory of Automata** **8 hours**

Definition of an Automata, Description of a Finite Automation, Transition systems, properties of transition functions, acceptability of a string by a finite automaton, non-Deterministic finite state machines, the equivalences of DFA and NDFA, Melay and Moore models, Minimization of finite automata.

UNIT 2 **Formal languages** **8 hours**

basic definitions and examples, Chomsky classification of Languages, Languages and their relation, Recursive and recursively enumerable sets, operations of languages, languages, and automata.

UNIT 3 **Regular sets and regular grammars** **8 hours**

Regular expressions, finite automata and regular expressions, pumping lemma for regular sets, application of pumping lemma, closure properties of regular sets, regular sets and regular grammars.

UNIT 4 **Context –free Languages** **8 hours**

Context- free languages and derivation trees, ambiguity in context-free Grammars, simplification of context-free grammars, normal forms for context-free grammars.

UNIT 5 Turing Machines and Linear Bounded Automata 8 hours

Turing Machine model, Representation of Turing Machines, Language acceptability by Turing Machines, Design of Turing Machines, Universal Turing Machines, and other modifications.

Textbooks:

1. Theory of Computer science (Automata, Languages and computation) Chapters: 2,3,4,5.1 to 5.4 and 7.1 to 7.5 by K.L.P.Mishra, N.Chandrasekaran, PHI , Second edition, 1998

Course Outcomes:

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

- explain the concept of deterministic and non-deterministic finite state machines
- establish equivalences of DFA and NDFA
- classify Chomsky type of languages
- discuss the ambiguity in context-free grammars
- design Turing machines

CO-PO Mapping:

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	1	1	1	1	1	2	3	3	3	2
CO2	3	1	1	1	1	1	2	3	3	3	2
CO3	3	1	1	1	1	1	2	3	3	3	2
CO4	3	1	1	1	1	1	2	3	3	3	2
CO5	3	1	1	1	1	1	2	3	3	3	2

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

APPROVED IN:

BOS : 13-09-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

Ensuing an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities

SDG Justification:

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

MATH3141	FLUID DYNAMICS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**MATH3011: Vector Calculus**						
Co-requisite	**MATH3011: Vector Calculus**						
Preferable exposure	**None**						

Course Description:

This course aims to study the fundamentals of fluid mechanics such as kinematics of fluid, incompressible flow, and boundary layer flows.

Course Educational Objectives:

- To understand general equations of motion and equation of continuity
- To learn the basic concept of two-dimensional motion
- To learn the basic concept of Navier stokes equations of motion
- To learn about boundary layer theorem
- To identify integral equations of the boundary layer

UNIT 1 **8 hours**

General equations of motion – Equation of continuity, Equations of motion of an inviscid fluid, irrotational motion, Persistence of irrotational motion, Bernoulli's equation, motion of a fluid element, Kinetic energy, uniqueness theorem, Euler's momentum theorem.

UNIT 2 **8 hours**

Two-dimensional motion introduction, Basic singularities source, sink, doublet, Ranking technique of constructing streamlines method of images circle theorem, Blasius theorem lift force.

UNIT 3 **8 hours**

Dynamics of real fluids- introduction, Navier stokes equations of motion- vorticity and circulation in a Viscous fluid, Exact solutions of N.S. equations. Unsteady of flows.

UNIT 4 **8 hours**

Boundary layer theory- introduction derivation of two-dimensional boundary layer equations- integral equations of the boundary layer.

UNIT 5 **8 hours**

Analytical solutions of the boundary layer equation. Flow parallel to a semi-infinite flat plate. Flow near the stagnation points of a cylinder.

Textbooks:

1. Modern Fluid Dynamics on Compressible flow, Volume 1 by N.Curle and H.J.Davie D.Van Nostrand Company Ltd., London, 1968

References:

1. Fluid Dynamics by M. D. Raisinghania, S. Chand and Co., 2010
2. Textbook of Fluid Dynamics by F. Chorlton, CBS Publications, Delhi, 1985

Course Outcomes:

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

- explain general equations of motion and equation of continuity
- explain the basic concept of two-dimensional motion
- evaluate basic concept of Navier stokes equations of motion
- discuss about boundary layer theorem
- identify integral equations of the boundary layer

CO-PO Mapping:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
CO1	2	1	1	1	1	1	2	3	3	2	2
CO2	2	1	1	1	1	1	2	3	3	2	2
CO3	2	1	1	1	1	1	2	3	3	2	2
CO4	2	1	1	1	1	1	2	3	3	2	2

CO5	2	1	1	1	1	1	2	3	3	2	2

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

APPROVED IN:

BOS : 13-09-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4

Ensuing an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities

SDG Justification:

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

MATH3151	TRANSFORM TECHNIQUES AND TENSOR ANALYSIS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

Transform techniques develops mathematical techniques which are useful in solving real world problems involving differential equations and is a development of ideas which arise in Laplace transforms, integral equations, Calculus of variations, integral transforms, and tensor analysis.

Course Educational Objectives:

- To discuss the properties of Laplace transforms.
- To familiarize the concepts of transforms of derivatives
- To explain convolution theorem
- To discuss the application to differential equations
- To classify the integral equations

UNIT 1 **Laplace transforms** **8 hours**

Transformation of elementary functions, properties, Transforms of derivatives, Transforms of integrals, inverse transforms, convolution theorem, Application to differential equations, simultaneous linear equation with constant coefficients, periodic functions and special functions.

UNIT 2 **Integral equations** **8 hours**

Classification of integral equations, connection with differential equations, integral equations of convolution type, method of successive approximations.

UNIT 3 **Calculus of variations** **8 hours**

Euler's equations, other forms, Solutions of Euler's equations, several dependent variables. Functions involving higher order derivatives.

UNIT 4 **Integral transforms** **8 hours**

Fourier sine, cosine transforms, properties, Applications to Boundary value problems.

UNIT 5 **Tensor Analysis** **8 hours**

N-dimensional space, covariant and contra variant vectors, contraction, second and higher order tensors, quotient law, fundamental tensor, associate tensor, Christoffel symbols, covariant derivatives.

Textbooks:

1. Higher Engineering Mathematics by B.S. Grewal, Khanna publishers, 2012.
2. Tensor calculus a concise course by Barry Spain, Mc Graw Hill, 2002

References:

1. Vector and Tensor Analysis by Lass, Mc Graw Hill, 2002
2. Calculus of variations by Weinstock, Mc Graw Hill, 2002
3. Differential Equations and Calculus of Variations by Elsgolts L, MIR Publishers, 1998

Course Outcomes:

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

1. explain transformation of elementary functions and properties
2. illustrate the concepts of transforms of derivatives and integrals
3. classify integral equations and describe the connection with differential equations
4. explain calculus of variations
5. explain properties of Fourier sine and cosine transforms

CO-PO Mapping:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
CO1	2	1	1	1	1	1	2	3	3	2	2
CO2	2	1	1	1	1	1	2	3	3	2	2
CO3	2	1	1	1	1	1	2	3	3	2	2
CO4	2	1	1	1	1	1	2	3	3	2	2
CO5	2	1	1	1	1	1	2	3	3	2	2

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

APPROVED IN:

BOS : 13-09-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4

Ensuing an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities

SDG Justification:

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