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

Accredited by NAAC with A++ Grade

CURRICULAM AND SYLLABUS

OF

UMATH04 B.Sc. Statistics

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.

UMATH04 B.Sc. Statistics

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.

UMATH04 B.Sc. Statistics

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

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO 1	To apply basic knowledge of statistics to understand the data interpretation problems.
PEO 2	To develop complexity data problem solving techniques using statistical tools.
PEO 3	To establish the methodologies for core statistical 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

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
(Choice Based Credit System)

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

* Pass/Fail courses

Opt any three courses among the five

^ Online/Swayam/NPTEL Courses

Soft skills courses 5 and 6								
Course code	Level	Course title	L	T	P	S	J	C
CLAD2001	2	Preparation for Campus Placement-1 (Soft skills 5A)	0	0	2	0	0	1
CLAD2011	2	Preparation for Higher Education (GRE/ GMAT)-1 (Soft skills 5B)	0	0	2	0	0	1
CLAD2021	2	Preparation for CAT/ MAT - 1 (Soft skills 5C)	0	0	2	0	0	1
CLAD2031	2	Preparation for Campus Placement-2 (Soft skills 6A)	0	0	2	0	0	1
CLAD2041	2	Preparation for Higher Education (GRE/ GMAT)-2 (Soft skills 6B)	0	0	2	0	0	1
CLAD2051	2	Preparation for CAT/ MAT - 2 (Soft skills 6C)	0	0	2	0	0	1

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

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

FACULTY CORE (FC)								
Course code	Level	Course title	L	T	P	S	J	C
MATH1151	1	Differential Calculus	3	0	0	0	0	3
MATH1201	1	Matrices	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
MATH1231	1	Differential Equations	3	0	0	0	0	3
CSCI1281	1	Fundamentals of Object-Oriented Programming with C++	3	0	0	0	0	3
MATH1241	1	Differential Equations Lab	0	0	2	0	0	1
CSCI1291	1	C++ Programming Lab	0	0	2	0	0	1

Program Core courses for B.Sc. Statistics

Course code	Level	Course Title	L	T	P	J	S	C
MATH1171	1	Descriptive Statistics and Probability Theory	3	0	0	0	0	3
MATH1181	1	Descriptive Statistics Lab	0	0	2	0	0	1
MATH1211	1	Mathematical Expectation and Probability Distributions	3	0	0	0	0	3

MATH1221	1	Probability Distributions Lab	0	0	2	0	0	1
MATH2061	2	Statistical Methods	3	0	0	0	0	3
MATH2071	2	Statistical Inference	3	0	0	0	0	3
MATH2081	2	Statistical Methods Lab	0	0	2	0	0	1
MATH2091	2	Statistical Inference Lab	0	0	2	0	0	1
MATH2101	2	Optimization Techniques	3	0	0	0	0	3
MATH2111	2	Optimization Techniques Lab	0	0	2	0	0	1
MATH3061	3	Sampling Techniques and Design of Experiments	3	0	0	0	0	3
MATH3071	3	Statistical Quality Control and Reliability	3	0	0	0	0	3
MATH3081	3	Sampling Techniques and Design of Experiments Lab	0	0	2	0	0	1
MATH3091	3	Statistical Quality Control and Reliability Lab	0	0	2	0	0	1
MATH3101	3	Applied Statistics	3	0	0	0	0	3
MATH3111	3	Applied Statistics Lab	0	0	2	0	0	1

Program Elective courses for B.Sc. Statistics

Course code	Level	Course Title	L	T	P	J	S	C
MATH2201	2	Statistical Demography	3	0	0	0	0	3
MATH2211	2	Actuarial Statistics	3	0	0	0	0	3
MATH2221	2	Statistical Demography Lab	0	0	2	0	0	1
MATH2231	2	Actuarial Statistics Lab	0	0	2	0	0	1
MATH2241	2	Testing of Hypothesis	3	0	0	0	0	3
MATH2251	2	Stochastic Process	3	0	0	0	0	3
MATH2261	2	Estimation Theory	3	0	0	0	0	3
MATH2271	2	Sampling Methods	3	0	0	0	0	3
MATH3161	3	Machine Learning	3	0	0	0	0	3
MATH3171	3	Big Data Analytics	3	0	0	0	0	3
MATH3181	3	Multivariate Analysis	3	0	0	0	0	3
MATH3191	3	Econometrics	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)								

Eligible MINOR courses to be offered to the students of B.Sc. Program		
Stream	**Major course**	**Minor course (Select one)**
Mathematical Science	Statistics	Physics
		Electronics
		Chemistry
		Data Science
		Environmental Science

Students pursuing 4ᵗʰ year of the B.Sc. Statistics 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
MATH4411	400	Statistical Modelling in Predictive Analysis	4	0	0	0	0	4
MATH4311	400	Survival Analysis	3	0	2	0	0	4
MATH4421	400	Optimization Techniques and Decision Modelling	4	0	0	0	0	4
DIST4888	400	Dissertation - I	0	0	0	8	0	4
MATH4441	400	Advanced Design of Experiments	4	0	0	0	0	4
MATH4461	400	Advanced Design of Experiments - Lab	0	0	4	0	0	2
MATH4471	400	Data Analysis Using R - Lab	0	0	4	0	0	2
DIST4999	400	Dissertation - II	0	0	0	16	0	8
		Total						**32**

Minor Enhancement Courses

Bioinformatics

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

Biotechnology

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

Chemistry (Opt Any Two Courses)

Course code	Level	Course Title	L	T	P	S	J	C
CHEM4001	400	Advanced Inorganic Chemistry-1	3	0	2	0	0	4
CHEM4011	400	Advanced Organic Chemistry -1	3	0	2	0	0	4
CHEM4021	400	Advanced Physical Chemistry -1	3	0	2	0	0	4
CHEM4031	400	Advanced Analytical Chemistry -1	3	0	2	0	0	4
CHEM4041	400	Advanced Inorganic Chemistry-2	3	0	2	0	0	4
CHEM4051	400	Advanced Organic Chemistry-2	3	0	2	0	0	4
CHEM4061	400	Advanced Physical Chemistry-2	3	0	2	0	0	4
CHEM4071	400	Advanced Analytical Chemistry-2	3	0	2	0	0	4
CHEM4081	400	Medicinal Chemistry	3	0	2	0	0	4
CHEM4131	400	Regulatory affairs and Quality assurance	3	1	0	0	0	4

Mathematics

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

Statistics

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

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

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

Allocation of credits for 3-year and 4-year B.Sc. Program				
	3-year B.Sc. Program		**4-year B.Sc. Program**	
Type of Course	Credits	% Of Program (in credits)	Credits	% Of Program (in credits)
University Core	12	10%	12	7.5%
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	PSO 1	PSO 2	PSO 3	PSO 4
MATH1151: Differential Calculus	M	L	L	L	L	L	M	H	H	L	H
MATH1201: Matrices	M	L	L	L	L	L	M	H	H	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
MATH1231: Differential Equations	M	L	L	L	L	L	M	H	H	M	M

CSCI1281: Fundamentals of Object-Oriented Programming with C++	H	L	M	L	L	L	M	L	M	H	M
MATH1241: Differential Equations Lab	M	L	L	L	L	L	M	H	H	M	M
CSCI1291: C++ Programming Lab	H	L	M	L	L	L	M	L	M	H	M
MATH1171: Descriptive Statistics and Probability Theory	H	L	L	L	L	L	M	M	M	L	H
MATH1181: Descriptive Statistics Lab	H	L	L	L	L	L	M	M	M	L	H
MATH1211: Mathematical Expectation and Probability Distributions	H	L	L	L	L	L	M	M	M	L	H
MATH1221: Probability Distributions Lab	H	L	L	L	L	L	M	M	M	L	H
MATH2061: Statistical Methods	H	L	L	L	L	L	M	M	M	L	H
MATH2071: Statistical Inference	H	L	L	L	L	L	M	M	M	L	H
MATH2081: Statistical Methods Lab	H	L	L	L	L	L	M	M	M	L	H
MATH2091: Statistical Inference Lab	H	L	L	L	L	L	M	M	M	L	H
MATH2101: Optimization Techniques	H	L	M	L	L	L	M	H	H	M	H
MATH2111: Optimization Techniques Lab	H	L	M	L	L	L	M	H	H	M	H
MATH3061: Sampling Techniques and Design of Experiments	H	L	L	L	L	L	M	M	M	L	H
MATH3071: Statistical Quality Control and Reliability	H	L	L	L	L	L	M	M	M	L	H

MATH3081: Sampling Techniques and Design of Experiments Lab	H	L	L	L	L	L	M	M	M	L	H
MATH3091: Statistical Quality Control and Reliability Lab	H	L	L	L	L	L	M	M	M	L	H
MATH3101: Applied Statistics	H	L	L	L	L	L	M	M	M	L	H
MATH3111: Applied Statistics Lab	H	L	L	L	L	L	M	M	M	L	H
MATH2201: Statistical Demography	H	L	L	L	L	L	M	M	M	L	H
MATH2211: Actuarial Statistics	H	L	L	L	L	L	M	M	M	L	H
MATH2221: Statistical Demography Lab	H	L	L	L	L	L	M	M	M	L	H
MATH2231: Actuarial Statistics Lab	H	L	L	L	L	L	M	M	M	L	H
MATH2241: Testing of Hypothesis	H	L	L	L	L	L	M	M	M	L	H
MATH2251: Stochastic Process	H	L	L	L	L	L	M	M	M	L	H
MATH2261: Estimation Theory	H	L	L	L	L	L	M	M	M	L	H
MATH2271: Sampling Methods	H	L	L	L	L	L	M	M	M	L	H
MATH3161: Machine Learning	H	L	L	L	L	L	M	M	M	L	H
MATH3171: Big Data Analytics	H	L	L	L	L	L	M	M	M	L	H
MATH3181: Multivariate Analysis	H	L	M	L	L	L	M	M	M	L	H
MATH3191: Econometrics	H	L	L	L	L	L	M	M	M	L	H

Syllabus

University Core

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

Course Description:

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

Course Educational Objectives:

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

10 hours

List of Experiments:

1. Create a typical document consisting of text, tables, pictures, multiple columns, with different page orientations.
2. Create a technical paper / technical report consisting of table of contents, table of figures, table of tables, bibilography, index, etc.
3. Compose and send customized mail / e-mail using mail-merge.
4. Create / modify a power point presentation with text, multimedia using templates with animation.
5. Create spreadsheet with basic calculations with relative reference, absolute reference and mixed reference methods.
6. Simple report preparation using filtering tool / advanced filtering commands / pivot tables in spreadsheet application.
7. Analyze the results of a examination student wise, teacher wise, course wise, institute-wise.

8. Collecting and consolidating data using collaborative tools like google docs, sheets, forms.
9. Create charts / pictures using online tools like: www.draw.io or smartdraw
10. Create a website of his interest.

Text Books:

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

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

References

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

Course Outcomes:

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

Co-Po Mapping

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

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

APPROVED IN:

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

SDG No. & Statement:4

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

SDG Justification:

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

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

Course Description:

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

Course Educational Objectives:

- Use EI to relate more effectively to themselves, their colleagues and to others. Apply self-awareness and self-assessment (SWOT) to better understand and manage their own emotions. Apply social awareness to empathize with others and build stronger relationships with others.

- Set meaningful goals based on their strengths and weaknesses and apply time management techniques, such as Q4 organizing to put first things first.

- Manage conflicts and work in teams in an emotionally intelligent manner.

- Solve questions on non-verbal and analytical reasoning, data sufficiency and puzzles

List of Activities & Tasks for Assessment:

Unit	Topics	Hours
1	Self-Awareness & Self-Regulation: Introduction to Emotional Intelligence, *Self-Awareness:* Self-Motivation, Accurate Self-Assessment (SWOT Analysis),Self-Regulation: *Self Control, Trustworthiness & Adaptability*	3
2	Importance, Practising Social Awareness, Building Relationships, Healthy andUnhealthy Relationships, Relationship Management Competencies-	3

	Influence, Empathy, Communication, Types of Conflicts, Causes, Conflict Management	
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

APPROVED IN:

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

SDG No. & Statement:4

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

SDG Justification:

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

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

Course Description:

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

Course Educational Objectives:

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

List of Activities & Tasks for Assessment:

1. Career Preparedness: Resume & Cover Letter Writing, Interview Skills: Elevator Pitch, Making the First Impression, Being Other-Oriented, Being Positive and Curious, communicating with Confidence and Poise, Frequently Asked Questions & How to Answer Them, Pitfalls to Avoid, Etc. Etiquette: Hygiene, Courtesy, Culture differences, Workplace, use of cell phone, Profanity, Slang, Protocol.

2. Verbal Ability: Practicing Reading Comprehension, Error Detection, Sentence Completion, MCQs, FIBs, Para jumbles, Cloze Test, Critical Reasoning.

3. Quantitative Aptitude: Number Systems, Algebra, Geometry, Data Handling, Data Sufficiency, Word Problems

4. Reasoning: Logical and Verbal Reasoning

References:

1. Verbal Ability & Reading Comprehension by Arun Sharma and MeenakshiUpadhyay

2. Study material for CAT, SAT, GRE, GMAT by TIME, 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 behaviour and community values.

Course Educational Objectives:

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

List of Community Service Activities:

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

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

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

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

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

CO-PO Mapping:

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

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

APPROVED IN:

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

SDG No. & Statement:

SDG 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

SDG17 : Strengthen the means of implementation and revitalize the global partnership for sustainable development

SDG Justification:

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

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

Course Description:

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

Course Educational Objectives:

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

List of Community Service Activities:

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

List of Activities:
1. Organizing and leading teams in various community service activities
2. Fortnightly reflection paper
3. Portfolio (on social media using an 60nstagram account)
4. Two learning papers (one per semester)

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

References:

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

Course Outcomes:

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

CO-PO Mapping:

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

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

APPROVED IN:

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

SDG No. & Statement:

SDG 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

SDG17 : Strengthen the means of implementation and revitalize the global partnership for sustainable development

SDG Justification:

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

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

Course Description:

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

Course Educational Objectives:

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

List of Activities:

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

Instructional Plan:

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

References:

1. Handbook of the Badminton World Federation (BWF)

Course Outcomes:

1. Learn to play Badminton

2. Understanding of the fundamental concepts such as rules of play, game variations

3. Understanding of the governing structure and administration of the sport

4. Understand the event management of the sport

5. Apply sport concepts into an active physical lifestyle

CO-PO Mapping:

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

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

APPROVED IN:

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

SDG No. & Statement:4

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

SDG Justification:

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

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

Course Description:

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

Course Educational Objectives:

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

List of Activities:

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

Instructional Plan:

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

References:

1. International Chess Federation (FIDE) Handbook

Course Outcomes:

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

CO-PO Mapping:

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

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

APPROVED IN:

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

SDG No. & Statement:4

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

SDG Justification:

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

DOSP1021	CARROM	L	T	P	S	J	C
		0	0	0	2	0	2

Pre-requisite	None
Co-requisite	None
Preferable exposure	None

Course Description:

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

Course Educational Objectives:

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

List of Activities:

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

Instructional Plan:

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

References:

1. Indian Carrom Federation Handbook - Laws

Course Outcomes:

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

CO-PO Mapping:

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

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

APPROVED IN:

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

SDG No. & Statement:4

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

SDG Justification:

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

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

Course Description:

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

Course Educational Objectives:

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

List of Activities:

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

Instructional Plan:

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

References:

1. FIFA Laws of the Game

Course Outcomes:

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

CO-PO Mapping:

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

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

APPROVED IN:

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

SDG No. & Statement:4

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

SDG Justification:

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

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

Course Description:

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

Course Educational Objectives:

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

List of Activities:

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

Instructional Plan:

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

References:

1. FIVB - Official Volleyball Rules

Course Outcomes:

1. Learn to play Volleyball

2. Understanding of the fundamental concepts such as rules of play, game variations

3. Understanding of the governing structure and administration of the sport

4. Understand the event management of the sport

5. Apply sport concepts into an active physical lifestyle

CO-PO Mapping:

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

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

APPROVED IN:

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

SDG No. & Statement:4

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

SDG Justification:

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

DOSP1051	KABADDI	L	T	P	S	J	C
		0	0	0	2	0	2

Pre-requisite	None
Co-requisite	None
Preferable exposure	None

Course Description:

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

Course Educational Objectives:

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

List of Activities:

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

Instructional Plan:

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

References:

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

Course Outcomes:

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

CO-PO Mapping:

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

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

APPROVED IN:

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

SDG No. & Statement:4

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

SDG Justification:

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

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

Course Description:

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

Course Educational Objectives:

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

List of Activities:

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

Instructional Plan:

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

References:

1. Khelo India Official Rulebook of Kho Kho

Course Outcomes:

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

CO-PO Mapping:

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

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

APPROVED IN:

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

SDG No. & Statement:4

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

SDG Justification:

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

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

Course Description:

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

Course Educational Objectives:

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

List of Activities:

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

Instructional Plan:

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

References:

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

Course Outcomes:

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

CO-PO Mapping:

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

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

APPROVED IN:

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

SDG No. & Statement:4

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

SDG Justification:

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

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

Course Description:

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

Course Educational Objectives:

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

List of Activities:

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

Instructional Plan:

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

References:

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

Course Outcomes:

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

CO-PO Mapping:

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

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

APPROVED IN:

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

SDG No. & Statement:4

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

SDG Justification:

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

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

Course Description:

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

Course Educational Objectives:

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

List of Activities:

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

Instructional Plan:

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

References:

1. FIBA Basketball Official Rules

Course Outcomes:

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

CO-PO Mapping:

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

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

APPROVED IN:

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

SDG No. & Statement:4

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

SDG Justification:

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

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

Course Description:

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

Course Educational Objectives:

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

List of Activities:

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

Instructional Plan:

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

References:

1. Handbook of the International Tennis Federation (ITF)

Course Outcomes:

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

CO-PO Mapping:

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

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

APPROVED IN:

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

SDG No. & Statement:4

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

SDG Justification:

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

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

Course Description:

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

Course Educational Objectives:

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

List of Activities:

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

Instructional Plan:

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

References:

1. World Throwball Federation - Rules of the Game

Course Outcomes:

1. Learn to play Throwball

2. Understanding of the fundamental concepts such as rules of play, game variations

3. Understanding of the governing structure and administration of the sport

4. Understand the event management of the sport

5. Apply sport concepts into an active physical lifestyle

CO-PO Mapping:

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

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

APPROVED IN:

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

SDG No. & Statement:4

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

SDG Justification:

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

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

Course Description:

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

Course Educational Objectives:

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

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

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**   **10 hours**
                        Protection Act and Field work

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.

Reference Book(s):

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

Journal(s):

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

Website(s):

https://www.ugc.ac.in/oldpdf/modelcurriculum/env.pdf From_Climate_Science_to_Action_|_Coursera

Course Outcomes:

After the completion of the course student will be able to

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

CO-PO Mapping:

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

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

APPROVED IN: BOS

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

SDG No. & Statement:

1. SDG-6-Clean water and Sanitation

2. SDG-7-Affordable and clean energy

3. SDG-13 - Climate change

4. SDG-14 - Life below water

5. SDG-15 - Life on Land

SDG Justification:

1. The learner will understand the importance of clean water and sanitation through this course and apply in their daily activities – SDG-6

2. The learner will make use of renewable resources to reduce pollution achieves SDG-7

3. The learner will understand present situation in climate change and takes appropriate steps to combat climate change – SDG-13

4. The learner will understand the existence of life below water – SDG-14

5. The learner will understand to promote sustainable terrestrial ecosystem – SDG15

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

Course Description:

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

Course Educational Objectives:

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

UNIT 1   Basics of Financial Planning

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

Reference Books:

1. P. Kiranmayi Dutt, Geetha Rajeevan. (2007). Basic Communication Skills. FoundationBooks. CUP

2. Harmer, J. (1998). How to teach English. Longman

3. Sanjay Kumar & Pushp Lata. (2018). Communication Skills: A Workbook. OUP.

4. Cambridge IGCSE: English as a Second Language Teacher's Book Fourth Edition.By Peter Lucantoni. CUP (2014).

5. Cambrdige Academic English: An Integrated Skills Course for EAP (Upper Intermediate) By Martin Hewings, CUP (2012)

6. Richards, J.C. and Bohlke, D. (2012). Four Corners-3. Cambridge: CUP.

7. Headway Academic Skills: Reading, Writing, and Study Skills Student's Book, Level-2 bySarah Philpot. OUP

8. Latham-Koenig, C. & Oxenden, C. (2014). American English File. Oxfor: OUP.

9. McCarthy, M. & O' Dell. F. (2016). Academic Vocabulary in Use. Cambridge: CUP

Online Resources:

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

Course Outcomes:

1. Understand the speaker's point of view in fairly extended talks on general or discipline-specifictopics, and follow simple lines of argument in discussions on familiar contemporary issues. (Bloom's Taxonomy Level/s: 3)

2. "Read and demonstrate understanding of articles and reports on limited range of contemporary issues in which the writers adopt particular stances. Also provide samples of written communication containing fairly complex information and reasons for choices/opinions/stances. (Bloom's Taxonomy Level/s: 2 & 3)"

3. Make short presentations on a limited range of general topics using slides, and engage in smallgroup discussions sharing experiences/views on familiar contemporary issues and give reasonsfor choices/opinions/plans. (Bloom's Taxonomy Level/s: 3 & 4)

4. Write clear, fairly detailed text (a short essay) on a limited range of general topics, and subjectsof interest, and communicate clearly through email/letter to seek/pass on information or give reasons for choices/opinions/plans/actions. (Bloom's Taxonomy Level/s: 3)

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

CO-PO Mapping:

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

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

APPROVED IN:

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

SDG No. & Statement:

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

SDG Justification:

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

LANG1021	ADVANCED COMMUNICATION SKILLS IN ENGLISH	L	T	P	S	J	C
		0	0	4	0	0	2

Pre-requisite	None
Co-requisite	None
Preferable exposure	None

Course Description:

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

Course Educational Objectives:

- Enable learners to listen actively become aware of tone and attitude in speech, and demonstrate their comprehension of fairly complex lines of argument presented by a variety of speakers in talks/presentations/discussions. (Bloom's Taxonomy Level/s: 2 & 4)

- Enable learners to become aware of tone and attitude in written texts, and demonstrate theircomprehension of fairly complex lines of argument and points of view presented in a variety of texts by equipping them with upper intermediate to advanced level reading skillsand strategies. (Bloom's Taxonomy Level/s:2 & 3)

- Make effective presentations, engage in formal group discussions, and write structured essays/ short reports to highlight the significance of actions/decisions/experiences, and sustain views by providing relevant evidence and argument. (Bloom's Taxonomy Level/s:3 & 4)

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

List of Activities & Tasks for Assessment:

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

	vocabulary and conventions, observation, reflective discussion, and self-reflective writing	participating in role-plays using expressions appropriate to the context.	
7	Collaborative writing in groups of 3 - 4 on topics that would require data collection and reading followed by recorded peer-reflection and peer-feedback, group presentation and feedback	Pre-task modelling (peer), general discussion on structure, group work (collaboration), presnetation, peer feedback, Open-class discussion	5
8	Formal Group Discussion on topics of currentinterest and relevance; focus on effective participation, reflection on control over argument/ counter argument, and adherence to the conventions of formal GD	Noticing strategies from AV modelling, teacher scafolding though open-house discussion, Note-making (Group work), Group Discussion (free), post perfromance discussion, Feedback	2
9	Mind-mapping for advanced reading, making correlations across texts, extending author's point of view	Reading texts on abstract topics and comprehending the author's perspective by inferring the unknown words' meaning in the context and making notes using mind-map strategy and presenting it orally.	3
10	Handling question and answer sessions after presentations: justifying arguments, taking counter-arguments, agreeing and disgreeing with rationale	Listening to some lectures, talks, and presentations in the academic seminars and adapting some strategies to handle the Q&A sessions using polite and formal expressions to agree or disagree with the statements.	1
11	Modelling an interview: with a panel of fourjudges (peers)	Pre-task activity for orientation/ strategies (controlled/guided), Model interview (AV support), Group work (role play), interview in pair (one-to-one), Interview in group (many -to-one), oral corrective feedback (peer/ teacher)	2
12	Writing a short reflective report of an event - incident/ meeting/ celebration	Writing a report on meetings/ celebrations/ events etc. by actively involving in such events and giving a short oral presentation on the same.	4
13	Speaking on abstract and complex 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	3

		topic of other discipline and making short oral presentation by sharing views and opinions.	
14	Self-relfection on own speech in context(recorded): tone, pitch, relevance, content; extending the reflections/ideas toothers	Listening to selected general discussions (audios and videos) and observing the language production. Recording own speech on some general topic and providing a critical review (self-reflection) on it by focusing on the tone, expressions and relevance of the content, etc.	1
15	Collaborative and individual task: planning, preparing (preparing an outline, structure, setting objectives and presenting the plan of action) and executing a mini-project, and submitting a brief report on the same peer and instructor feedback after the planning stage and on completion of the mini project	Pre-task modelling (peer/teacher), general discussion on structure, group work (collaboration), oral corrective, task distribution, presentation, feedback	5

Reference Books:

1. Latham-Koenig, C. & Oxenden, C. (2014). American English File-5. Oxford: OUPRichards,

2. J.C. and Bohlke, D. (2012). Four Corners-4. Cambridge: CUP.

3. Cambrdige Academic English: An Integrated Skills Course for EAP (Advanced) By MartinHewings and Craig Thaine, CUP (2012)

4. Berlin, A. (2016). 50 Conversation Classes: 50 Sets of Conversation Cards with an Accompanying Activity Sheet Containing Vocabulary, Idioms and Grammar. Poland: CreateSpace Independent Publishing Platform

5. Zemach, D. E., Islam, C. (2011). Writing Paragraphs: From Sentence to Paragraph. Germany: Macmillan Education.

6. Stewart, J. P., Fulop, D. (2019). Mastering the Art of Oral Presentations: Winning Orals, Speeches, and Stand-Up Presentations. United Kingdom: Wiley.

7. Kroehnert, Gary. (2010). Basic Presentation Skills. Sidney: McGraw Hill.

8. Cunninghum, S. & Moor, P. (nd). Cutting Edge (Advanced) With Phrase Builder. Longman Publishers. CUP

9. McCarthy, M & O'Dell, F. (2017). English Idioms in Use (Advanced). Cambridge: 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.

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 the current scenario.
-

UNIT 1   MK Gandhi: Childhood and Education

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

UNIT 2   From Mohan to Mahatma-South African Experiences

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

UNIT 3   Gandhi and Indian National Movement

Gandhi and Indian National Movement (1915-1947): Introduction of Satyagraha in Indian soil -non- cooperation movement - call for women's participation - social boycott - Quit-India movement - fighting against un-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 Publishing House
3. Gandhi, M K. (1968). *Satyagraha in South Africa*. Ahmadabad: Navjivan Publishing House.
4. Khoshoo, T N (1995). *Mahatma Gandhi: An Apostle of Applied Human Ecology*. New Delhi:TERI
5. Kripalani, J.B. (1970). *Gandhi: His Life and Thought*. New Delhi: Publications Division.
6. Narayan, Rajdeva (2011). *Ecological Perceptions in Gandhism and Marxism*. Muzaffarpur: NISLS
7. Pandey, J. (1998). *Gandhi and 21st Century*. New Delhi: Concept.
8. Weber, Thomas (2007).Gandhi as Disciple and Mentor. New Delhi: CUP

Course Outcomes:

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

CO-PO Mapping:

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

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

APPROVED IN:

BOS : 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   6 hours
                State Policy**

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

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

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

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

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

UNIT 4   Citizenship   6 hours

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

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

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

UNIT 5   Separation and Distribution of Powers   6 hours

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

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

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

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

Economic and Political Weekly, Vol 51, Issue 15

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

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

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

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

Recommended Readings:

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

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

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

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

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

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

Course Outcomes:
On the successful completion of the course students would be able to:
1. Demonstrate an understanding of the Constitution of India and how constitutional governance is carried out in India
2. Interpret knowledge of the Fundamental Rights and Duties of the Citizens as well

as the Obligation of the state towards its citizens
3. Correlate familiarity with key political developments that have shaped the Constitution and amended it from time to time.
4. Equip themselves to take up other courses in law after having done a foundation course on Indian Constitution

CO-PO Mapping:

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

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

APPROVED IN:

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

SDG No. & Statement:

SDG Justification:

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:

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

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 Euler's theorem
- Tracing of curves and to find tangents and normal
- Rolle's theorem and mean value theorem
- Expansion of the function using Taylor's series and Maclaurin's 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, Euler's theorem on homogeneous functions

UNIT 3   8 hours

Tangents and normal, 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.

UNIT4   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, ex, 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 Text Book of B.Sc. Mathematics Volume-II" by V.Venkateswara Rao, N Krishna Murthy, B.V.S.S. Sarma and S. AnjaneyaSastry, published by S.Chand& Company Ltd., New Delhi.

References:

1. "Calculus Single Variable" by Howard Anton, IrlBivens 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:

- Define the basic properties of limits and continuity
- Explain different types of discontinuities
- Trace the parametric curves
- Evaluate Taylor's theorem with Lagrange's and Cauch's forms of remainder
- Evaluate Maxima and minima of a function

CO-PO Mapping:

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

MATH1201	MATRICES	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

Matrix mathematics applies to several branches of science, as well as different mathematical disciplines. This course aims to provide basic concepts of vector spaces, matrix form of basic geometric transformations.

Course Educational Objectives:

The focus of the course is to

- study the fundamental properties of matrices and applications of matrices in geometry, physics, chemistry, combinatorics and statistics.
- introduce vector spaces and subspaces
- discuss the fundamental properties of matrices , eigen values and eigen vectors
- study the rank of a matrix and its applications
- know the applications of matrices in geometry, physics, chemistry, combinatorics and statistics

UNIT 1   8 hours

R, R2, R3 as vector spaces over R. Standard basis for each of them. Concept of Linear

Independence and examples of different bases. Subspaces of R2, R3.

UNIT 2   8 hours

Translation, Dilation, Rotation, Reflection in a point, line and plane. Matrix form of basic geometric transformations. Interpretation of eigen values and eigen vectors for such transformations and eigen spaces as invariant subspaces.

UNIT 3   8 hours

Types of matrices. Rank of a matrix. Invariance of rank under elementary transformations. Reduction to normal form, Solutions of linear homogeneous andnon-homogeneous equations with number of equations and unknowns upto four.

UNIT 4   8 hours

Matrices in diagonal form. Reduction to diagonal form upto matrices of order 3.Computation of matrix inverses using elementary row operations.

UNIT 5   8 hours

Solutions of a system of linear equations using matrices. Illustrative examples of above concepts from Geometry, Physics, Chemistry, Combinatorics and Statistics.

Textbooks:

1. A.I. Kostrikin, Introduction to Algebra, Springer Verlag, 1984.
2. S. H. Friedberg, A. L. Insel and L. E. Spence, Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi, 2004.

References:

1. Richard Bronson, Theory and Problems of Matrix Operations, Tata McGraw Hill,1989.

Course Outcomes:

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

- Define vector spaces over a field and subspaces

- Learn the concept of linear independence of vectors and linear dependence of vectors

- Evaluate inverse of a matrix using elementary row operations

- Explain rank of a matrix using different methods

- Explain the applications of matrices in Geometry, Physics, Chemistry, combinatorics and statistics

CO-PO Mapping:

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

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:

1. Let Us C by Yashwant Kanetkar, 13th Edition, Bpb Publications, 2012.
2. Programming in ANSI C by E. Balaguruswamy, 6th Edition, McGraw Hill Education, 2012.
3. 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:

*   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 flowcarts 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	3	2
CO2	3	1	2	1	1	1	2	1	2	3	2
CO3	3	1	2	1	1	1	2	1	2	3	2
CO4	3	1	2	1	1	1	2	1	2	3	2
CO5	3	1	2	1	1	1	2	1	2	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

CSCI1011	PROGRAMMING WITH C LAB	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.

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

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 integratingfactor. 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**

Linear partial differential equation of first order, Lagrange's method, Charpit's method.

UNIT 5   **8 hours**

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

Textbooks:

1. N.Krishna Murthy & others " A text book 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:

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

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
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

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SDG No. & Statement: 4

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SDG Justification:

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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	C Programming						

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

Control Structures: 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

Functions and Arrays: 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**

Object Oriented Concepts: 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.
2. Examine the working of Control structures in C++ programs.
3. Understand the concepts of functions and arrays in C++ programs
4. Develop and implement classes and objects, overloading.
5. Understand various Inheritance mechanisms, operator overloading, polymorphism and apply in applications.

CO-PO Mapping:

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

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

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MATH1241	DIFFERENTIAL EQUATION 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. Soving 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:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
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

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

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

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

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Program 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. William Feller: 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., Kolkata.
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	2	1	3
CO2	3	1	1	1	1	1	2	2	2	1	3
CO3	3	1	1	1	1	1	2	2	2	1	3
CO4	3	1	1	1	1	1	2	2	2	1	3
CO5	3	1	1	1	1	1	2	2	2	1	3

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

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MATH1181	DESCRIPTIVE STATISTICS LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	**MATH1171: Descriptive Statistics and Probability Theory**						
Co-requisite	**MATH1171: Descriptive Statistics and Probability Theory**						
Preferable exposure	**None**						

Course Description:

Descriptive statistics are brief informational coefficients that summarize a given data set, which can be either a representation of the entire population or a sample of a population. Descriptive statistics are broken down into measures of central tendency and measures of variability (spread). Measures of central tendency include the mean, median, and mode, while measures of variability include standard deviation, variance, minimum and maximum variables, kurtosis, and skewness

Course Educational Objectives:

1. To determine measures of central tendency
2. To evaluate measures of dispersion
3. To determine kurtosis
4. To determine skewness
5. To distinguish difference between measures of central tendency and measures of variability

1. Graphical presentation of data (Histogram, frequency polygon, Ogives).

2. Graphical presentation of data (Bar diagram, Histogram, frequency polygon, Ogives) using MS Excel

3. Diagrammatic presentation of data (Bar and Pie).

4. Diagrammatic presentation of data (Bar and Pie) using MS Excel

5. Computation of Mean, Standard deviation, Coefficient of Variation

6. Computation of Mean, Standard deviation, Coefficient of Variation using MS Excel

7. Computation of non-central and central moments – Sheppard's corrections for grouped data.

8. Computation of coefficients of Skewness (β_1) and Kurtosis (β_2) – Karl Pearson's and Bowley's s coefficient of skewness.

9. Computation of measures of central tendency, dispersion and coefficients of Skewness, Kurtosis using MS Excel.

Course Outcomes:

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

1. determine measures of central tendency such as mean, median and mode
2. evaluate measures of dispersion such as range, mean deviation, standard deviation
3. determine kurtosis
4. determine skewness
5. differentiate measures of central tendency and measures of variability

CO-PO Mapping:

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

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

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MATH1211	MATHEMATICAL EXPECTATION AND PROBABILITY DISTRIBUTION	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

UNIT 1	Mathematical expectation	8 hours

Mathematical expectation: 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

Discrete Distributions: 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. Poisson approximation to Binomial distribution.

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

Negative Binomial, geometric, hyper geometric distributions - 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

Continuous Distributions: 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

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

- To explain moment generating function and cumulative generating function for continuous distributions
- To discuss the properties of Normal 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 distributions

CO-PO Mapping:

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

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

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MATH1221	PROBABILITY DISTRIBUTION 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:

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

CO-PO Mapping:

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

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

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MATH2061	STATISTICS 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 $\chi 2$, t, F distributions

UNIT 1   Correlation   8 hours

Correlation: 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

Regression: 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

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

| UNIT 4 | Attributes | 8 hours |

Attributes: 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 |

Exact sampling distributions: Concept of population, Parameter, random sample, statistic, sampling distribution, standard error. Statement and Properties of χ^2, t, F distributions and their inter relationships.

Textbooks:

1. V.K. Kapoor and S.C. Gupta: Fundamentals of Mathematical Statistics, Sultan Chand& Sons, New   Delhi
2. BA/B. Sc 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., Kolkata
2. Hoel P.G.: Introduction to mathematical statistics, Asia Publishing house.
3. Sanjay Arora and Bansi Lai: New mathematical Statistics Satya Prakashan, New Delhi

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	2	1	3
CO2	3	1	1	1	1	1	2	2	2	1	3
CO3	3	1	1	1	1	1	2	2	2	1	3
CO4	3	1	1	1	1	1	2	2	2	1	3
CO5	3	1	1	1	1	1	2	2	2	1	3

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

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MATH2071	STATISTICAL INFERENCE	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:

Statistical inference is the process of drawing conclusions about populations or scientific truths from data. There are many modes of performing inference including statistical modeling, data-oriented strategies and explicit use of designs and randomization in analyses.

Course Educational Objectives:

- To estimate the population parameters using maximum likelihood method
- To test the hypothesis using normal distribution
- To test the hypothesis for large sample tests
- To test the hypothesis for small sample tests
- To learn non-parametric tests.

UNIT 1	Theory of estimation	8 hours

Estimation of a parameter, criteria of a good estimator –unbiasedness, consistency, efficiency, &sufficiency and. Statement of Neyman's factorization theorem. Estimation of parameters by the methods of moments and maximum likelihood (M.L), properties of MLE's. Binomial, Poisson &Normal Population parameters estimate by ML method. Confidence intervals of the parameters of normal population.

UNIT 2	Concepts of Statistical hypothesis	8 hours

Null and alternative hypothesis, critical region, two types of errors, level of significance, power of a test. 1 tailed, 2 tailed tests, Neyman - Pearson's lemma. Examples in of Binomial. Poisson, Normal distributions.

UNIT 3	Large Sample Tests	8 hours

Large sample tests for single mean, two means, Single proportion, Two proportions, Standard Deviation of single and double samples and Fisher's Z transformation.

| **UNIT 4** | **Small sample tests**: | **8 hours** |

Tests of significance based on $\chi 2$, t and F. $\chi 2$-test for test for independence of attributes, t-test for single, double and paired tests, Variance Ratio Test(F-test).

| **UNIT 5** | **Non-parametric tests** | **8 hours** |

- Advantages and Disadvantages. Two sample run test, Two sample Median test and Two sample sign test.

Textbooks:

1. BA/BSc II year statistics - statistical methods and inference - Telugu Academy by A. Mohanrao, N. Srinivasa Rao, DrR.Sudhakar Reddy, Dr T.C. Ravichandra Kumar.
2. K.V.S. Sarma: Statistics Made Simple: Do it yourself on PC. PHI.

References:

1. V.K.Kapoor and S.C.Gupta : Fundamentals of Applied Statistics. Sultan Chand
2. ParimalMukhopadhyay : Applied Statistics . New Central Book agency,
3. Daroga Singh and Chowdhary: Theory and Analysis of Sample survey designs., Wiley Eastern.
4. M.R.Saluja : Indian Official Statistics. ISI publications.
5. B.L.Agarwal: Basic Statistics.New Age publications.
6. S.P.Gupta : Statistical Methods. Sultan Chand and Sons.
7. PratirupaSidhanthamulu - Telugu Academy.
8. PrayogaRachana and Visleshana - Telugu Academy.

Course Outcomes:

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

1. Estimate the population parameters
2. Test the hypothesis using one tailed test and two tailed test
3. Test the hypothesis for single mean, two means
4. Test the hypothesis for single proportion and two proportions
5. Test the significance based on chi-square distribution, t- distribution, and F distribution

CO-PO Mapping:

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

MATH2081	STATISTICS METHODS LAB	L	T	P	S	J	C
		0	0	2	0	0	1
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

1. Fitting of straight line.

2. Fitting of exponential curves.

3. Fitting of power curve.

4. Computation of correlation coefficient & Fitting of Regression lines.

5. Rank correlation coefficient.

6. Computation of Contingency coefficients.

7. MS-Excel methods any for the Serial Numbers 1,2,4,5.

Course Outcomes:

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

- Explain coefficient of correlation
- Evaluate rank correlation coefficient
- Explain linear regression and its properties
- Evaluate association of attributes
- 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: 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

MATH2091	STATISTICS INFERENCE LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	MATH1171: Descriptive Statistics and Probability Theory						
Co-requisite	MATH1211:Mathematical Expectation and Probability Distributions						
Preferable exposure	None						

Course Description:

Statistical inference is the process of drawing conclusions about populations or scientific truths from data. There are many modes of performing inference including statistical modeling, data-oriented strategies and explicit use of designs and randomization in analyses.

Course Educational Objectives:

- To estimate the population parameters using maximum likelihood method
- To test the hypothesis using normal distribution
- To test the hypothesis for large sample tests
- To test the hypothesis for small sample tests
- To learn non-parametric tests

1. Large sample tests for mean(s).

2. Large sample tests for proportion(s).

3. Large sample tests for standard deviation(s).

4. Large sample tests for Fisher's Z- transformation.

5. Small sample tests for Single and Double test.

6. Small sample tests for Paired t-test.

7. F-Test.

8. Chi square test for independence of attributes.

9. non-parametric tests t – run test.

10. non-parametric tests - median test.

11. non-parametric tests - sign tests.

12. MS-Excel methods for the above Serial Numbers 1,2,3,4.

Course Outcomes:

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

1. Estimate the population parameters
2. Test the hypothesis using one tailed test and two tailed test
3. Test the hypothesis for single mean, two means
4. Test the hypothesis for single proportion and two proportions
5. Test the significance based on chi-square distribution, t- distribution, and F distribution

CO-PO Mapping:

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

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

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

SDG No. & Statement:

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SDG Justification:

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MATH2101	OPTIMIZATION TECHNIQUES	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Description:

Optimization techniques have gained importance to solve many engineering design problems by developing linear and nonlinear mathematical models. The aim of this course is to educate the student to develop a mathematical model by defining an objective function and constraints in terms of design variables and then apply a particular mathematical programming technique.

Course Educational Objectives:

1. To define an objective function and constraint functions in terms of design variables, and then state the optimization problem.
2. To state single variable and multi variable optimization problems, without and with constraints.
3. To explain linear programming technique to an optimization problem, define slack and surplus variables, by using Simplex method.
4. To state transportation and assignment problem as a linear programming problem to determine optimality conditions by using Simplex method.
5. To explain optimal solutions for sequencing problems with n jobs

UNIT 1   **Linear Programming**   **8 hours**

Linear Programming Problem (LPP), Mathematical Formulation, Graphical method of solution of LPP with two variables, Some exceptional cases, General LPP, Canonical and Standard forms of LPP.

UNIT 2   **Simplex Method**   **8 hours**

Simplex Method, Artificial variables, Big-M and Two-phase simplex Methods, Revised simplex Method, Degeneracy in Linear Programming

UNIT 3   **Duality in Linear programming**   **8 hours**

Introduction, Formulation of a dual problem, Properties of duality, Application of duality to solve LPP, Dual simplex method.

| **UNIT 4** | **Transportation and Assignment Problems** | **8 hours** |

Introduction and LP formulation of Transportation Problem, Methods to find Initial basic feasible solutions of transportation problem, Transportation Algorithm (MODI Method) to obtain optimal solution. Assignment problem- Mathematical formulation, Hungarian Method of solution.

| **UNIT 5** | **Sequencing Problem** | **8 hours** |

Introduction, Basic terminology, Algorithms to obtain optimal solutions for sequencing problems with n jobs and two machines and n jobs and k machines

Textbooks:

1. KantiSwarup, P.K Gupta and Manmohan: Operations Research, Sultan Chand, and Sons
2. Hamdy A Taha, Operations Research: An Introduction, Pearson Education
3. S.D Sharma: Operations Research, Kedarnath, Ramnath& Co.

References:

1. H.M. Wagner: Principles of Operations Research, Prentice Hall of India.
2. G. Hadley: Linear Programming, Narosa Book Distributors
3. Gass: Linear Programming, Mc Graw Hill.

Course Outcomes:

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

1. define an objective function and constraint functions in terms of design variables, and then state the optimization problem.
2. Explain Two-phase simplex method
3. Explain application of duality to solve Linear programming problem
4. state transportation and assignment problem as a linear programming problem to determine optimality conditions by using Simplex method.
5. explain optimal solutions for sequencing problems with n jobs

CO-PO Mapping:

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

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MATH2111	OPTIMIZATION TECHNIQUES LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	**MATH2101: Optimization Techniques**
Co-requisite	**MATH2101: Optimization Techniques**
Preferable exposure	**None**

Course Description:

Optimization techniques have gained importance to solve many engineering design problems by developing linear and nonlinear mathematical models. The aim of this course is to educate the student to develop a mathematical model by defining an objective function and constraints in terms of design variables and then apply a particular mathematical programming technique.

Course Educational Objectives:

1. To define an objective function and constraint functions in terms of design variables, and then state the optimization problem.
2. To state single variable and multi variable optimization problems, without and with constraints.
3. To explain linear programming technique to an optimization problem, define slack and surplus variables, by using Simplex method.
4. To state transportation and assignment problem as a linear programming problem to determine optimality conditions by using Simplex method.
5. To explain optimal solutions for sequencing problems with n jobs

1. Simplex Method

2. Big M Method

3. Two phase simplex Method

4. Dual Simplex Method

5. Revised Simplex Method

6. Transportation problem

7. Job sequencing problem

Course Outcomes:

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

1. define an objective function and constraint functions in terms of design variables, and then state the optimization problem.
2. Explain Two-phase simplex method
3. Explain application of duality to solve Linear programming problem
4. state transportation and assignment problem as a linear programming problem to determine optimality conditions by using Simplex method.
5. explain optimal solutions for sequencing problems with n jobs

CO-PO Mapping:

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

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

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

SDG No. & Statement:

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SDG Justification:

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MATH3061	SAMPLING TECHNIQUES AND DESIGN OF EXPERIMENTS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	MATH1211: Mathematical Expectation and Probability Distributions						
Co-requisite	MATH2071: Statistical Inference						
Preferable exposure	None						

Course Description:

Samples can be drawn in statistically rigorous and careful ways, using random selection and control methods. We will examine simple random sampling that can be used for sampling persons or records, cluster sampling that can be used to sample groups of persons or records or networks, stratification which can be applied to simple random and cluster samples, systematic selection, and stratified multistage samples. Learn modern experimental strategy, including factorial and fractional factorial experimental designs, designs for screening many factors, designs for optimization experiments, and designs for complex experiments such as those with hard-to-change factors and unusual responses. Applications include electronics and semiconductors, automotive and aerospace, chemical and process industries, pharmaceutical and bio-pharm, medical devices, and many others.

Course Educational Objectives:

- To explain types of sampling
- To explain mixed sampling methods
- To explain random sampling
- To explain analysis of variance for one way and two-way classifications
- To design of experiments for completely randomized design, Randomized block design, and Latin square design

UNIT 1	Sampling Theory	8 hours

Principle steps in a sample survey, Censes versus sample survey, sampling, and non-sampling errors. Types of sampling - subjective, probability and mixed sampling methods.

UNIT 2	Simple Random Sampling	8 hours

: Meaning of Samples and methods to draw, estimation of population means, variances in SRSWR& SRSWOR.

UNIT 3	Stratified random sampling	8 hours

Proportional and optimum allocation of sample sizes in stratification. Variances in these methods. Systematic sampling: Systematic sampling when N = nk comparison of their relative efficiencies. Advantages and Disadvantages of above methods of sampling.

UNIT 4	Analysis of Variance	8 hours

One way with equal and unequal classifications and two-way classifications.

UNIT 5	Design of Experiments	8 hours

Principles of experimentation in Designs, analysis of completely randomised design (CRD), Randomised block design (RBD) and Latin square design (LSD) including one missing observation. efficiency of these designs and concept of factorial Experiment.

Textbooks:

1. TeluguAcademyBA/BSc III year paper - III Statistics - applied statistics - Telugu academy by prof.K. Srinivasa Rao, Dr D. Giri. Dr A. Anand, Dr V. PapaiahSastry.
2. K.V.S. Sarma: Statistics Made Simple: Do it yourself on PC. PHI.

References:

1. Fundamentals of applied statistics: VK Kapoor and SC Gupta.
2. Indian Official statistics - MR Saluja.
3. AnuvarthitaSankyakaSastram- Telugu Academy.

Course Outcomes:

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

1. Explain types of sampling
2. Explain subjective, probability and mixed sampling methods
3. Analyze completely randomized design
4. Analyze randomized block design
5. Analyze Latin square design

CO-PO Mapping:

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

MATH3071	STATISTICAL QUALITY CONTROL AND RELIABILITY	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	MATH1171: Descriptive Statistics and Probability Theory						
Co-requisite	MATH1211:Mathematical Expectation and Probability Distributions						
Preferable exposure	None						

Course Description:

Statistical Quality Control refers to the use of statistical methods in the monitoring and maintaining of the quality of products and services

Course Educational Objectives:

- To explain importance of statistical quality control in industry
- To interpret control charts and control limits
- To construct X-bar and R charts for variables
- To estimate reliability
- To explain exponential distribution as life model.

UNIT 1   Statistical Quality Control   8 hours

Importance of SQC in industry, statistical basis of shewart control charts, uses of control charts. Interpretation of control charts, control limits, Natural tolerance limits and specification limits.

UNIT 2   Variable Control Chart   8 hours

Construction of $\overline{X}$, R charts for variables, Attribute control charts- NP, P charts, C chart.

UNIT 3   Acceptance sampling plans   8 hours

Scope, Producer's risk, and consumer's risk. Concepts of AQL and LTPD.

UNIT 4   Sampling Plans   8 hours

Single and double sampling plans, OC and ASN functions, Double and single Sampling plans for attributes using Binomial.

UNIT 5   Reliability   8 hours

Introduction, failure rates, Hazard function, estimation of reliability, exponential distribution as life model, its memory less property.

Textbooks:

1. Kapoor, V.K. and Gupta, S.P. (1978): Fundamentals of applied statistics, Sultan Chand & Sons.
2. Gupta, R.C. (1974): Statistical Quality Control.
3. Montgomery, D.C. (1983): Introduction to Statistical Quality Control, John Waley&Sons.

References:

1. Ekambaram, S K. (1963): Statistical basis of Acceptance sampling, Asia Publishing House.
2. Grant, E, L. and Laven Worth, R.S.: Statistical Quality Control, McGraw Hill.

Course Outcomes:

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

1. Explain uses of control charts
2. Interpret control charts and control limits
3. Construct X-bar and R charts for variables
4. Construct NP charts
5. Explain sampling plans

CO-PO Mapping:

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

MATH3081	SAMPLING TECHNIQUES AND DESIGN OF EXPERIMENTS LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	MATH3061: Sampling Techniques and Design of Experiments						
Co-requisite	MATH3061: Sampling Techniques and Design of Experiments						
Preferable exposure	None						

Course Description:

Samples can be drawn in statistically rigorous and careful ways, using random selection and control methods. We will examine simple random sampling that can be used for sampling persons or records, cluster sampling that can be used to sample groups of persons or records or networks, stratification which can be applied to simple random and cluster samples, systematic selection, and stratified multistage samples. Learn modern experimental strategy, including factorial and fractional factorial experimental designs, designs for screening many factors, designs for optimization experiments, and designs for complex experiments such as those with hard-to-change factors and unusual responses. Applications include electronics and semiconductors, automotive and aerospace, chemical and process industries, pharmaceutical and bio-pharm, medical devices, and many others.

Course Educational Objectives:

- To explain types of sampling
- To explain mixed sampling methods
- To explain random sampling
- To explain analysis of variance for one way and two-way classifications
- To design of experiments for completely randomized design, Randomized block design, and Latin square design

1. Estimation of population Mean, variance by SRSWOR.

2. Estimation of population Mean, variance by SRSWR.

3. Comparison of proportional, optimum allocations with SRSWOR.

4. Systematic Sampling.

5. ANOVA-CRD.

6. ANOVA - RBD with one missing observation.

7. ANOVA - LSD with one missing observation.

8. Ms-excel practicals.

Course Outcomes:

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

1. Explain types of sampling
2. Explain subjective, probability and mixed sampling methods
3. Analyze completely randomized design
4. Analyze randomized block design
5. Analyze Latin square design

CO-PO Mapping:

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

MATH3091	STATISTICAL QUALITY CONTROL AND RELIABILITY LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	MATH3071: Statistical Quality Control and Reliability						
Co-requisite	MATH3071: Statistical Quality Control and Reliability						
Preferable exposure	None						

Course Description:

Statistical Quality Control refers to the use of statistical methods in the monitoring and maintaining of the quality of products and services

Course Educational Objectives:

- To explain importance of statistical quality control in industry
- To interpret control charts and control limits
- To construct X-bar and R charts for variables
- To estimate reliability
- To explain exponential distribution as life model.

1. Construction of($\overline{X}$,R) charts.

2. Construction of P-chart-Fixed sample size.

3. Construction of P-chart-variable sample size.

4. Construction of NP-Chart.

5. Construction of C-Chart.

6. MS-Excel methods for the Serial Numbers 1.

7. MS-Excel methods for the Serial Numbers 2 to 4.

8. Problems on Reliability

Course Outcomes:

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

1. Explain uses of control charts
2. Interpret control charts and control limits
3. Construct X-bar and R charts for variables
4. Construct NP charts
5. Explain sampling plans

CO-PO Mapping:

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

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MATH3101	APPLIED STATISTICS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**MATH1171: Descriptive Statistics and Probability Theory**						
Co-requisite	**MATH1211: Mathematical Expectation and Probability Distributions**						
Preferable exposure	**None**						

Course Description:

Applied Statistics includes planning for the collection of data, managing data, analyzing, interpreting, and drawing conclusions from data, and identifying problems, solutions and opportunities using the analysis

Course Educational Objectives:

- To illustrate time series and its components
- To explain growth curves and their fitting
- To learn good index numbers
- To study base shifting, splicing and deflation of index numbers
- To define vital statistics

UNIT 1   Time series   8 hours

Time series: -Time series and its components with illustrations, additive, multiplicative and mixed models. Determination of trend by least squares, moving average methods. Growth curves and their fitting with reference to modified exponential, Gompertz and Logistic curves. Determination of seasonal indices by Ratio to moving average, ratio to trend and link relative methods.

UNIT 2   Index Numbers   8 hours

Index Numbers: -Concept, construction, uses and limitations of simple and weighted index numbers. Laspeyer's, Paasche's and Fisher's index numbers, criterion of a good index numbers, problems involved in the construction of index numbers. Fisher's index as ideal index number. Fixed and chain base index numbers. Cost of living index numbers and wholesale price index numbers. Base shifting, splicing and deflation of index numbers.

UNIT 3   Vital statistics   8 hours

Vital statistics: Introduction, definition, and uses of vital statistics. Sources of vital statistics, registration method and census method. Rates and ratios, Crude death rates, age specific death rate, standardized death rates, crude birth rate, age specific fertility rate, general fertility rate, total fertility rate. Measurement of population growth, crude rate of natural increase- Pearl's vital index. Gross reproductive rate sand Net reproductive rate, Life tables, construction and uses of life tables and abridged life tables.

UNIT 4	Demand Analysis	8 hours

Demand Analysis: Introduction. Demand and supply, price elasticity of supply and demand. Methods of determining demand and supply curves, Leontief's, Pigous's methods of determining demand curve from time series data, limitations of these methods Pigou's method from time series data. Pareto law of income distribution curves of concentration.

UNIT 5	Official Statistics	8 hours

Official Statistics: - Functions and organization of CSO and NSSO. Agricultural Statistics, area, and yield statistics. National Income and its computation, utility, and difficulties in estimation of national income.

Textbooks:

1. V.K. Kapoor and S.C. Gupta: Fundamentals of Applied Statistics. Sultan Chand
2. ParimalMukhopadhyay: Applied Statistics. New Central Book agency.
3. Daroga Singh and Chowdhary: Theory and Analysis of Sample survey designs. Wiley Eastern.
4. M.R. Saluja: Indian Official Statistics. ISI publications

References:

1. B.L. Agarwal: Basic Statistics. New Age publications.
2. S.P. Gupta: Statistical Methods. Sultan Chand and Sons.
3. PratirupaSidhanthamulu – Telugu Academy.
4. PrayogaRachana and Visleshana – Telugu Academy

Course Outcomes:

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

1. Illustrate time series and its components
2. develop additive, multiplicative, and mixed models
3. evaluate criterion of a good index number
4. explain the cost-of-living index numbers
5. evaluate crude death rates

CO-PO Mapping:

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

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

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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

MATH3111	APPLIED STATISTICS LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	**MATH3101: Applied Statistics**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

Applied Statistics includes planning for the collection of data, managing data, analyzing, interpreting, and drawing conclusions from data, and identifying problems, solutions and opportunities using the analysis

Course Educational Objectives:

- To illustrate time series and its components
- To explain growth curves and their fitting
- To learn good index numbers
- To study base shifting, splicing and deflation of index numbers
- To define vital statistics

1. Determination of trend by method of least squares – straight line and parabola.

2. Determination of trend by method of moving averages.

3. Determination of seasonal indices by the method of Ratio to moving averages.

4. Determination of seasonal indices by the method of Ratio to trend.

5. Determination of seasonal indices by Link relatives' method.

6. Computation of all weighted indices.

7. Computation of Cost-of-living index number.

8. Base shifting, splicing and Deflation

9. Construction of various rates, complete and abridged life tables.

10. Construction of Lorenz curve

Course Outcomes:

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

1. Illustrate time series and its components
2. develop additive, multiplicative, and mixed models
3. evaluate criterion of a good index number
4. explain the cost-of-living index numbers
5. evaluate crude death rates

CO-PO Mapping:

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

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MATH2201	STATISTICAL DEMOGRAPHY	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 is designed to explore to the basic idea about demography like population of India and fertility and mortality rates.

Course Educational Objectives:

- Acquire the knowledge of the population, composition, and ratio in India
- Know the different types of fertility measurements
- Know the different types of mortality measurements
- Know the growth of population
- Know different types of errors in demographic data

UNIT 1   **8 hours**

Scope and content of population census of India. Population, Composition, Dependency ratio. Brief Coverage and content errors in demographic data. Adjustment of age data – use of Whipple, Myer, and UN indices. Chandrasekhar – Deming formula to check completeness of registration data.

UNIT 2   **8 hours**

Measures of fertility: Stochastic models for reproduction, (Dandekar`s Modified Binomial and Poisson distributions, William Brass Model), distributions of time to first birth, inter-live birth intervals and number of births.

UNIT 3   **8 hours**

Measures of Mortality: Construction of abridged life tables (l_x–linear, exponential, Reed, and Merrell`s, Grevill's) Relations between functions of Life Tables. Distributions of life table functions.

UNIT 4   **8 hours**

Stable and quasi-stable populations, intrinsic growth rate. Methods for population projection. Use of Leslie matrix.

UNIT 5   **8 hours**

Models for population growth and their fitting to population data. Linear, Exponential, logarithmic, modified logarithmic, Gompertz and Logistic Curves. Stochastic models for population growth (Pure Birth Model, Simple Birth & Death Model, Birth, death and migration model).

Textbooks:

1. Sudhendra Biswas (1995): Applied Stochastic Processes, New Age International Publishers Ltd.
2. Pathak, K.B. & Ram, F. (1998):   Techniques of Demographic Analysis, Himalayas Publishers
3. K. Srinivasan (1998): Basic Demographic Techniques and Applications: Sage publications.
4. Asha A bhande, Tara Kanitkar (2004): Principles of Population Studies; Himalayas publishing House.

References:

1. Saxena H.C and Surrendran P.U: Statistical Inference.
2. Bartholomew, D.J. (1982): Stochastic Modals for Social Processes, John Wiley.
3. Benjamin, B. (1969): Demographic Analysis, Geprge. Allen and Unwin.
4. Chain, C.L (1968): Introduction to Stochastic Processes in Biostatisties; John Wiley.
5. Cox, P.R. (1970): Applied Mathematical Demography, Springer Verlag.
6. Spiegelman, M. (1969): Introduction to Demographic Analysis; Harvard University Press.

Course Outcomes:

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

1. Knowledge about the census of India
2. Acquire the knowledge about the measures of fertility
3. Learn about the distributions of time to first birth
4. Acquire the knowledge about the measures of mortality
5. Acquire the knowledge of stochastic models

CO-PO Mapping:

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

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

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SDG No. & Statement: 4

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MATH2211	ACTUARIAL STATISTICS	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:

The aim of Actuarial Statistics is to provide a grounding in mathematical and statistical methods that are of relevance for actuarial work. It equips the student with knowledge of statistical distributions, methods to summarize data, the principles of statistical inference, regression models (including generalized linear models) and the fundamental concepts of Bayesian statistics

Course Educational Objectives:

- To learn the life tables used in insurance products.

- To learn the concept of interest,

- To learn different life insurance products

- To learn life annuities and net premiums.

- To motivate students to prepare for exams required for employment in the actuarial science profession.

UNIT 1   8 hours

Theory of interest rates ate of interest, nominal rate of interest. Accumulation factors. Force of interest, present values, Stoodley formula for the force of interest, present value of cash flows, valuing cash flows. Basic compound interest function, equations of values and yield on transaction-annuities certain, present values and accumulation, concepts of different annuities, continuously payable annuities, varying annuities.

UNIT 2   8 hours

Utility theory, insurance and utility theory, models for individual claims their sum, approximations for the distribution of the sum. Application to insurance. Survival function, time until death for a person age x, curate future lifetime, force of mortality.

UNIT 3   8 hours

Life table and its relation with survival function, examples, the deterministic survivorship group, recursion formulas, assumptions for fractional ages, some analytical laws of mortality, select and ultimate tables.

UNIT 4   8 hours

Life insurance: insurance payable at the moment of death and at the end of the year of death-level benefit insurance, endowment insurance, deferred insurance a varying benefit insurance. Life annuities. single payment, continuous life annuities, discrete life annuities, life annuities with monthly payments, recursions, complete annuities-immediate and apportion able annuities-due.

UNIT 5   8 hours

Multiple life functions, joint life and last survivor status, insurance and annuity benefits through multiple life functions, evaluation for special mortality laws. Multiple decrement models, deterministic and random survivorship groups, associated single decrement tables, central rates of multiple decrements, central force assumptions for multiple decrements. Uniform distribution assumption for multiple decrements

Textbooks:

1. Bowers, N.L., Gerber, H.U., Hickman, J.C, Jones, D.A., and Nesbitt, C.J. (1986). Actuarial Mathematics. Society of Actuaries, Ithaca, Illinois, U.S.A. 2nd ed. (1997) CH. 1,2,3,4,5,9 & 10.
2. McCutcheon, J.J. and Scott, W.F. An Introduction to Mathematics of Finance. Butter Worth & Heinemann.

References:

1. Spurgeon, E.T. (1972). Life Contingencies. Cambridge University press.Nall, A. (1977). Life Contingencies. Heinemann.

Course Outcomes:

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

1. Understand the utility theory, insurance products and life tables.

2. Understand the concept of utility theory and interest.

3. Understand the concept of life tables and to know some analytical laws of mortality.

4. Know insurance and the existing insurance products of different insurance company, life annuities, net premium, and net premium reserves.

5. Know the concept of multiple life functions and decrement models.

CO-PO Mapping:

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

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

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SDG No. & Statement: 4

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SDG Justification:

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MATH2221	STATISTICAL DEMOGRAPHY LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	**MATH2201: Statistical Demography**						
Co-requisite	**MATH2201: Statistical Demography**						
Preferable exposure	**None**						

Course Description:

This course is designed to explore to the basic idea about demography like population of India and fertility and mortality rates.

Course Educational Objectives:

- Acquire the knowledge of the population, composition, and ratio in India
- Know the different types of fertility measurements
- Know the different types of mortality measurements
- Know the growth of population
- Know different types of errors in demographic data

1. United Nations Index

2. Reproduction Rate

3. Infant Mortality Rate

4. Life Tables

5. Population Growth

6. Urban-Rural Growth difference

Course Outcomes:

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

1. Knowledge about the census of India
2. Acquire the knowledge about the measures of fertility
3. Learn about the distributions of time to first birth
4. Acquire the knowledge about the measures of mortality
5. Acquire the knowledge of stochastic models

CO-PO Mapping:

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

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

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SDG No. & Statement: 4

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SDG Justification:

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MATH2231	ACTUARIAL STATISTICS LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	**MATH2211: Actuarial Statistics**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

The aim of Actuarial Statistics is to provide a grounding in mathematical and statistical methods that are of relevance for actuarial work. It equips the student with knowledge of statistical distributions, methods to summarize data, the principles of statistical inference, regression models (including generalized linear models) and the fundamental concepts of Bayesian statistics

Course Educational Objectives:

- To learn the life tables used in insurance products.

- To learn the concept of interest,

- To learn different life insurance products

- To learn life annuities and net premiums.

- To motivate students to prepare for exams required for employment in the actuarial science profession.

1. Stoodley formula for the force of interest

2. Basic compound interest function, equations of values and yield on transaction-annuities

3. Models for individual claims and their sums

4. The deterministic survivorship groups

5. Life annuities. single payment, continuous life annuities, discrete life annuities, life annuities with monthly payments

6. Multiple decrement models, deterministic and random survivorship groups

Course Outcomes:

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

1. Understand the utility theory, insurance products and life tables.

2. Understand the concept of utility theory and interest.

3. Understand the concept of life tables and to know some analytical laws of mortality.

4. Know insurance and the existing insurance products of different insurance company, life annuities, net premium, and net premium reserves.

5. Know the concept of multiple life functions and decrement models.

CO-PO Mapping:

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

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

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MATH2241	TESTING OF HYPOTHESIS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**MATH1171: Descriptive Statistics and Probability Theory**						
Co-requisite	**MATH2071: Statistical Inference**						
Preferable exposure	**None**						

Course Description:

This course is concerned with statistical inference which is the mainstream of present-day statistical thinking. One of the main objectives of Statistics is to draw inferences about a population from the analysis of a sample drawn from a population. Statistical inference is classified into 1). Estimation 2). Testing of hypothesis. The theory of testing of hypothesis initiated by J. Neyman and E. S. Pearson is discussed. In N-P theory, we use statistical methods to arrive at decisions in certain situations where there is lack of certainty based on a sample whose size is fixed in advance while in Wald's sequential theory the sample size is not fixed but is regarded as a random variable.

Course Educational Objectives:

- To learn Neyman Pearson theory.
- To perform uniformly most powerful tests (UMP) for one sided and composite hypothesis.
- To study Wald's Sequential probability ratio test.
- To apply nonparametric tests.
- To learn Chi square test for goodness of fit, Kendall's and Spearman's test involving rank correlation.

UNIT 1   **8 hours**

Neyman-Pearson theory. Lemma using critical functions. Uniformly most powerful tests, their relation with sufficient statistics,

UNIT 2   **8 hours**

Monotone likelihood ratio and UMP tests for one-sided hypothesis, composite hypothesis. Unbiased tests, uniformly most powerful unbiased tests. Type-A and Type-A regions.

UNIT 3   **8 hours**

Likelihood ratio criterion, its asymptotic distribution, one sample, two sample and k-sample problems. Linear hypothesis. Wald's SPRT. Proof that it terminates in a finite number of steps with probability 1. O.C ad A.S.N. functions. Examples of binomial and normal cases for testing hypothesis on μ and σ^2

UNIT 4   **8 hours**

Notion of non-parametric test, different NP tests. Run test, sign test, Wilcoxon and Mann-Whitney test, Median test, derivations of the mean and variance of the above test statistics when null hypothesis is true.

UNIT 5   **8 hours**

Chi-square test for goodness of fit, its asymptotic distribution, description of Kolmogorov-Smirnov test, tests involving rank correlation (Kendall's and Spearman's).

Textbooks:

1. Rohatgi, V.K. Statistical Inference, John Wiley, and Sons.
2. Gibbons, J.D. Non-parametric Inference, McGraw Hill
3. Wald. Sequential Analysis, John Wiley, and Sons.
4. Goon, Gupta, and Das Gupta. An Outline of Statistical Theory. Vol. 2, The World Press Pvt. Ltd., Kolkata.

References:

1. Lehmann, E.L. Testing of Statistical Hypothesis. John Wiley and Sons.
2. Rao, C.R... Linear Statistical Inference and its Applications. John Wiley and Sons.
3. Sidney Siegel. Non-parametric Statistics for the Behavioural Sciences.

Course Outcomes:

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

1. To learn Neyman Pearson lemma and UMP tests.
2. To understand unbiased tests and uniformly most powerful unbiased tests.
3. To study OC and ASN functions in case of Binomial and Normal distributions.
4. To apply Run test, Sign test, Wilcoxon and Mann Whitney test and Median test.
5. To understand Chi square test for goodness of fit, Kolmogorov and Smirnov test and Kendall's and Spearman's test

CO-PO Mapping:

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

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

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MATH2251	STOCHASTIC PROCESS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**MATH1171: Descriptive Statistics and Probability Theory**						
Co-requisite	**MATH2071: Statistical Inference**						
Preferable exposure	**None**						

Course Description:

A stochastic process is a mathematical object defined as a family of random variables. Stochastic processes are widely used as mathematical models of systems and phenomena that appear to vary in a random manner.

Course Educational Objectives:

- To define stochastic process
- To classify general stochastic processes into discrete and continuous time
- To define Markov chain, transition probability matrix
- To evaluate basic limit theorem of Markov chain
- To explain pure birth process and Poisson process

UNIT 1   8 hours

Basic Concepts: Definition and examples of stochastic process, classification of general stochastic processes into discrete and continuous time, discrete and continuous state spaces, types of stochastic processes, elementary problems.

UNIT 2   8 hours

Markov chains I: Definition and examples of Markov chain, Transition Probability Matrix, classification of states, recurrence, simple problems.

UNIT 3   8 hours

Markov chains-II: Basic limit theorem of Markov chain (statement only), stationary probability distribution, applications.

UNIT 4   8 hours

Continuous Time Markov chain: Pure birth process and Poisson process, Birth and Death process, problems.

UNIT 5   **8 hours**

Branching process: Definition and examples of discrete time branching process, probability generating function, mean and variance, probability of extinction, simple problems.

Textbooks:

1. Karlin, S. and Taylor, H.M. (1975): A first course in Stochastic processes, Academic press.
2. Hoel, P.M.G., Port, S.C. and Stone, C.J. (1991): Introduction to Stochastic processes, Universal Book Stall.
3. Parzen, E. (1962): Stochastic processes, Holden-Day.
4. Cinlar, B. (1975) Introduction to Stochastic processes, Prentice Hall.

References:

1. Adke, S.R. and Manjunath, S.M. (1984): An introduction to Finite Markov Processes, Wiley Eastern.
2. Medhi, J. (1996): Stochastic processes, New Age International (p) Ltd.
3. Ross, S.M. (1983): Stochastic processes, John Wiley.
4. Taylor, H.M. and Karlin, S. (1999): Stochastic Modelling, Academic press

Course Outcomes:

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

1. define stochastic process
2. classify general stochastic processes into discrete and continuous time
3. define Markov chain, transition probability matrix
4. evaluate basic limit theorem of Markov chain
5. explain pure birth process and Poisson process

CO-PO Mapping:

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

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

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MATH2261	ESTIMATION THEORY	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**MATH1171: Descriptive Statistics and Probability Theory**						
Co-requisite	**MATH2071: Statistical Inference**						
Preferable exposure	**None**						

Course Description:

This course is designed to expose students about Point and Interval Estimation and the characteristics of Estimation theory.

Course Educational Objectives:

- Acquire the knowledge of point estimation
- Acquire the characteristics of estimation theory.
- Ability to learn sufficiency and related theorems
- Learn about maximum likelihood Estimation and related theorems
- Acquire the knowledge about censored and truncated distributions

UNIT 1   8 hours

Point estimation. Concepts of unbiasedness, consistency, minimum variance unbiased estimation. Information in a sample, Cramer-Rao inequality, efficiency of an estimator, Chapman-Robin's inequality and Bhattacharya bounds, definition of CAN estimator.

UNIT 2   8 hours

Concept of sufficiency, single parameter, and several parameter cases. Fisher-Neyman Factorization theorem, minimal-sufficient statistic, exponential families, and Pitman families. Invariance property of sufficiency under 1-1 transformation of sample space and parameter space.

UNIT 3   8 hours

Distributions admitting sufficient statistics, Rao-Blackwell theorem, completeness, Lehman-Scheffe theorem, joint sufficiency (regular case).

UNIT 4   8 hours

Method of maximum likelihood, CAN estimators for one-parameter Cramer family. Cramer-Huzurbazar theorem, solution of likelihood equations, method of scoring. Connection between MLEs and efficient estimators, MLEs and sufficient estimators.

UNIT 5   **8 hours**

Censored and truncated distributions. Type I and Type II censoring for normal and exponential distributions and their MLEs. Interval estimation. confidence intervals using pivots, shortest expected length confidence intervals.

Textbooks:

1. Goon, A.M., Gupta, M.K., Das Gupta, B. An Outline of Statistical Theory. Vol. II, The World Press PVT. Ltd., Kolkata.
2. Rohatgi, V. (1998). An Introduction to Probability and Mathematical Statistics. Wiley Eastern Ltd., New Delhi.

Kale, B.K. (1999). A First Course on Parametric Inference. Narosa Publishing House

References:

1. Lehmann, E.L. (1986). Theory of Point Estimation.
2. Rao, C.R. (1973). Linear Statistical Inference.
3. Dudewicz, E.J. and Misra, S.N(1988) . Modern Mathematical Statistics. Student's Edition, Wiley.
4. Lawless, J.F., Statistical Models and Methods for Lifetime Data. John Wiley &Sons.

Course Outcomes:

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

1. Learn about Cramer-Rao Inequality theorem and its applications
2. Acquire the knowledge about Lehman-Scheffe theorem and its applications
3. Acquire the knowledge about CAN estimators for one parameter
4. Learn about censoring some probability distributions and their maximum likelihood estimators
5. Learn about the concept of Interval estimation

CO-PO Mapping:

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

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

APPROVED IN:

BOS :13-07-2021   **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

MATH2271	SAMPLING METHODS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	MATH1171: Descriptive Statistics and Probability Theory						
Co-requisite	None						
Preferable exposure	None						

Course Description:

This course is concerned with the design of sample surveys and the statistical analysis of data collected from such surveys. Topics covered are: Simple random sampling with associated estimation and confidence interval methods, selecting sample sizes, Estimating proportions, Unequal probability sampling, Ratio and regression estimation, Stratified sampling, Cluster and systematic sampling, Multistage designs and Double or Two-stage sampling. The aim of this course is to cover sampling design and analysis methods that would be useful for research and management in many fields.

Course Educational Objectives:

- To learn scientific view to conduct the survey in proper way to collect the data about specific perspective.
- To Learn variety of probability and non-probability sampling methods for selecting a sample from a population.
- To amalgamate the intellectual facts of the sampling techniques to implement in projects
- To motivate the students in carrying out the field projects in scientific manner and statistical skills
- To convey some extended concepts in sampling to encourage the students in industrial and research aspects

UNIT 1   8 hours

Selection with varying probabilities, PPS sampling, Horvitz and Thompson estimator, Yates' and Grundy's estimator, Midzuno-Sen sampling scheme

UNIT 2   8 hours

Systematic sampling. Estimation of population mean and its variance, methods for populations with linear trend. Yates correction modified systematic sampling, balanced systematic sampling, centrally located sampling, circular systematic sampling.

UNIT 3   8 hours

Cluster sampling. Estimation of population mean and its variance, efficiency of cluster sampling, determination of optimal cluster size, estimation of proportion, cluster sampling with varying sizes. Two-stage sampling. Two-stage sampling with equal first stage units. Estimation of mean and its variance. Optimum allocation. Three –stage sampling with equal probabilities. Two-stage sampling.

UNIT 4   8 hours

Ratio estimation: Introduction. Bias and mean square error, estimation of variance, confidence interval, comparisons with mean per unit estimator, ratio estimator in stratified random sampling. Difference estimator and regression estimator: Introduction. Difference estimator, difference estimator in stratified sampling. Regression estimator, comparison of regression estimator with mean per unit estimator and ratio estimator. Regression estimator in stratified sampling

UNIT 5   8 hours

Multi-phase sampling: Introduction. Double sampling for difference estimation, double sampling for ratio estimation, double sampling for regression estimator, optimum allocation varying probability sampling. Non-sampling errors. Sources and types of non-sampling errors, non-response errors, techniques for adjustment of non-response, Hansen and Horvitz technique, Deming's model.

Textbooks:

1. F.S. Chaudhary. Theory and Analysis of Sample Survey Designs, New Age International Publishers, Delhi.
2. Des Raj. Sampling Theory.
3. Cochran, W.G. Sampling Techniques.
4. Murthy, M.N... Sampling Theory Techniques.

References:

1. Parimal Mukhopadhyay. Theory and Methods of Survey Sampling. Prentice-Hall of India Pvt. Ltd., New Delhi.
2. Sukhatme, P.V. and Sukhatme, B.V... Sampling Theory of Survey with Applications.

Course Outcomes:

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

1. Understand the basic principles underlying survey design and estimation.

2. Apply the concept of systematic sampling along with centrally located sampling and circular systematic sampling.

3. Implement Cluster sampling, Two Stage Sampling and Optimum allocation in real life problems.

4. Apply Ratio and Regression estimation in real life problems. Comparison of regression estimator with mean per unit estimator and ratio estimator. Regression estimator in stratified sampling.

5. Apply Multi-phase sampling techniques, double sampling for regression estimator, non-sampling errors, Hansen and Harvitz technique, Deming's model.

CO-PO Mapping:

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

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

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MATH3161	MACHINE LEARNING	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	MATH1171: Descriptive Statistics and Probability Theory						
Co-requisite	None						
Preferable exposure	None						

Course Description:

Machine Learning addresses the question how to enable computers to learn from past experiences. It introduces the field of machine learning describing a variety of learning paradigms, algorithms, theoretical results, and applications. Upon successful completion of the course, students will have an understanding the working of various machine learning algorithms which can be implemented through.

Course Educational Objectives:

- To design a learning system and know about the learning tasks.
- To apply decision tree learning in classification tasks.
- To develop neural networks algorithms in machine learning.
- To illustrate Bayesian learning and instance-based learning.
- To examine the concepts of genetic algorithms and reinforcement learning.

UNIT 1	Introduction:	10 hours

Introduction: Well-Posed Learning Problems, Designing a Learning System, Perspectives, and Issues in Machine Learning.
Concept Learning and the General-to-Specific Ordering: Introduction, A Concept Learning Task, Concept Learning as Search, FIND-S: Finding a Maximally Specific Hypothesis, Version Spaces and the Candidate-Elimination Algorithm, Remarks on Version Spaces and Candidate- Elimination, Inductive Bias.

UNIT 2	Decision Tree Learning:	10 hours

Decision Tree Learning: Introduction, Decision Tree Representation, Appropriate Problems for Decision Tree Learning, The Basic Decision Tree Learning Algorithm, Hypothesis Space Search in Decision Tree Learning, Inductive Bias in Decision Tree Learning, Issues in Decision Tree Learning.

UNIT 3	Artificial Neural Networks	10 hours

Artificial Neural Networks: Introduction, Neural Network Representations, Appropriate Problems for Neural Network Learning, Perceptron's, Multilayer Networks and the BACKPROPAGATION algorithm, Remarks on the Backpropagation algorithm, Illustrative Example, Advanced Topics in Artificial Neural Network.

Evaluating Hypothesis: Estimating Hypothesis Accuracy, Basics of Sampling Theory, A General Approach for deriving Confidence intervals, Difference in Error of two Hypothesis, Comparing Learning Algorithms.

| UNIT 4 | Bayesian Learning | 8 hours |

Bayesian Learning: Introduction, Bayes Theorem, Bayes Theorem and Concept Learning, Maximum Likelihood and Least Squared Error Hypothesis, Maximum Likelihood Hypothesis for predicting probabilities, Naive Bayes Classifier, Bayesian Belief Networks, EM A l g o r i t h m .

| UNIT 5 | Instance-Based Learning | 8 hours |

Instance-Based Learning: Introduction, k-Nearest Neighbour Learning, Locally Weighted Regression. **Genetic Algorithms:** Motivation, Genetic Algorithms, An Illustrative Example, Hypothesis Space Search, Genetic Programming. **Reinforcement Learning:** Introduction, The Learning Task, Q Learning

Textbooks:

1. Machine Learning by Tom M. Mitchell, McGraw Hill Education Private Limited, 2013.

References:

1. Pattern Recognition and Machine Learning by Christopher Bishop, Springer series, 1st edition, 2006.
2. Machine Learning a Probabilistic Perspective by Kevin P Murphy & Francis Bach, MIT Press, 1st Edition, 2012

Course Outcomes:

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

1. Define a well-posed learning problem.
2. Illustrate the decision tree learning algorithm and hypothesis space search.
3. Use the Bayes theorem and EM Algorithm in machine learning.
4. Model genetic learning method by an analogy to biological evolution.
5. Experiment with hypothesis space search in genetic learning.

CO-PO Mapping:

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

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

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MATH3171	BIG DATA ANALYTICS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**MATH1171: Descriptive Statistics and Probability Theory**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

The internet, Big Data, vastly improved computational power, and a wide variety of variables are involved in complex, real-world problems led to a new set of analytic techniques and technologies. The concept of Big Data includes massive volumes of data and huge benefits that can accrue from the analysis of it.

Course Educational Objectives:

- To introduce an in depth understanding of all the concepts related to Big Data.
- To provide a sight into the real-life implementations of Big Data solutions and problem solving in data analytics.
- To provide learners with a deep and systematic knowledge of business and technical strategies for data analytics and the subsequent skills to implement solutions in these areas.
- To understand the evolution and elements of Big Data
- To explore different opportunities available in the career path

**UNIT 1   Getting an overview of Big Data and Exploring use of Big Data   8 hours
in Business Context**

Getting an overview of Big Data: Big Data definition, History of Data Management, Structuring Big Data, Elements of Big-data, Big Data Analytics.

Exploring use of Big Data in Business Context: Use of Big Data in Social Networking, Use of Big Data in preventing Fraudulent Activities in Insurance Sector & in Retail Industry.

**UNIT 2   Introducing Technologies for Handling Big Data,   10 hours
Understanding Hadoop Ecosystem and Understanding
MapReduce Fundamentals and HBase**

Introducing Technologies for Handling Big Data: Distributed and parallel computing for Big Data, Introducing Hadoop, Cloud computing and Big Data, In-memory Computing Technology for Big Data.

Understanding Hadoop Ecosystem: Hadoop Ecosystem**,** Hadoop Distributed File System,

MapReduce, Hadoop YARN, Introducing HBase, Combing HBase and HDFS, Hive, Pig and Pig Latin, Sqoop, Zookeeper, Flume, Oozie.

Understanding MapReduce Fundamentals and HBase: The MapReduce Framework, Techniques to Optimize Map Reduce Jobs, Uses of Map Reduce, Role of HBase in Big Data Processing

| UNIT 3 | Understanding Big Data Technology Foundations, Processing Data with MapReduce and Customizing MapReduce Execution and Implementing MapReduce Program | 10 hours |

Understanding Big Data Technology Foundations: Exploring the Big Data Stack, Virtualization and Big Data, Virtualization approaches.

Processing Data with MapReduce: Recollecting the Concept of MapReduce Framework, Developing Simple MapReduce Applications.

Customizing MapReduce Execution and Implementing MapReduce Program: Controlling MapReduce Execution with Input Format, Reading Data with Custom Record Reader, Organizing Output data with Output Formats, Customizing Data with Record Writer, Optimizing MapReduce Execution with Combiner, Controlling Reducer Execution with Partitioners, Customizing the MapReduce Program for Sorting Text Data, implementing a Map Reduce Program for Sorting Text Data

| UNIT 4 | Understanding Hadoop YARN Architecture | 8 hours |

Background of YARN, Advantages of YARN, YARN Architecture, Working of YARN, YARN Schedulers, Backward Compatibility with YARN, YARN Configurations, YARN commands, YARN containers, Registry.

| UNIT 5 | Exploring Hive, Analyzing Data with Pig Understanding Analytics and Big Data | 8 hours |

Exploring Hive: Introducing Hive, Getting Started with Hive, Hive Services, Data Types, Built-in Functions, Hive-DDL, Data Manipulation, Data Retrieval Queries, Using Joins.
Analyzing Data with Pig: Introducing Pig, Running Pig, Getting started with Pig Latin, working with operators in Pig, Debugging Pig, Working with Functions in pig, Error Handling in Pig.

 Understanding Analytics and Big Data: Comparing Reporting and analysis, Types of Analytics, Developing an Analytic Team, Understanding Text Analytics.

Textbooks:

1. Big Data Black Book by Dt Editorial Services, Dreamtech Publications, 2016.

References:

1. Hadoop the Definitive Guide by Tom White, O'Reilly ,4th Edition,2016.

Course Outcomes:

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

- Able to handle a real time big data application.
- Able to develop Map Reduce Applications.
- Perform YARN Configuration for handling Big Data.
- Learn to execute queries in Hive.
- Learn how Pig Latin is used for programming in Hadoop.

CO-PO Mapping:

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

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

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MATH3181	MULTIVARIATE ANALYSIS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	MATH1171: Descriptive Statistics and Probability Theory						
Co-requisite	None						
Preferable exposure	None						

Course Description:

The course is concerned with statistical methods designed to elicit information from different kinds of data sets. Since the data include simultaneous measurement on many variables, the methodology is called Multivariate analysis.

Course Educational Objectives:

- To learn the techniques of data reduction, sorting, and grouping.
- To investigate the dependence among variables.
- To predict values of one or more variables based on observations.
- To apply classification and discrimination procedures between two multivariate normal distributions
- To sensitize the basic ideas and concepts in Cluster analysis

UNIT 1   **8 hours**

Hotelling's T^2 and its sampling distribution, application in test on mean vector for one and more multivariate normal population and also on equality of components of a mean vector in multivariate normal population.

UNIT 2   **8 hours**

Definition of Wishart matrix and its properties, Mahalanobis distance, null distribution of Hotelling's T^2 statistic. Its application, tests on mean vector for one and more multivariate normal populations, equality of the components of a mean vector in a multivariate population

UNIT 3   **8 hours**

Classification and discrimination procedures: Procedures for discriminating between two multivariate normal populations, sample discriminant function, tests associated with discriminant functions, probability of mis-classification and their estimation.

UNIT 4   **8 hours**

Principle components, dimension reduction. Canonical variables and canonical correlation-

definition, use, estimation, and computation.

UNIT 5   **8 hours**

Cluster analysis: Hierarchical clustering - single, complete and average linkage methods, centroid and Ward's methods. Non-hierarchical methods – K-means algorithm.

Text books:

1. T.W. Anderson, An Introduction to Multivariate Statistical Analysis, 3nd Ed., Willey, 2003.
2. Johnson, R. and Wichern (1992) .Applied Multivariate Statistical Analysis. Prentice- Hall, 3rd edition.
3. Naresh K. Malhotra and Satyabhushan Das, " Marketing Research an applied orientation", 7th edition revised, Pearson education.

References:

1. N.C. Giri, Multivariate Statistical Inference, Academic Press, 2014.
2. D.F. Morrison, Multivariate Statistical Methods, 4nd Ed. McGraw Hill, 2014.

Course Outcomes:

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

1. To understand the concept of Hotelling's T^2 and its sampling distribution.

2. To learn the concept of Wishart matrix and its properties.

3. To apply classification and discrimination procedures between two multivariate normal distributions.

4. To understand Principal components and dimension reduction.

5. To sensitize the basic ideas and concepts in Cluster analysis.

CO-PO Mapping:

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

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

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MATH3191	ECONOMETRICS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	MATH1171: Descriptive Statistics and Probability Theory						
Co-requisite	None						
Preferable exposure	None						

Course Description:

The focus of this course is on economic models. The models that have been developed in econometrics play an important role in social sciences where there is a concern with building and estimating models and the interconnection between various sets of variables in predominantly nonexperimental situation.

Course Educational Objectives:

- To learn the nature and scope of econometrics and to formulate General linear model.

- To study equality of two regression equations.

- To learn about heteroscedasticity and autocorrelation.

- To understand distributed lag models

- To understand simultaneous equation models.

UNIT 1   **Review of Statistics Descriptive statistics**   **8 hours**

(a) the univariate case, (b) the bivariate case Random Variables and Probability distributions Estimation of parameters, Testing of hypotheses

UNIT 2   **Classical Linear Regression Model**   **8 hours**

Two Variable Case Descriptive Aspects, Properties of Least Squares estimates; tests of hypotheses and confidence intervals; Gauss - Markov Theorem Forecasting

UNIT 3   **Classical Multiple Linear Regression Model and Classical Model**   **8 hours**

Classical Multiple Linear Regression Model. Descriptive Aspects: Least Squares Estimation, R^2 and Adjusted R^2

The Classical Model: Gauss - Markov Theorem; Standard Error of Estimate Standard errors of regression coefficients, Partial Correlations Tests of Hypotheses: Single Parameters; Sets of Parameters iv) Forecasting; v) Functional Forms of Regression Models ;vi)Dummy Variables

UNIT 4   **8 hours**

Violations of Classical Assumptions and Remedies Multico linearity Heteroscedasticity Auto-correlation

UNIT 5   **8 hours**

Specification Analysis, Omission of a relevant variable, Inclusion of irrelevant variable Tests of Specification Errors.

Textbooks:

1.D. N. Gujarati and D.C. Porter, Essentials of Econometrics, 4th Edition, McGraw Hill International Edition

2. Jan Kmenta, Elements of Econometrics, Indian Reprint, Khosla Publishing House, 2008, few pages for 'Review of Statistics'. Edition, McGraw Hill International Edition.

References:

1. Christopher Dougherty, Introduction to Econometrics, 4th edition, OUP, Indian edition
2. Maddala, G.S and Kajal Lahiri, Introduction to Econometrics, 4th Wiley publication,2009

Course Outcomes:

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

1. To learn General linear model, OLS method of estimation and tests of hypothesis.
2. To understand tests of structural change in two variable and K variable linear model.
3. To learn about Generalized least squares estimators and Durbin Watson statistic.
4. To understand the sources of lagged variables and its estimation methods.
5. To learn simultaneous equation models and its estimation

CO-PO Mapping:

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

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

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