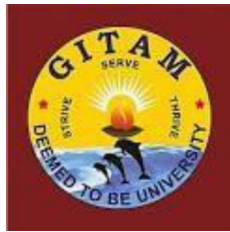


**GANDHI INSTITUTE OF TECHNOLOGY AND MANAGEMENT (GITAM)  
(Deemed to be University)  
VISAKHAPATNAM \* HYDERABAD \* BENGALURU**

**Accredited by NAAC with A<sup>+</sup> Grade**



**CURRICULUM AND SYLLABUS**

**of**

**B.Sc. Statistics**

**(w.e.f. 2021-22 admitted batch)**

## **Academic Regulations**

Applicable for the Undergraduate programmes in the Faculties of  
**Engineering, Humanities, Management and the Sciences**

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



### **Program Educational Objectives**

- To apply basic knowledge of statistics to understand the data interpretation problems.
- To develop complexity data problem solving techniques using statistical tools.
- To establish the methodologies for core statistical problems.
- To implement computer solution methods for large systems.
- To imbibe professional and ethical responsibility towards the society.

### **Program Outcomes**

- Apply basic knowledge of statistics to understand the data interpretation problems.
- Develop complexity data problem solving techniques using statistical tools.
- Establish the methodologies for core statistical problems.
- Implement computer solution methods for large systems.
- Assess the influence of global changes on organization for effective decision making business problems.
- Acquire knowledge of fast changing methodologies for solving big data problems.
- Exhibit leadership capabilities
- Perform inter-disciplinary research objectives
- Communicate effectively in peer and research related conferences
- Acquire skills to become a good researcher
- Engage in life-long learning environment.
- Imbibe professional and ethical responsibility towards the society.

### **Program Specific Outcomes**

- Apply statistical knowledge to analyse and solve complex problems using appropriate statistical methodology and interpret results in a variety of settings.
- Demonstrate the ability of critical observation, logical, analytical and problem-solving skill.
- Write code to extract and reformat real data and to utilize statistical programming environments.

## CURRICULUM STRUCTURE OF B.Sc. STATISTICS

(2021-22 ADMITTED BATCH)

### University Core (UC)

Course code	Level	Course title	L	T	P	S	J	C
CSEN1001	1	IT Productivity Tools <sup>^</sup>	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
CLAD1001	1	Emotional Intelligence & Reasoning Skills (Softskills 1)	0	0	2	0	0	1
CLAD1011	1	Leadership Skills & Quantitative Aptitude (Softskills 2)	0	0	2	0	0	1
CLAD1021	1	Verbal Ability & Quantitative Ability (Softskills 3)	0	0	2	0	0	1
CLAD1031	1	Practicing Verbal Ability & Quantitative Aptitude (Softskills 4)	0	0	2	0	0	1
VEDC1001	1	Venture Development	0	0	0	2	0	2
DOSP10XX	1	Sports 1#	0	0	0	2	0	2*
DOSL10XX	1	Club Activity#	0	0	0	2	0	2*
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*
DOSL10XX	1	Community Service#	0	0	0	0	2	2*
ENVS1001	1	Environmental Studies <sup>^</sup>	3	0	0	0	0	3*
MFST1001	1	Health and Welbeing#	0	0	2	0	0	1*
CLAD20XX	2	Softskills 5A/5B/5C	0	0	2	0	0	1
CLAD20XX	2	Softskills 6A/6B/6C	0	0	2	0	0	1
FINA3001	3	Personal Financial Planning#	0	0	2	0	0	1*

\* Pass/Fail courses

# Opt any three courses among the five

<sup>^</sup> Online/Swayam/NPTEL Courses

### Softskills courses 5 and 6

Course code	Level	Course title	L	T	P	S	J	C
CLAD2001	2	Preparation for Campus Placement - 1 (Softskills 5A)	0	0	2	0	0	1
CLAD2011	2	Preparation For Higher Education (GRE/ GMAT) - 1 (Softskills 5B)	0	0	2	0	0	1
CLAD2021	2	Preparation for CAT/ MAT - 1 (Softskills 5C)	0	0	2	0	0	1
CLAD2031	2	Preparation For Campus Placement - 2 (Softskills 6A)	0	0	2	0	0	1
CLAD2041	2	Preparation For Higher Education (GRE/ GMAT) - 2 (Softskills 6B)	0	0	2	0	0	1
CLAD2051	2	Preparation for CAT/ MAT - 2 (Softskills 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 club)	0	0	0	2	0	2
DOSL1021	1	Club Activity (Leader of Club)	0	0	0	2	0	2
DOSL1031	1	Club Activity (Competitor)	0	0	0	2	0	2

### Community Service courses

Course code	Level	Course title	L	T	P	S	J	C
DOSL1041	1	Community Services - Volunteer	0	0	0	0	2	2
DOSL1051	1	Community Services - Mobilizer	0	0	0	0	2	2

### Faculty Core (FC)

Course code	Level	Course title	L	T	P	S	J	C
MATH1171	1	Descriptive Statistics and Probability Theory	3	0	0	0	0	3
MATH1191	1	Statistical Methods	3	0	0	0	0	3
CSCI1011	1	Programming with C	3	0	0	0	0	3
CSCI1021	1	Programming with C Lab	0	0	2	0	0	1
MATH1211	1	Mathematical Expectation and Probability Distributions	3	0	0	0	0	3
CSCI1261	1	Fundamentals of Object Oriented Programming with C++	3	0	0	0	0	3
MATH1221	1	Probability Distributions Lab	0	0	2	0	0	1
CSCI1271	1	C++ Programming Lab	0	0	2	0	0	1

**Programme Core/ Major Core (PC/MaC)**

Course code	Level	Course title	L	T	P	S	J	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

**Programme Elective (PE)\***

Course code	Level	Course title	L	T	P	S	J	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

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

**Note 2:** Theory and corresponding lab course are co-requisites (For example if a student opts to study MATH2201 then he/she has to study MATH2221 in the same semester)

**Open Elective (OE)\***

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

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

Stream	Major course	Minor course (Select one)
Mathematical Sciences	Statistics	Physics
		Electronics
		Chemistry
		Data Science

Minor Courses in Physics*								
Course code	Level	Course title	L	T	P	S	J	C
PHYS1171	1	Thermal Physics and Statistical Mechanics	3	0	0	0	0	3
PHYS1181	1	Thermal Physics and Statistical Mechanics Lab	0	0	2	0	0	1
PHYS1151	2	Waves and Optics	3	0	0	0	0	3
PHYS3001	2	Mechanics of System of Particles	3	0	0	0	0	3
PHYS2001	2	Electricity and Magnetism	3	0	0	0	0	3
PHYS2021	2	Elements of Modern Physics	3	0	0	0	0	3
PHYS2031	2	Modern Physics Lab	0	0	2	0	0	1
PHYS2041	2	Elementary Mathematical methods of Physics	3	0	0	0	0	3
PHYS2051	2	Elementary Mathematical methods of Physics Lab	0	0	2	0	0	1
PHYS3041	3	Introduction to Quantum Mechanics	3	0	0	0	0	3

*\* Eligibility: This minor course is offered to the students of B.Sc Electronics/ Mathematics/ Chemistry/ Statistics*

**Minor Courses in Electronics\***

Course code	Level	Course title	L	T	P	S	J	C
PHYS1191	1	Electronic Devices & Circuits	3	0	0	0	0	3
PHYS1201	1	Electronic Devices & Circuits Lab	0	0	2	0	0	1
PHYS1211	2	Digital Electronics	3	0	0	0	0	3
PHYS2061	2	Analog & Digital IC Applications	3	0	0	0	0	3
PHYS2081	2	Basic Electronic Instrumentation	3	0	0	0	0	3
PHYS2101	2	Microcontrollers& Applications	3	0	0	0	0	3
PHYS2111	2	Microcontrollers& Applications Lab	0	0	2	0	0	1
PHYS3061	3	Electronic communications	3	0	0	0	0	3
PHYS3071	3	Electronic Communications Lab	0	0	2	0	0	1
PHYS3101	3	Introduction to Embedded systems	3	0	0	0	0	3

*\* Eligibility: This minor course is offered to the students of B.Sc Physics/ Mathematics/ Chemistry/ Statistics*

### Minor Courses in Chemistry

Course code	Level	Course title	L	T	P	S	J	C
CHEM1061	1	Inorganic Chemistry I	3	0	0	0	0	3
CHEM1071	1	Inorganic Chemistry 1 Lab	0	0	1	0	0	1
CHEM1081	1	Physical Chemistry I	3	0	0	0	0	3
CHEM2001	2	Organic Chemistry – I	3	0	0	0	0	3
CHEM2021	2	Inorganic Chemistry-II	3	0	0	0	0	3
CHEM2041	2	Physical Chemistry II	3	0	0	0	0	3
CHEM1091	1	Physical Chemistry 1 Lab	0	0	1	0	0	1
CHEM3001	3	Organic Chemistry – II	3	0	1	0	0	3
CHEM2011	2	Organic Chemistry 1 Lab	0	0	1	0	0	1
CHEM3021	3	Analytical Chemistry	3	0	1	0	0	3

\* Eligibility: This minor course is offered to the students of B.Sc Physics /Electronics/ Mathematics/ Electronics

### Minor courses in Data Science

Course code	Level	Course title	L	T	P	S	J	C
CSCI1031	1	Introduction to Python Programming	3	0	0	0	0	2
CSCI1271	1	Introduction to Python Programming Lab	0	0	2	0	0	2
CSCI2311	2	Basics of Data Structures and Algorithms	3	0	0	0	0	3
CSCI2321	2	Foundations of Artificial Intelligence	3	0	0	0	0	3
CSCI2331	2	Fundamentals of Cloud Computing	3	0	0	0	0	3
CSCI2341	2	Fundamentals of Database Management Systems	3	0	0	0	0	3
CSCI2071	2	Database Management Systems Lab	0	0	2	0	0	1
CSCI3301	3	Basics of Data Mining	3	0	0	0	0	3
CSCI3021	3	R Programming Lab	0	0	2	0	0	1
CSCI3311	3	Basics of Machine Learning	3	0	0	0	0	3

\* Eligibility: This minor course is offered to the students of B.Sc Mathematics/ Statistics/ Physics/ Electronics/ Chemistry

### Allocation of credits for 3-year B.Sc Program

Type of Course	Credits	% of Program (in credits)
University Core	12	10%
Faculty Core	18	15%
Major Core	32	26%
Major Electives	16	14%
Program Minor	24	20%
Open elective	18	15%
Total	120	100%

# CSEN1001: IT Productivity Tools

<b>L</b>	<b>T</b>	<b>P</b>	<b>S</b>	<b>J</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>1*</b>

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 Objectives

- to enable the learner, the skill in preparing technical documents of professional quality using docs, sheets and forms.
- to involve the student in designing and creating of websites and acquaint the student with the skill of processing audio, images, documents etc.
- to create awareness in analysing data using pivot tables, query manager etc.
- to create awareness in composing emails, mail merge, e-mail merge etc.
- to provide the exposure to work with collaborative tools.

## 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, bibliography, 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. Analyse the results of a examination studentwise, teacherwise, coursewise, 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](http://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/>
4. Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics Fourth Edition ISBN-13: 978-1449319274

## References/Online Resources

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

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



# LANG1001: Communication Skills in English - Beginners

L	T	P	S	J	C
0	0	4	0	0	2*

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

## Course 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 Cunninham, S. & Moor, P. (nd). New Cutting Hedge (Intermediate). Longman
2. Cambridge 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](http://www.teachingenglish.org.uk)
- [learnenglishteens.britishcouncil.org](http://learnenglishteens.britishcouncil.org)
- <https://eslflow.com/>
- <https://www.englishclub.com/>
- <https://www.oxfordlearnersdictionaries.com/>
- <https://dictionary.cambridge.org/>
- [learnenglishteens.britishcouncil.org](http://learnenglishteens.britishcouncil.org)
- <https://freerice.com/categories/english-vocabulary>

### Course Outcomes

- 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)
- 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)
- 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)
- 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)
- 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)

## LANG1011: Communication Skills in English

L T P S J C  
0 0 4 0 0 2

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 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 context (i.e. Identifying the situation and different roles and enacting their roles)

3	Information transfer: Verbal to visual (familiar context), demonstration by teacher, learners' task (guided with scaffolding), learners' task (free), presentation and feedback	Pair work for discussion & feedback, Presentations, question-answer
4	Information transfer: Visual to verbal (unfamiliar context); demonstration by teacher, learners' task (guided with scaffolding), learners' task (free), presentation and feedback	Pre-reading game/modelling, discussion in small groups, individual writing, and feedback
5	Introducing officials to peers and vice versa - Formal context	AV support, noticing, individual performance (3-4), pair work (in context), teacher modelling, group work for Introducing self and others in a formal context
6	Introducing friends to family and vice versa - Informal context	Teacher modelling/AV support, noticing structure & note-taking, Introducing friends and family in an informal context
7	Vocabulary in context: Find clues in a text and use them to guess the meaning of words/phrases. Apply the newly learnt vocabulary in communication (speaking and writing).	Comprehending verbal communication: Identifying the contextual clues in oral and written texts; guessing the meaning of words/phrases in context while reading texts and listening to discussions/talks
8	A five-day journal (diary) writing based on learners reading from newspaper on a single relevant/current social issue. Individual oral presentation and feedback from peers and instructor.	Note-making (group work), Discussion, Feedback
9	Follow the essentials of lectures, talks, discussions, reports and other forms of academic presentations and make individual and group presentations aided with images, audio, video, tabular data, etc.	Making power point presentation aided with images, audio, video, etc. with a small group by listening to academic lectures/talks/ discussions, etc.
10	Self-reflection: Re-reading one's own drafts, identifying errors, correcting the errors, and giving rationalize the changes	Pre-task discussion/modelling, Editing the texts by careful reading and identifying the errors, peer-exchange (Pair work), feedback/consolidation
11	Collaborative work (speaking and writing) in small groups of 3 or 4 learners: discussing a general/discipline-specific topic: creating outline, assigning specific roles to members of the group; and group presentation followed by peer and instructor feedback	Pre-task modelling (peer/teacher), general discussion on structure, group work (collaboration), feedback
12	Independent reading of different text types using appropriate reference sources by adapting suitable reading styles and speed. Focus on active reading for vocabulary: low-frequency collocations and idiomatic expressions.	Brain-storming, mapping of key terms (content specific), reading and note-making (individual), oral questioning, discussion
13	Role-play (specific social and academic situations): planning (making notes), understanding nuances of speaking in context, coordinating with situational clues and fellow speakers/participants	Peer discussion for outline, A-V support, observing (teacher modelling), role play (guided), role-play (free), feedback
14	Writing instructions: Guidelines - Flowcharts - Procedures to be followed	Pre-task reading, pair work, teacher/peer-discussion, feedback
15	Speaking spontaneously on topics of interest and writing short structured essays on the same topics adopting appropriate academic conventions and grammatical accuracy.	Reading for task preparation, note-making, speaking, reflection and corrective peer and teacher feedback

## Reference Books

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

- Understand the speaker's point of view in fairly extended talks on general or discipline-specific topics, and follow simple lines of argument in discussions on familiar contemporary issues. (Bloom's Taxonomy Level/s: 3)
- "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)"
- Make short presentations on a limited range of general topics using slides, and engage in small group discussions sharing experiences/views on familiar contemporary issues and give reasons for choices/opinions/plans. (Bloom's Taxonomy Level/s: 3 & 4)
- Write clear, fairly detailed text (a short essay) on a limited range of general topics, and subjects of interest, and communicate clearly through email/letter to seek/pass on information or give reasons for choices/opinions/plans/actions. (Bloom's Taxonomy Level/s: 3)
- Reflect on others' performance, give peer feedback on fellow learners' presentations, responses to writing tasks and reading comprehension questions. (Bloom's Taxonomy Level/s: 5)

## **LANG1021: Advanced Communication Skills in English**

<b>L</b>	<b>T</b>	<b>P</b>	<b>S</b>	<b>J</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>2</b>

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. analytical, 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 emphasizes free writing through meaningfully engaging tasks with a pre and post context building. There is ample scope for application of critical thinking through simulated activities for effective communication in real life situations.

### **Course Objectives**

1. 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)
2. Enable learners to become aware of tone and attitude in written texts, and demonstrate their comprehension of fairly complex lines of argument and points of view presented in a variety of texts by equipping them with upper intermediate to advanced level reading skills and strategies. (Bloom's Taxonomy Level/s:2 & 3)
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)
4. Equip learners with the skills and strategies to communicate effectively in speech and writing using the language with a degree of fluency, accuracy and spontaneity, and fairly good grammatical control adopting a level of formality appropriate to the context. Encourage learners to apply their knowledge of language and their communication skills in real life situations. (Bloom's Taxonomy Level/s:3 & 5)

## List of Activities & Tasks for Assessment

S.No.	Tasks	Activities	CO
1	Evaluative and extrapolative reading of a long text/short texts on a current topic related to technology and society, identifying and questioning the author's intention, post-reading discussion in small groups, maintaining group dynamics, arriving at a consensus	Pre-reading group discussion, silent reading (Note-making), modelling (questioning), post-reading reflection and brief presentation of thoughts/ideas/opinions on the theme of the text	3
2	Debate in pairs based on listening to two recorded contemporary speeches by well-known leaders in different fields. Peer feedback and instructor feedback.	Pre-recorded audio/video for listening, student checklist for noticing key words/concepts, pre-task orientation (by teacher), pair work, feedback	1
3	Information transfer: Verbal to visual (unfamiliar context); demonstration by teacher, learners' task (guided with scaffolding), learners' task (free), presentation, question-answer(among students), modification and feedback before the final version is done	Pair work for discussion and feedback, presentations, question-answer	2
4	Information transfer: Visual to verbal (unfamiliar context); demonstration by teacher, learners' task (guided with scaffolding), learners' task (free), presentation, question-answer(among students), modification, editing, proofreading, and feedback before the final version is done	Pre-reading game/modelling, discussion in small groups, independent writing and feedback	4
5	Expressing opinion on a short argumentative text (e.g. a journal article or a newspaper editorial) and justifying one's opinion/stance; focus on the use of appropriate conventions 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 argumentative essays).	3
6	Role-play (complex social and academic/professional situations): Focus on significant aspects of delivery including clarity, tone, and use of contextually appropriate vocabulary and conventions, observation, reflective discussion, and self-reflective writing	Reading newspaper/magazine articles/blog posts on current social issues, listening to talks/discussions/debates etc. and participating in role-plays using expressions appropriate to the context.	1
7	Collaborative writing in groups of 3 -4 on topics that would require data collection and reading followed by recorded peer-reflection and peer-feedback, group presentation and feedback	Pre-task modelling (peer), general discussion on structure, group work (collaboration), presentation, peer feedback, Open-class discussion	5
8	Formal Group Discussion on topics of current interest and relevance; focus on effective participation, reflection on control over argument/counter argument, and adherence to the conventions of formal GD	Noticing strategies from AV modelling, teacher scaffolding through open-house discussion, Note-making (Group work), Group Discussion (free), post performance 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 disagreeing with rationale	Listening to some lectures, talks, and presentations in the academic seminars and adapting some strategies to handle the Q&A sessions using polite and formal expressions to agree or disagree with the statements.	1
11	Modelling an interview: with a panel of four judges (peers)	Pre-task activity for orientation/strategies (controlled/guided), Model interview (AV support), Group work (role play), interview in pair (one-to-one), Interview in group (many -to-one), oral corrective feedback (peer/teacher)	2
12	Writing a short reflective report of an event - incident/meeting/celebration	Writing a report on meetings/celebrations/events etc. by actively involving in such events and giving a short oral presentation on the same.	4
13	Speaking on abstract and complex topics beyond his/her own area of interest/field of study, using the language flexibly and effectively.	Reading texts on abstract topics and comprehending the author's perspectives. Similarly, listening to talks and discussions on an abstract topic of other discipline and making short oral presentation by sharing views and opinions.	3
14	Self-reflection on own speech in context(recorded): tone, pitch, relevance, content; extending the reflections/ideas to others	Listening to selected general discussions (audios and videos) and observing the language production. Recording own speech on some general topic and providing a critical review (self-reflection) on it by focusing on the tone, expressions and relevance of the content, etc.	1
15	Collaborative and individual task: planning, preparing (preparing an outline, structure, setting objectives and presenting the plan of action) and executing a mini-project, and submitting a brief report on the same peer and instructor feedback after the planning stage and on completion of the mini project	Pre-task modelling (peer/teacher), general discussion on structure, group work (collaboration), oral corrective, task distribution, presentation, feedback	5

### Reference Books

1. Latham-Koenig, C. & Oxenden, C. (2014). American English File-5. Oxford: OUPRichards,
2. J.C. and Bohlke, D. (2012). Four Corners-4. Cambridge: CUP.
3. Cambridge Academic English: An Integrated Skills Course for EAP (Advanced) By Martin Hewings and Craig Thaine, CUP (2012)



4. Berlin, A. (2016). 50 Conversation Classes: 50 Sets of Conversation Cards With an Accompanying Activity Sheet Containing Vocabulary, Idioms and Grammar. Poland: CreateSpace Independent Publishing Platform
5. Zemach, D. E., Islam, C. (2011). Writing Paragraphs: From Sentence to Paragraph. Germany: Macmillan Education.
6. Stewart, J. P., Fulop, D. (2019). Mastering the Art of Oral Presentations: Winning Orals, Speeches, and Stand-Up Presentations. United Kingdom: Wiley.
7. Kroehnert, Gary. (2010). Basic Presentation Skills. Sidney: McGraw Hill.
8. Cunningham, 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](http://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**

- 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)
- Make presentations using suitable AV aids and engage in formal group discussions on a wide range of topics of contemporary interest, demonstrating awareness of standard/widely accepted conventions. (Bloom's Taxonomy Level/s: 3)
- 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)
- 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)
- 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)

## **CLAD1001: Emotional Intelligence & Reasoning Skills (Soft Skills 1)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>S</b>	<b>J</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>1</b>

### **Course Description:**

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

### **Course Objectives:**

1. 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.
2. Set meaningful goals based on their strengths and weaknesses and apply time management techniques, such as Q4 organizing to put first things first.
3. Manage conflicts and work in teams in an emotionally intelligent manner.
4. Solve questions on non-verbal and analytical reasoning, data sufficiency and puzzles

<b>Unit</b>	<b>Topics</b>	<b>Hours</b>
1	Self Awareness & Self Regulation: Introduction to Emotional Intelligence, <i>Self Awareness</i> : Self Motivation, Accurate Self Assessment (SWOT Analysis), Self Regulation: <i>Self Control, Trustworthiness &amp; Adaptability</i>	3
2	Importance, Practising Social Awareness, Building Relationships, Healthy and Unhealthy Relationships, Relationship Management Competencies- Influence, Empathy, Communication, Types of Conflicts, Causes, Conflict Management	3
3	Social Media: Creating a blog, use of messaging applications, creating a website to showcase individual talent, creation of a LinkedIn Profile	2
4	Goal Setting & Time Management: Setting SMART Goals, Time Wasters, Prioritization, Urgent Vs Important, Q2 Organization	3
5	Teamwork: Team Spirit, Difference Between Effective and Ineffective Teams, Characteristics of High Performance Teams, Team Bonding, Persuasion, Team Culture, Building Trust, Emotional Bank Account	4
6	Verbal Reasoning: Introduction, Coding-decoding, Blood relations, Ranking, Directions, Group Reasoning	6
7	Analytical Reasoning: Cubes and Dices, Counting of Geometrical figures	3
8	Logical Deduction: Venn diagrams, Syllogisms, Data Sufficiency, Binary logic	4
9	Spatial Reasoning: Shapes, Paper Cutting/Folding, Mirror images, Water images and Rotation of figures	2
	<b>Total Hours</b>	30

### Course Outcomes

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

### References:

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

## CLAD1011: Leadership Skills & Quantitative Aptitude (Soft Skills 2)

L T P S J C  
0 0 2 0 0 1

### Course Description:

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

### Course Objectives:

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

Unit	Topics	Hours
1	Communication Skills: <i>The Communication Process</i> , Elements of Interpersonal Communication, <i>Non-Verbal Communication</i> : Body Language, Posture, Eye Contact, Smile, Tone of Voice, <i>Barriers to Communication</i> . Effective Listening Skills: Active Listening, Passive Listening, Asking Questions, Empathizing, Being Non Judgemental, Being Open Minded, Mass Communication: Design of Posters, Advertisements, notices, writing formal and informal invitations	5
2	Focus on Audience Needs, Focus on the Core Message, Use Body Language and Voice, Start Strongly, Organizing Ideas & Using Visual Aids: SPAM Model, Effective Opening and Closing Techniques, Guy Kawasaki's Rule (10-20-30 Rule), Overcoming Stage Fear, Story Telling	3
3	Problem Solving & Decision Making: Difference Between the Two, Steps in Rational Approach to Problem Solving: Defining the Problem, Identifying the Root Causes, Generating Alternative Solutions, Evaluating and Selecting Solutions, Implementing and Following-Up, Case Studies	3

4	Group Discussion: Understanding GD, Evaluation Criteria, Nine Essential Qualities for Success, Positive and Negative Roles, Mind Mapping, Structuring a Response, Methods of Generating Fresh Ideas	4
5	Number Theory: Number System, Divisibility rules, Remainders and LCM & HCF	3
6	Numerical Computation and Estimation - I : Chain Rule, Ratio Proportions, Partnerships & Averages, Percentages, Profit-Loss & Discounts, Mixtures, Problems on Numbers & ages	6
7	Data Interpretation: Interpretation and analysis of data in Tables, Caselets, Line-graphs, Pie-graphs, Box-plots, Scatter-plots and Data Sufficiency	3
8	Mental Ability: Series(Number, Letter and Alphanumeric), Analogy(Number, Letter and Alphanumeric) and Classifications	3
	<b>Total Hours</b>	30

### Course Outcomes

- 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.
- Students will be able to apply the the rational model of problem solving and decision making in their problem solving and decision making efforts.
- Students will be able to solve questions based on numbers and arithmetic given in various competitive examinations
- Students will be able to solve questions based on data interpretation, progressions and series.

### References:

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

## CLAD1021: Verbal Ability & Quantitative Ability (Soft Skills 3)

L	T	P	S	J	C
0	0	2	0	0	1

### 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 Objectives:

1. List and discuss the different word formation methods, word denotation, connotation, collocation, etc. and introduce selected high frequency words, their antonyms, synonyms, etc
  2. Apply different advanced reading skills to solve questions based on author's tone, main ideas and sub-ideas, inferences, parajumbles, etc. that are frequently asked in various competitive exams and admission tests.
  3. 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.
  4. 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.
- 
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 Specific, Specific 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)

**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

**References:**

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

## **CLAD1031: Practicing Verbal Ability & Quantitative Aptitude (Soft Skills 4)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>S</b>	<b>J</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>1</b>

### **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], Cryptarithmic & Modular Arithmetic (Cryptarithmic, 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 Objectives:**

1. Apply the rules of grammar to solve questions in Error Detection, Sentence Correction and Sentence Improvement.
  2. Apply the rules of structure to solve questions in Error Detection, Sentence Correction and Sentence Improvement, Fill-in-blanks and Cloze Passages.
  3. Explain methods of solving problems in Combinatorics (Permutations & Combinations, Probability], Cryptarithmic & Modular Arithmetic (Cryptarithmic, Application of base system (7, 24), Clocks (Base 24), Calendars (Base 7)]
  4. 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)
- 
1. Error Detection: Pronouns, Conjunctions, Prepositions and Articles
  2. Error Detection: Tenses and their Uses
  3. Sentence Correction: Subject-Verb Agreement, Antecedent-Pronoun Agreement, Conditional Clauses
  4. Sentence Correction: Modifiers (Misplaced and Dangling) & Determiners, Parallelism & Word Order, and Degrees of Comparison
  5. Combinatorics: Permutations & Combinations, Probability



6. Crypt arithmetic & Modular Arithmetic: Crypt arithmetic, Application of Base System (7, 24), Clocks (Base 24), Calendars (Base 7)
7. Algebra: Exponents, Logarithms, Word-problems related to equations, Special Equations, Progressions, Statistics

**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, Cryptarithmic, and Modular Arithmetic
4. Solve problems in Mental Ability and Algebra

**References:**

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

# VEDC1001: Venture Development

<b>L</b>	<b>T</b>	<b>P</b>	<b>S</b>	<b>J</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>2</b>

## Course Description

In this course, you will discover your deeper self in terms of how you might contribute to society by creating exciting new products and services that can become the basis of a real business. Your efforts, creativity, passion, and dedication to solving challenging problems are the future of our society, both in your country and worldwide.

The course is divided into four sections:

1. Personal discovery of your core values and natural skills
2. Ideation and improving the impact
3. Business model design for the innovation
4. Presenting your idea in a professional manner suitable for a new venture pitch

Each section has key frameworks and templates for you to complete, improving your idea step by step until the final presentation.

First, you will discover your personal values and emerging areas of knowledge that are the foundations of any successful company. Next, you will learn how to develop insight into the problems and desires of different types of target customers and identify the design drivers for a specific innovation. Then, you will learn specific design methods for new products and services. And as important as the product or service itself, it is a strategy for monetizing the innovation – generating revenue, structuring the operating costs, and creating the operating profit needed to support the business, hire new employees, and expand forward.

This project is intended to be for teams of students. Innovation and entrepreneurship are inherently team-based. This course will give you that entrepreneurial experience.

This is the beginning of what might be the most important journey of personal and career discovery so far in your life, one with lasting impact. This is not just a course but potentially an important milestone in your life that you remember warmly in the years to come.

## Course Objectives

Students will have the opportunity to:

- Discovery who you 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 actually going through the innovation process.
- Conduct field research to test or validate innovation concepts with target customers.
- Understand innovation outcomes: issues around business models, financing for start-ups, intellectual property, technology licensing, corporate ventures, and product line or service extensions.

## Course Materials

- Meyer and Lee (2020), Personal Discovery through Entrepreneurship, The Institute for Enterprise Growth, LLC. Boston, MA., USA
- Additional readings

- Additional videos, including case studies and customer interviewing methods.

***Expectations of you in the classroom:*** Each student is expected to be prepared to discuss the readings/exercises assigned for each class. It's not optional! Students will be randomly asked to discuss and summarize the material. Your learning – and your success—in this course are heavily dependent upon your willingness to participate actively in class discussion. Your class participation will be assessed on the quality and consistency of your effort in each and every class.

***Late assignments:*** Late assignments are subject to grade penalty. Lateness will only be considered for grading if prior notice was given to the instructor before the due date.

***Presentation:*** Achieving success with an innovative idea requires you to package and present the idea in a crisp, creative, and powerful manner. The activity of presenting helps you to internalize your idea -- as you talk about it and obtain feedback – and improve upon it. There would be two major presentations during the course, plus a series of other smaller unscheduled presentations of work in progress or course material. Prepare, practice, and succeed!

***Time spent outside of class:*** The course is hands-on and requires students to conduct field research through direct interactions with people (interviews/surveys) and online/in the library. Specifically, the course requires that students conduct studies with potential target users and stakeholders. You must be prepared to go out of your comfort zone to dig for information. You will need to search for information online and arrange to meet or talk to relevant people who may have the information you need.

### **Group Project Overview**

This is a semester length project and the cornerstone component of the course. The group project will give you the opportunity to apply the course concepts to a real situation. You will learn about the entrepreneurship for your own business or your work in organizations. Even if you are not going to be an entrepreneur, you need to know how to identify the opportunities, who to persuade people, and how to create economic and social values in many different contexts.

Talking to customers is one of the most important steps in investigating your business because your entrepreneurial vision must correspond to a true market opportunity. With your group, select 5-6 potential customers willing to be interviewed. They should represent a cross-section of our target market and should provide information that helps you refine your opportunity. This is not a simple survey: you are seeking in-depth understanding of the lifestyle and behaviors of your customer that can help you shape your opportunity. Please remember, you are not simply looking to confirm you have a great idea, but to shape your idea into a great opportunity. You will maximize your chances for success and your ability to execute your business cost-effectively by making early (rather than later) changes to your concept.

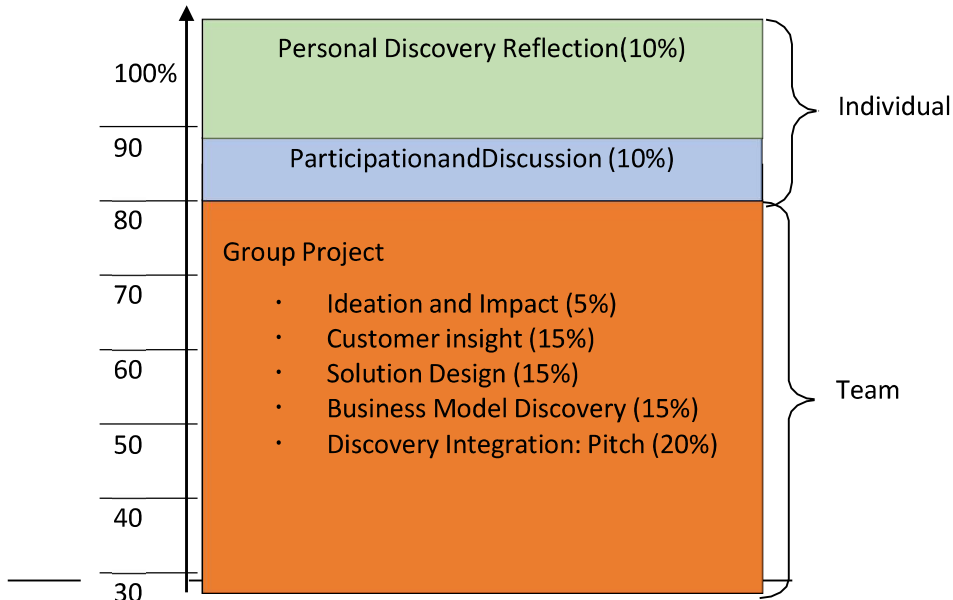
“Design” is fun, particularly when you merge customer insight with your own creativity. Enjoy! In this book, we provide structured methods to be an active listener and learner from customers as well as a product or service designer.

Business modeling is not as hard as it might sound. This is the design of your business – how it charges customers, what is spent producing and selling products or services, and the money that can be made for each unit sold. We keep it simple – so should you.

For the final outcome, you will be required to come up with Pitch that can be used as the basis for actually starting a company based on an impactful innovation. Once again, we provide a specific format and tools for creating a compelling Pitch. We also want you to think about an exciting proposition that is more than just making money, but rather, one that helps society. This will give

you innovation and venture concept greater lift with customers – and it will also make you feel better, deep inside.

**Project Components and Grading**



20 Solution Discovery 10	STEP 04 Ideation & Impact	STEP 07 User Insight	STEP 08 Concept Design	STEP 09 Product Line Strategy	STEP 10 Prototyping Solutions	STEP 11 Reality Check
STEP 05 Mission Statement						STEP 12 Business Model Design
STEP 04 Define Purpose						STEP 13 Understand the Industry
STEP 03 Build a Team						STEP 14 Types of Business Models
STEP 02 Excite & Excel						STEP 15 Define Revenue Models
STEP 01 Personal Values						STEP 16 Define Operating Models
Personal Discovery GO!	STEP 20 Tell Your Story	STEP 19 Create Value	STEP 18 Define Company Impact	Discovery Integation	STEP 17 Validate Business Model	STEP 16 Define Customer Journey

[20 Steps and activities in this course]

**Deliverables**

There are a number of different deliverables for the course that follow the templates presented in the book, as applied to your own venture idea. Do your best to keep up with the timeline of the

class; do not fall behind! Later templates build on the learnings from prior templates. Make the most of your team! Everyone needs to pitch in. In no case, should one person be taking the lead on all templates. Rather, different team members should take the lead on specific deliverables. Coordinate well. Let your teacher know if a team member is not carrying his or her load.

## Specific Deliverables

**Ideation and Impact** Hand-in Package: 5% of total grade  
clearly written, with a one-page explanation for the team's decision

- Problem to Solve Templates, Step 4, Page 62 and 63 (with a page of additional explanation if needed)
- Idea Impact Template, Step 6, Page 69 (with a page of explanation)

**Customer Interviews and Insight** Hand-in Package: 15%  
(1<sup>st</sup> Round of Customer Interviews)

- Customer Interviews Template, Step 7, Pages 75-78, plus add additional template forms for each additional customer interview. The more, the better.
- Idea Reshaping Template, Step 7, Pages 84 and 85. Integration into overall conclusions. How have you improved your original idea through customer research?
- Latent Needs Template, Step 7, Page 93 – what are the frustrations of users that are not solved by current products or services?
- Full Use Case Template, Step 7, Page 99 – how do your customers' needs change over the full use case, and what innovative ideas can you propose at each step of the way?

**Concept Design (and Test)** Hand-in Package: 15%

- Customer Value Proposition Template: Step 8, Page 107. This becomes the landing point for what you learned in your customer interviews.
- Competitive Analysis Template: Step 8, Page 109. (Use the Web or actual stores/dealers)
- Product Vision and Subsystem Design Templates: Step 10, Pages 121 and 126 (You can add additional pages with design illustration and explanations of your bubble chart)
- Reality Check Survey Template and Results: Step 11, Page 141, 143-144 (You can use more than 2 pages for reporting the results.)

**Business Model Design** Hand-in Package: 15%

- Industry Analysis Templates: Step 12, Pages 153 and 154
- Illustrate the Business Model Template: Step 13, Page 170 (Use different colours or line patterns to show the flows of product, money, and information)
- Revenue Model Template: Step 14, Page 177
- Operating Model Template: Step 15, Page 187
- Customer Journey Template: Step 16, Page 195
- Validating the Business Model Template: Step 17, Pages 199 and 200

**Discovery Integration** Hand-in Package: 20%

- Business and Social Vision Impact Statement Template: Step 18, Page 210.
- Per Unit Profitability Template: Step 19, Page 229
- Your Venture Story Pitch: Step 20 (PowerPoint)
- Overall Pitch Design Template: Page 264



Assemble the templates from all your work above, plus any others that you found particularly meaningful, and from these, create your Team’s Innovation Pitch. The book has lists specific templates that fit for each part of the final presentation.

Do not just regurgitate the templates in your pitch; rather, take the key points from them to create your own, unique presentation. The templates help you think – but most are too complex to present to outside people who have not taken the course. Therefore, design this pitch as if you presenting to a new set of investors.

And don’t forget to add an attractive title page with your team members names and email addresses! You can also add an Appendix at the very back with particularly interesting information, such as industry data or the results of your customer interviews and Reality Check.

**Individual Innovation Assignments**

You will be required to submit two Reflection Journals as well as a maximum two pages double spaced Synthesis, Integration and Application paper by email at the Week 4 and Week 14 respectively. Please note, this exercise is not about regurgitating the course concepts.

**(1) Personal Discovery Reflection Journal (10%)**

At the beginning of this semester, you will have a time to think about your self (who you are, what you are good at, what areas you want to contribute on) using a couple of templates. After that sessions, you will have a quiet moment to think about yourself, your career, and your happiness in your life. Please write 2-page reflectional journal what you feel and learning through the personal discovery sessions.

**(2) Insight Learning Reflection Journal (10%)**

At the end of this semester, you are to prepare a short reflection of impressive sessions as well as related activities outside the classroom. Specially, (1) reflect on the key points from lectures, reading, discussion, guest speakers, and interviews, (2) apply this to your own situation, and (3) outline ways that you intend to use this knowledge in the future.

## Course Schedule

<b>Week</b>	<b>Session</b>	<b>Topics and Steps</b>	<b>Key CONCEPTS Introduced in Class</b>	<b>Class Focus Activity</b>
1	1	<b>Course Overview</b>	<ol style="list-style-type: none"> <li>1. Why is entrepreneurship important?</li> <li>2. What is Personal Discovery through Entrepreneurship?</li> <li>3. Four Stages; Personal Discovery, Solution Discovery, Business Model Discovery, Discovery Integration</li> <li>4. Preparation (finding interesting areas)</li> </ol>	<b>Lecture and Discussion</b>
	2	<b>Personal Discovery</b> (Step 01, Step 02)	<ol style="list-style-type: none"> <li>1. Personal Values</li> <li>2. Strength and Weakness</li> </ol>	Individual: <ul style="list-style-type: none"> <li>• Work with the templates provided on pages:</li> <li>• Core values: 22, 23</li> <li>• Skills: 27, 28, 29, 30, 31</li> <li>• Societal Contribution: 33, 34</li> </ul>
2	3	<b>Find Teammates</b> (Step 03)	<ol style="list-style-type: none"> <li>1. Review Problem Area Template at the beginning of the book to find classmates who want to work on the same problem area.</li> <li>2. Findteammates               <ol style="list-style-type: none"> <li>(1) Shared values</li> <li>(2) Levels of commitment</li> <li>(3) Skills and experiences (Same or Different?)</li> </ol> </li> </ol>	Problem template: Page 9 <ul style="list-style-type: none"> <li>• Talk to your classmates and find teammates. See who wants to work on in the same problem space, with a shared vision of solutions, and complementary skill sets.</li> <li>• Sit back and assess: Team templates on Pages 44, 45, and 46.</li> <li>• Prepare to present your team, the problem it is going to tackle, and its collective skills.</li> </ul>
	4	<b>Define Purpose</b> (Step 04) <b>Create Mission</b> (Step 05)	<ol style="list-style-type: none"> <li>1. Methods for defining and refining a venture's purpose</li> <li>2. Defining a Venture's Purpose</li> <li>3. Creating a Vision Statement</li> </ol>	Team: <ul style="list-style-type: none"> <li>• Purpose and Mission Templates: Pages 49 and 52</li> <li>• Be prepare to present to the class.</li> <li>• Personal Discovery Reflection Journal Due</li> </ul>


<b>Week</b>	<b>Session</b>	<b>Topics and Steps</b>	<b>Key CONCEPTS Introduced in Class</b>	<b>Class Focus Activity</b>
3	5	<b>Ideation &amp; Impact</b> (Step 06)	Ideation Methods <ul style="list-style-type: none"> <li>An in-class ideation exercise</li> </ul>	Team: <ul style="list-style-type: none"> <li>Problem to Solve Templates, Step 4, Page 62, and 63</li> </ul>
	6		Increasing the Impact of an Idea. (The Eat-Your-Coffee Video – a good example of ideation)	Team: <ul style="list-style-type: none"> <li>Idea Impact Template, Step 6, Page 69</li> </ul>
4	7	<b>User Insights Frameworks</b> (Step 07)	<ul style="list-style-type: none"> <li>Identify and find the right target users.</li> <li>Interview style and methods</li> <li>The Customer Interview template.</li> </ul>	Team: <ul style="list-style-type: none"> <li>Customer Interviews Template, Step 7, Pages 75</li> <li>Edit interview template for your project.</li> </ul>
	8		Laddering methods for interviews	Team: <ul style="list-style-type: none"> <li>Latent Needs Template, Step 7, Page 93</li> </ul>
5	9	<b>User Insights Customer Interviews</b> (Step 07)	<ul style="list-style-type: none"> <li>Finding latent needs</li> <li>Field work check-in</li> </ul>	Team: <ul style="list-style-type: none"> <li>Latent Needs Template, Step 7, Page 93</li> <li>Field work – customer interviewing</li> </ul>
	10		<ul style="list-style-type: none"> <li>Think about innovation across the entire use case</li> <li>Field work check-in</li> </ul>	Team: <ul style="list-style-type: none"> <li>Full Use Case Template, Step 7, Page 99</li> <li>Field work – customer interviewing</li> </ul>
6	11	<b>User Insights Interpreting Results</b> (Step 07)	<ul style="list-style-type: none"> <li>Interpreting customer interview results</li> <li>Field work check-in</li> </ul>	Team: <ul style="list-style-type: none"> <li>Field work – customer interviewing</li> <li>Also talk to retailers/dealers if appropriate</li> </ul>
	12		<ul style="list-style-type: none"> <li>Idea Reshaping based on Customer Interviews</li> <li>Field work check-in</li> </ul>	Teams prepare results of results from customer interviews and how the original ideas have been reshaped & improved.
7	13	<b>User Insights Interpreting Results</b> (Step 07)	<ul style="list-style-type: none"> <li>Customer Research Reports</li> <li>Implications for product and service design</li> </ul>	<ul style="list-style-type: none"> <li>Teams prepare PPTs for class presentation</li> <li><b>Customer Insight Template Hand-in Package</b></li> </ul>
	14			



<b>Week</b>	<b>Session</b>	<b>Topics and Steps</b>	<b>Key CONCEPTS Introduced in Class</b>	<b>Class Focus Activity</b>
8	15	<b>Concept Design</b> (Step 08)	<ul style="list-style-type: none"> <li>• Defining Customer Value</li> <li>• Understanding Customer Value Proposition</li> </ul>	Team: <ul style="list-style-type: none"> <li>• Customer Value Proposition</li> <li>• Template: Step 8, Page 107</li> <li>• Draft the CVP</li> </ul>
	16		<ul style="list-style-type: none"> <li>• Presentation and review of CVPs</li> </ul>	Team: <ul style="list-style-type: none"> <li>• Complete CVP</li> </ul>
9	17	<b>Competitive Analysis and Positioning</b> (Step 08)	<ul style="list-style-type: none"> <li>• Understanding of Competitive Matrix</li> <li>• Competitive positioning: creating your separate space</li> </ul>	Team: <ul style="list-style-type: none"> <li>• Identify major competitors, and dimensions for analysis</li> <li>• Template: Step 8, Page 109</li> </ul>
	18		<ul style="list-style-type: none"> <li>• Presentations of Competitive Analyses and Positionings</li> </ul>	Team: <ul style="list-style-type: none"> <li>• Perform the competitive analysis and present results, including positioning</li> </ul>
10	19	<b>Product Line Strategy</b> (Step 09)	<ul style="list-style-type: none"> <li>• Product line framework: good, better, best on underlying platforms, plus application to Services.</li> </ul>	Team: <ul style="list-style-type: none"> <li>• Identify good, better, best variations based on the underlying concept.</li> <li>• Product line template: Page 115</li> </ul>
	20	<b>Product Visioning Subsystem Design, and Prototype Sketch</b> (Step 10)	<ul style="list-style-type: none"> <li>• The structured bubble chart, showing implementation options and the team's choices</li> <li>• Prototype sketching (The Bluereo Video is a good example of iterative prototyping driven by customer discovery.)</li> </ul>	Team: <ul style="list-style-type: none"> <li>• Prototype sketch, and for Web apps, a wireframe. For physical products, an initial bill of materials.</li> <li>• Underlying bubble chart showing your decision process.</li> <li>• Product Vision and Subsystem Design Templates: Step 10, Pages 121 and 126</li> </ul>
<b>Week</b>	<b>Session</b>	<b>Topics and Steps</b>	<b>• Key CONCEPTS Introduced in Class</b>	<b>Team or Individual Activity</b>
11	21	<b>Reality Check</b> (Step 11)	<ul style="list-style-type: none"> <li>• The purpose of the Reality Check, testing the product concept, channel preferences, and much other.</li> </ul>	Team: <ul style="list-style-type: none"> <li>• Reality Check Survey Template and Results: Step 11, Page 141, 143-144</li> </ul>

	22		<ul style="list-style-type: none"> <li>• Guidance on the number or additional customers for the reality check survey</li> <li>• How to analyze and interpret the results</li> </ul>	<ul style="list-style-type: none"> <li>• Customize the Reality Check template for your venture.</li> <li>• Do a quick round of customer surveying. Aim for 12 more interviews.</li> </ul>
12	23	<b>Industry Analysis</b> (Step 12)	<ul style="list-style-type: none"> <li>• Team reports on Reality Check Results</li> <li>• Examine major components of an Industry Analysis</li> <li>• Review Templates</li> </ul>	<p>Team:</p> <ul style="list-style-type: none"> <li>• Prepare and present the results of your reality check, plus any pivots you wish to make.</li> <li>• <b>Concept Design (and Test) Hand-in Package</b></li> <li>• Industry Analysis Templates: Step 12, Pages 153 and 154s</li> </ul>
	24	<b>Business Model</b> (Step 13)	<ul style="list-style-type: none"> <li>• Defining the Business Model:</li> <li>• Lecture on basic structure and different types.</li> <li>• Illustrating it as the flow of product, money, and information.</li> </ul>	<p>Team:</p> <ul style="list-style-type: none"> <li>• Business Model Illustration Template, Step 13, Page 170</li> </ul>

Week	Session	Topics and Steps	• Key CONCEPTS Introduced in Class	Team or Individual Activity
13	25	<b>Business Model</b> (Steps 14, 15, 16, 17)	<ul style="list-style-type: none"> <li>• Revenue and Expenses</li> <li>• The key decision points in the Revenue Model</li> <li>• The key decision points in the Operating Model</li> <li>• Designing the Customer Journey</li> <li>• Validating the Business Model (The Polka Dog Bakery Video: an example of creating a new retail experience, plus new products.)</li> </ul>	Team <ul style="list-style-type: none"> <li>• Step 14, Page 177</li> <li>• Step 15, Page 187</li> <li>• Step 16, Page 195</li> <li>• Step 17, Pages 199 and 200</li> <li>• Validate the Revenue and Operating Model by trying to have phone calls with a few Sellers and Manufacturers to validating pricing, channels, and costs.</li> </ul>
	26			Team: <ul style="list-style-type: none"> <li>• Start integrating your research and templates towards the final presentation, provided in Step 20, Page 264</li> <li>• <b>Business Model Design Hand-in Package</b></li> </ul>
14	27	<b>Impact Visioning</b> (Step 18)	<ul style="list-style-type: none"> <li>• Develop clear statements for business and societal impact.</li> <li>• Look at good existing examples of companies that do both.</li> </ul>	Team: <ul style="list-style-type: none"> <li>• Develop and present Unit of 1 Economics Template, Step 19, Page 229</li> <li>• Keep working on the Final presentation</li> </ul>
	28	<b>Creating Value</b> (Step 19)	<ul style="list-style-type: none"> <li>• Develop a project of the profitability in make low volumes for a product, a service, and a Web app.</li> <li>• Discuss applications of the framework to your venture.</li> </ul>	

Week	Session	Topics and Steps	Key CONCEPTS Introduced in Class	Team or Individual Activity
15	29	<b>Tell Your Story</b>	<ul style="list-style-type: none"> <li>• Presentation Format and Style</li> <li>• Format:               <ol style="list-style-type: none"> <li>(1) Title Slide with names and contact information</li> <li>(2) The Target Customer and the Problem to be Solved</li> <li>(3) The Market Opportunity</li> <li>(4) The Innovation Story</li> <li>(5) The Business Model Story</li> <li>(6) The Customer Journey</li> <li>(7) The Team</li> <li>(8) The Proposed Action Steps.</li> <li>(9) Appendices (if needed or desired)</li> </ol> </li> <li>• If you have built a prototype during the class, please bring it and show it to us!</li> </ul> <p>(The Fortify Video is a good example of how a good technical idea can translate into a business model, and next, into a well-funded venture.)</p>	<p>Team:</p> <ul style="list-style-type: none"> <li>• The PPT Presentation</li> </ul>  <ul style="list-style-type: none"> <li>• Practice, practice, practice!</li> <li>• Not too many words on one slide</li> <li>• Use pictures</li> <li>• Use template to develop your thinking, but try to create slides that are not just the templates.</li> </ul>
	30			

## Course Outcomes

5. Identify one's values, passions, skills and their will to contribute to society
6. Formulate an idea and validate it with customers
7. Demonstrate prototyping and analyze the competition for the product
8. Create business models for revenue generation and sustainability of their business
9. Come up with a pitch that can be used as the basis for actually starting a company based on an impactful innovation and societal impact

# **DOSP1001: Badminton**

**L T P S J C**  
**0 0 0 2 0 2\***

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 Objectives:**

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

## **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

## **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

## **Reference:**

1. Handbook of the Badminton World Federation (BWF)

## **DOSP1011: Chess**

**L T P S J C**  
**0 0 0 2 0 2\***

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 Objectives:**

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

### **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

### **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

### **Reference:**

1. International Chess Federation (FIDE) Handbook

# DOSP1031: Football

L T P S J C  
0 0 0 2 0 2\*

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 Objectives:

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

## 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

## 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

## Reference:

1. FIFA Laws of the Game

# DOSP1041: Volleyball

L T P S J C  
0 0 0 2 0 2\*

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 Objectives:

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

## 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

## 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

## Reference:

1. FIVB - Official Volleyball Rules



## **DOSP1051: Kabaddi**

<b>L</b>	<b>T</b>	<b>P</b>	<b>S</b>	<b>J</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>2*</b>

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 Objectives:**

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

### **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

### **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

### **Reference:**

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

## DOSP1091: Basketball

<b>L</b>	<b>T</b>	<b>P</b>	<b>S</b>	<b>J</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>2*</b>

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 Objectives:

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

### 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

### 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

### Reference:

1. FIBA Basketball Official Rules

# DOSP1111: Throwball

<b>L</b>	<b>T</b>	<b>P</b>	<b>S</b>	<b>J</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>2*</b>

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 Objectives:

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

## 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

## 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

## Reference:

1. World Throwball Federation - Rules of the Game

## DOSL1001: Club Activity – Participant

L	T	P	S	J	C
0	0	0	2	0	2*

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 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)

### Text Books

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

- Identify personal interest areas
- Learn from diverse perspectives and experiences
- Gain exposure to various activities and opportunities for extra-curricular activities
- Learn to manage time effectively
- gain confidence

## DOSL1011: Club Activity – Member of the Club

L	T	P	S	J	C
0	0	0	2	0	2*

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 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

### Text Books

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

## DOSL1021: Club Activity – Leader of the Club

L	T	P	S	J	C
0	0	0	2	0	2*

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

### Course 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



**Text Books**

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

## DOSL1031: Club Activity – Competitor

<b>L</b>	<b>T</b>	<b>P</b>	<b>S</b>	<b>J</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>2*</b>

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

### Course 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

**Text Books**

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

# **POLS1001: Indian Constitution and History**

<b>L</b>	<b>T</b>	<b>P</b>	<b>S</b>	<b>J</b>	<b>C</b>
<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2*</b>

## **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 Objectives:**

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

## **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

## **Unit I: India as a Nation**

**6 hrs**

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.

## Module Learning Outcomes

1. Understand ideas of India
2. Explain the story behind making constitution and its future.
3. Articulate the differences between pre and post-colonial governments.

## Unit 2: Understanding the Constitution

6 hrs

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.

### Module Learning Outcomes

Understand the concept of constitutionalism. Demonstrate strength or weakness of constitutional morality in India

Evaluate constituent assembly debates in framing Indian Constitution.

## Unit 3: The Preamble, Fundamental Rights and Directive Principles of State Policy 6 hrs

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

### Module Learning Outcomes

1. Explain the relationship between 'Preamble' and 'The constitution'.
2. Interpret the key concepts of preamble
3. Analyzes the dynamic nature of Indian constitution
4. Understanding Fundamental Rights
5. Evaluate Directive Principles of State Policy
6. Interpret case studies on Fundamental Rights.

## Unit 4: Citizenship

6 hrs

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 Rodrigues

### Module Learning Outcomes

1. Explain different dimensions of citizenship in Indian context
2. Evaluate the basis of citizenship
3. Compare 'claim' and 'status' of citizenship

### **Unit 5: Separation and Distribution of Powers**

**6 hrs**

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

### Module Learning Outcomes

1. Explain the importance of separation of powers in a democracy
2. Understand the relation between three organs of the government
3. Evaluate the system of 'checks and balances'
4. Understand the difference between unitary and federal political systems
5. Critically analyze the Indian model of Federalism
6. Evaluate the distribution of responsibilities between union and state governments.

### **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.

## PHPY1001: Gandhi for the 21st Century

L	T	P	S	J	C
2	0	0	0	0	2*

### 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 Objectives

The objectives of the course are;

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

### Module I : MK Gandhi: Childhood and Education

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

### Module II: 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.

### Module III: 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.

### Module IV: Gandhi and Sustainable Development

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

### Module V: Gandhi and Contemporary Issues

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

### Learning Outcomes

1. To understand the life of Gandhi
2. To understand the role of Gandhi in Indian national movement
3. To analyse the origin and significance of Satyagraha
4. To understand the eleven vows of Gandhi which he followed through-out his life.

5. To examine the significance of constructive programs today

### **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.

### **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



## **DOSL1041: Community Services - Volunteer**

<b>L</b>	<b>T</b>	<b>P</b>	<b>S</b>	<b>J</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>2*</b>

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

### **Course Objectives**

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

### **List of Community Service Activities**

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

### **List of Activities**

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

### **Text Books**

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

**References**

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

**Course Outcomes**

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

## DOSL1051: Community Services - Mobilizer

<b>L</b>	<b>T</b>	<b>P</b>	<b>S</b>	<b>J</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>2*</b>

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

### Course Objectives

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

### List of Community Service Activities

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

### List of Activities

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

### Text Books

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

**References**

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

**Course Outcomes**

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

# ENVS1001: Environmental Studies

<b>L</b>	<b>T</b>	<b>P</b>	<b>S</b>	<b>J</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3*</b>

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 Objectives

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

## 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

### UNIT – I    **Multidisciplinary nature of environmental studies & Natural Resources:**

No of Hours:  
10

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 – II    **Ecosystem and biodiversity**

No of Hours:  
10

**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 – Environmental Pollution**  
**III**

No of Hours:  
10

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

**Learning Outcomes:**

After completion of this unit, the student will be able to

**UNIT – IV Social Issues and the Environment**

No of Hours:  
10

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 – V Human Population and the Environment and Environment Protection**  
**Act and Field work**

No of Hours:  
10

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

Activity:

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

**Text Book(s)**

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

**Additional Reading**

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

**Reference Book(s):**

1. McKinney M.L., Schoch R.M., Yonavjak L. Mincy G. Environmental Science: Systems and Solutions. Jones and Bartlett Publishers. 6<sup>th</sup> Edition. 2017.
2. Botkin D.B. Environmental Science: Earth as a Living Planet. John Wiley and Sons. 5<sup>th</sup> 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](#)

	Programme Objectives (POs)												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2												2		
CO2		2				1							2		
CO3			1						1					1	
CO4				2							2				1
CO5	1													1	
CO6					2							1			1

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

# MFST1001: Health & Wellbeing

L T P S J C  
0 0 2 0 0 1\*

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

## Course 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-I

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-II

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-III

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

## UNIT-IV

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

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



# CLAD2001: Preparation for Campus Placement-1

## (Soft Skills 5A)

L	T	P	S	J	C
0	0	2	0	0	1

### 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 Objectives:

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

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: Practising 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

### 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

**References:**

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

# **CLAD2011: Preparation for Higher Education (GRE/ GMAT)-1 (Soft Skills 5B)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>S</b>	<b>J</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>1</b>

## **Course Description:**

1. 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 Objectives:**

1. Prepare the students to solve questions from all four broad areas of GRE/ GMAT
  2. Orient the students for GRE/ GMAT through mock tests
- 
1. Verbal Reasoning: Reading Comprehension, Sentence Equivalence, Text Completion, Sentence Correction, Critical Reasoning
  2. Quantitative Reasoning: Arithmetic, Algebra, Geometry, Data Analysis
  3. Analytical Writing Assessment: Issue/ Argument
  4. Integrated Reasoning

## **Course Outcomes:**

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

## **References:**

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

## **CLAD2021: Preparation for CAT/ MAT - 1 (Soft Skills 5C)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>S</b>	<b>J</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>1</b>

### **Course Description:**

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

### **Course Objectives:**

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

### **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

### **References:**

1. Verbal Ability & Reading Comprehension by Arun Sharma and Meenakshi Upadhyay

2. Study material for CAT, SAT, GRE, GMAT by TIME, CareerLauncher and IMS etc.
3. Quantitative Aptitude by R S Agarwal S Chand Publications
4. Quantitative Aptitude by Pearson Publications

# CLAD2031: Preparation for Campus Placement-2

## (Soft Skills 6A)

L	T	P	S	J	C
0	0	2	0	0	1

### 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 Objectives:

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

### 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.

### References:

1. Verbal Ability & Reading Comprehension by Arun Sharma and Meenakshi Upadhyay

2. Study material for CAT, SAT, GRE, GMAT by TIME, CareerLauncher and IMS etc.
3. Quantitative Aptitude by R S Agarwal S Chand Publications
4. Quantitative Aptitude by Pearson Publications

# **CLAD2041: Preparation for Higher Education (GRE/ GMAT)-2**

## **(Soft Skills 6B)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>S</b>	<b>J</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>1</b>

### **Course Description:**

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

### **Course Objectives:**

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

### **Course Outcomes:**

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

### **References:**

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



## **CLAD2051: Preparation for CAT/ MAT - 2 (Soft Skills 6C)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>S</b>	<b>J</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>1</b>

### **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 Objectives:**

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

### **Course Outcomes:**

1. Solve higher difficulty level questions from all four relevant areas of CAT/ MAT as listed above
2. Practice test-cracking techniques through relevant mock tests

### **References:**

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

# FINA3001: Personal Financial Planning

<b>L</b>	<b>T</b>	<b>P</b>	<b>S</b>	<b>J</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>1*</b>

## Course Overview

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 Objectives:

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

## Course Outcome:

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

## 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

#### **Text Books**

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

#### **Reference Books**

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.

## B.Sc. Statistics

### MATH1151 : Differential Calculus

**No. of hrs/week: 3**

**Credits: 3**

**Preamble:** 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 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-I

Limit and Continuity ( $\epsilon$  and  $\delta$  definition), Types of discontinuities, Differentiability of functions, Successive differentiation, Leibnitz's theorem.

**Learning Outcomes:** The student will be able to:

- Define the basic properties of limits and continuity
- Explain different types of discontinuities
- Define differentiability of functions and successive differentiation

#### UNIT-II

Partial differentiation, Euler's theorem on homogeneous functions.

**Learning Outcomes:** The student will be able to:

- Define partial differentiation
- Evaluate problems on partial differentiation
- Apply Euler's theorem on homogeneous functions with the help of partial differentiation

#### UNIT-III

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

**Learning Outcomes:** The student will be able to:

- Define tangents and normals
- Explain curvature and asymptotes
- Trace the parametric curves
- Define polar coordinates

#### UNIT-IV

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

**Learning Outcomes:** The student will be able to:

- Explain Rolle's theorem with an application
- Explain mean value theorems with some examples
- Evaluate Taylor's theorem with Lagrange's and Cauchy's forms of remainder

#### UNIT-V

Taylor's series, Maclaurin's series of  $\sin x$ ,  $\cos x$ ,  $e^x$ ,  $\log(1+x)$ ,  $(1+x)^m$ , Maxima and Minima, Indeterminate forms.

**Learning Outcomes:** The student will be able to:

- Explain Taylor's series
- Explain Maclaurin's series
- Evaluate Maxima and minima of a function

#### 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 Cauchy's forms of remainder
- Evaluate Maxima and minima of a function

#### Books Recommended :

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. Anjaneya Sastry, published by S.Chand & Company Ltd., New Delhi.
3. "Calculus Single Variable" by Howard Anton, Irl Bivens and Stephen Davis, published by John Wiley and Sons, Inc., 2002.
4. "Calculus and Analytic Geometry" by George B. Thomas, Jr. and Ross L. Finney, published by Pearson Education, 2007, 9<sup>th</sup> edition.

## B.Sc. Statistics

### MATH1201 : MATRICES

**No. of hrs/week: 3**

**Credits: 3**

**Preamble :** 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 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-I**

$\mathbb{R}$ ,  $\mathbb{R}^2$ ,  $\mathbb{R}^3$  as vector spaces over  $\mathbb{R}$ . Standard basis for each of them. Concept of Linear Independence and examples of different bases. Subspaces of  $\mathbb{R}^2$ ,  $\mathbb{R}^3$ .

**Learning Outcomes:** The student 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
- Define different bases of vector spaces

#### **UNIT-II**

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.

**Learning Outcomes:** The student will be able to:

- Define translation, dilation, rotation, reflection
- Evaluate eigen values and eigen vectors of a matrix
- Explain eigen spaces as invariant subspaces

#### **UNIT-III**

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

**Learning Outcomes:** The student will be able to:

- Explain different types of matrices

- Evaluate rank of matrix using various methods
- Explain solutions of linear and non-homogeneous equations

#### UNIT-IV

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

**Learning Outcomes:** The student will be able to:

- Explain reduction of matrices to diagonal form
- Evaluate inverse of a matrix using elementary row operations
- Explain rank of a matrix using different methods

#### UNIT-V

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

**Learning Outcomes:** The student will be able to:

- Explain solutions of a system of linear equations using matrices
- Evaluate system of linear equations
- Explain the applications of matrices in Geometry, Physics, Chemistry, combinatorics and statistics

**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

#### Books Recommended

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

**B.Sc. Statistics**  
**CSCI 1011 : PROGRAMMING WITH C**

**Hours per week: 3**

**Credits: 3**

**Preamble :**

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 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 – I**

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.

**Learning Outcomes:**

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

- list the data types, operators and some statements in C
- describe the basic concepts of control statements
- explain the concepts of Loop statements

**UNIT- II**

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.

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

- describe the basic concepts of functions
- explain different types of functions used in C
- explain difference between Local and Global variables
- explain the concept of recursive functions

**UNIT -III**

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



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

- describe the basic concepts of arrays
- explain different types of arrays and functions
- explain multidimensional arrays and character arrays

#### **UNIT-IV**

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.

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

- describe the basic concepts of pointers
- explain different types of pointers and functions
- explain the concept of pointer and strings and also pointers to pointers

#### **UNIT-V**

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.

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

- describe the basic concepts of structures and unions
- explain different types of functions and structures
- explain the concept of arrays of structures, structures within a structure and flowcharts and structures

#### **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

#### **Text Book:**

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

#### **Reference Books:**

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

**B.Sc. Statistics**  
**CSCI1021 : PROGRAMMING WITH C LAB**

**Hours per week: 2**

**Credits: 1**

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 function
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:**

- Able to solve problems using switch case structure
- Differentiate the sorting of numbers using different methods
- Explain looping structure to create a matrix
- Identify the differences in matrix multiplication and to find inverse of a matrix
- Examine the working of Control structures in C programs

## B.Sc. Statistics

### MATH1231 : Differential Equations

No. of hrs/week: 3

Credits: 3

**Preamble:** 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 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-I

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

**Learning Outcomes:** By the end of this Unit, the student will be able to

- Distinguish between linear, nonlinear, partial and ordinary differential equations.
- Recognize and solve an exact differential equation.
- Recognize and solve a non-exact differential equation by finding integrating factor.
- Recognize and solve First order higher degree equations solvable for  $x$ ,  $y$ ,  $p$
- Evaluate basic application problems described by first order differential equations

#### UNIT-II

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.

**Learning Outcomes:** By the end of this Unit, the student will be able to

- Use the existence theorem for boundary value problems to determine uniqueness of solutions.
- Use the Wronskian condition to determine if a set of functions is linearly independent.
- Determine the complete solution of a homogeneous differential equation with constant coefficients by examining the characteristic equation and its roots.
- Evaluate the complete solution of a non-homogeneous differential equation as a linear combination of the complementary function and a particular solution.
- Determine the complete solution of a non-homogeneous differential equation with constant coefficients by the method of undetermined coefficients.

- Find the complete solution of a differential equation with constant coefficients by variation of parameters and also solve Cauchy-Euler Equation Evaluate Simultaneous differential equations and total differential equation
- Evaluate basic application problems described by second order linear differential equations with constant coefficients.

### UNIT-III

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

**Learning Outcomes:** By the end of this Unit, the student will be able to

- Recognize the concept of linear and non-linear partial differential equations.
- Recognize the concept of order and degree of partial differential equations
- Construct a first order partial equation by elimination of arbitrary constants
- Construct a first order partial equation by elimination of arbitrary functions of specific functions
- Construct a first order partial equation by Elimination of Arbitrary Functions
- Construct a physical or biological model to a first order partial differential equations

### UNIT-IV

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

**Learning Outcomes:** By the end of this Unit, the student will be able to

- Distinguish between general solution and complete solution
- Recognize and solve Lagrange's equation
- Find Lagrange's multipliers
- Recognize and solve first order non linear partial differential equation by Charpit's method.
- Recognize and reduce the first order partial different equation to different forms

### UNIT-V

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

**Learning Outcomes:** By the end of this Unit, the student will be able to

- Recognize the second order partial differential equations into elliptic, parabolic and hyperbolic
- Construct the different example for elliptic, parabolic and hyperbolic
- Transform the second order partial differential equations into normal form
- Solve basic application problems like one dimensional wave equation and heat equation

**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

### Books Recommended

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

## B. Sc. Statistics

### CSCI1281 Fundamentals of Object Oriented Programming with C++

No. of hrs/week: 3

Credits: 3

**Preamble:** 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.

#### 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- I

Introduction: 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.

**Learning Outcomes:** By the end of this Unit, the student will be able to

- Show the logic involved in solving a problem through algorithms and flowcharts.(L1)
- Describe the basic concepts of object oriented programming. (L2)
- Develop and run simple C++ programs.(L3)
- Choose appropriate data type and operators in programs. (L3)

#### UNIT- II

**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.

**Learning Outcomes :** By the end of this Unit, the student will be able to

- Select the right control structure (L1)
- Develop applications by using appropriate concepts. (L3)

#### UNIT -III

**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.

**Learning Outcomes:** By the end of this Unit, the student will be able to

- Differentiate between local and global variables (L3)

- Identify the need of static and Automatic variables. (L2)
- Develop the concept of overloading functions. (L2)
- Utilize the one dimensional and two dimensional arrays in programming. (L3)

#### UNIT- IV

**Object Oriented Concepts:** Abstraction, Encapsulation, Classes, Objects, methods, constructors, Destructor, constructor overloading, Function Overloading, Unary Operators, Rules for Operator Overloading.

**Learning Outcomes :** By the end of this Unit, the student will be able to

- Illustrate the concept of classes and objects (L3)
- Develop real world applications by using appropriate concepts. (L3)
- Use unary operators for overloading.(L3)

#### UNIT- V

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

**Learning Outcomes:** By the end of this Unit, the student will be able to

- Explain the need of reusability concept with inheritance.(L2)
- Summarize different types of inheritance.(L2)
- Identify the need of pointer.(L1)

**Course Outcomes:** Upon completion of the course, the student is 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)

#### Text Books:

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

#### Reference Books:

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

## B.Sc. Statistics

### MATH1241 : Differential Equations Lab

No. of hrs/week: 3

Credits: 1

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

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

- Evaluate first order and first degree differential equations
- Solve problems on first order and higher degree differential equations
- Explain linear differential equations with constant coefficients
- Explain the methods to solve partial differential equations
- Classify second order partial differential equations

**B. Sc. Statistics**  
**CSCI 1291 : C++ Programming Lab**

Hours per week: 2

Credits: 1

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 overrrding.
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:

- Write a program on different types of arrays
- Demonstrate constructors and constructor overloading
- Demonstrate single inheritance and multiple inheritance
- Demonstrate multi level inheritance and hierarchal inheritance
- Demonstrate polymorphism.



## B.Sc. Statistics

### MATH1171: Descriptive Statistics and Probability Theory

**No. of hrs/week: 3**

**Credits: 3**

**Preamble:**

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 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-I**

**Introduction to Statistics:** 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.

**Learning Outcomes:**

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

- Explain the diagrammatic and graphic representation of data
- Describe the basic concepts of Measures of central tendency
- Describe the properties of mean, median and mode
- Describe the basic concepts of geometric mean and Harmonic mean

**Unit-II**

**Measures of dispersion:** 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.

**Learning Outcomes:**

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

- Explain the concepts of measures of dispersion
- Describe the basic concepts of central and non-central moments
- Describe the difference between central and non-central moments
- Describe the basic concepts of skewness and kurtosis

**Unit-III**

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

**Learning Outcomes:**

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

- Define probability

- Describe the basic concepts of axiomatic approach to probability
- Concept of conditional probability and problems
- Evaluate problems on independence of events

#### **Unit-IV**

**Probability theorems:** 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.

#### **Learning Outcomes:**

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

- Describe probability theorems for two and n events
- Describe the basic concepts of axiomatic approach to probability
- Concept of conditional probability and problems
- Evaluate problems on addition theorem , multiplication theorems
- Evaluate problems on Bayee's theorem

#### **Unit-V**

**Random variable:** 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.

#### **Learning Outcomes:**

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

- Define discrete and continuous random variables with examples
- Describe the basic concepts of probability mass function
- Concepts of probability density function
- Evaluate problems on conditional and marginal distributions

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

- Explain the diagrammatic and graphic representation of data
- Describe the basic concepts of Measures of central tendency
- Describe the basic concepts of central and non-central moments
- Describe the difference between central and non-central moments
- Concept of conditional probability and problems

#### **Text Books:**

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.

#### **Reference books:**

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.

## B.Sc. Statistics

### MATH1181 : Descriptive Statistics Lab

No. of hrs/week: 2

Credits: 1

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 ( $\beta_1$ ) and Kurtosis ( $\beta_2$ ) – Karl Pearson's and Bowley'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:

- Explain the diagrammatic and graphic representation of data
- Evaluate Mean, standard deviation using MS Excel
- Solve problems on non-central moments
- Solve problems on central moments
- Evaluate Skewness and Kurtosis

## B.Sc. Statistics

### MATH1211: Mathematical Expectation and Probability Distributions

No. of hrs/week: 3

Credits: 3

#### Preamble:

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

#### Course Objectives:

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

#### Unit-I

**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.

**Learning Outcomes:** By the end of this Unit, the student will be able to

- Distinguish between mathematical expectation of a random variable and function of a random variable
- Recognize and solve problems on addition and multiplication theorems on expectations
- Define moment generating function, cumulative generating function, probability generating function, cumulative function

#### Unit-II

**Discrete Distributions** : Binomial and Poisson distributions, their definitions, 1<sup>st</sup> 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.

**Learning Outcomes:** By the end of this Unit, the student will be able to

- Distinguish between binomial distribution and Poisson distribution
- Evaluate central moments for binomial distribution and Poisson distribution
- Explain Poisson approximation to binomial distribution

#### Unit-III

**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.

**Learning Outcomes:** By the end of this Unit, the student will be able to

- Distinguish between negative binomial distribution, geometric and hyper geometric distribution
- Evaluate mean and variance for negative binomial distribution and geometric distribution
- Explain Poisson approximation to negative binomial distribution

#### Unit-IV

**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.

**Learning Outcomes:** By the end of this Unit, the student will be able to

- Explain rectangular, exponential, gamma, beta distributions
- Evaluate mean and variance for gamma, beta distribution
- Explain moment generating function and cumulative generating function for continuous distributions

#### Unit - V

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

**Learning Outcomes:** By the end of this Unit, the student will be able to

- Define normal distribution
- Discuss properties of normal distribution
- Explain interrelation between normal and binomial distributions
- Explain interrelation between normal and Poisson distributions

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

- Distinguish between mathematical expectation of a random variable and function of a random variable
- Recognize and solve problems on addition and multiplication theorems on expectations
- Evaluate central moments for binomial distribution and Poisson distribution
- Discuss properties of normal distribution
- Explain interrelation between normal and binomial distributions

#### Text Books:

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

#### Reference Books:

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.

## B.Sc. Statistics

### MATH1221 : Probability Distributions Lab

No. of hrs/week: 3

Credits: 1

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:

- fit binomial distribution
- fit binomial distribution using recurrence relation method
- fit poisson distribution
- fit poisson distribution using recurrence relation method
- fit normal distribution using areas method and ordinates method

## B.Sc. Statistics

### MATH2061 : Statistical Methods

No. of hrs/week: 3

Credits: 3

#### Preamble:

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

#### Course 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-I

**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.

**Learning Outcomes:** The student will be able to:

- Define correlation and scatter diagram
- Explain coefficient of correlation
- Evaluate rank correlation coefficient

#### Unit-II

**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.

**Learning Outcomes:** The student will be able to:

- Explain linear regression and its properties
- Explain concept of correlation ratio
- Discuss the difference between correlation and regression

#### Unit – III

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

**Learning Outcomes:** The student will be able to:

- Define method of least squares
- Fit linear and quadratic curves
- Fit exponential and power curves

#### Unit-IV

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

**Learning Outcomes:** The student will be able to:

- Explain nature of attributes

- Evaluate association of attributes
- Define coefficient of association
- Explain contingency of attributes

#### **Unit –V**

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

**Learning Outcomes:** The student will be able to:

- Define population, sample, parameter, and statistic
- Define standard error
- Explain the properties of  $\chi^2$ , t, F distributions

**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  $\chi^2$ , t, F distributions

#### **Text books**

1. V.K.Kapoor and S.C.Gupta: Fundamentals of Mathematical Statistics, Sultan Chahnd& 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.

#### **List of Reference text books**

1. Goon.A.M, Gupta.M.K, Das Gupta B: Outlines of Statistics, Vol-II, the World Press Pvt.Ltd.,Kolakota
2. Hoel P.G.: Introduction to matechemical statistics, Asia Publishing house.
3. Sanjay Arora and Bansi Lai: New mathematical Statistisc Satya Prakashan, New Delhi



## B.Sc. Statistics

### MATH2071: Statistical Inference

**No. of hrs/week: 3**

**Credits: 3**

**Preamble :** 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 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-parameteric tests

#### **UNIT-I**

**Theory of estimation:** 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.

**Learning Outcomes:** The student will be able to:

- Estimate the population parameters
- Estimate the binomial population parameters
- Estimate poisson & normal population parameters
- Evaluate confidence intervals of the parameters

#### **UNIT II**

**Concepts of Statistical hypothesis:** 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.

**Learning Outcomes:** The student will be able to:

- Test the hypothesis using one tailed test and two tailed test
- Evaluate Neyman-Pearson's lemma
- Testing of hypothesis using binomial, poisson, normal distributions

#### **Unit-III**

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

**Learning Outcomes:** The student will be able to:

- Test the hypothesis for single mean, two means
- Test the hypothesis for single proportion and two proportions
- Test the hypothesis for standard deviation of single and double samples in Large samples

#### Unit-IV

**Small sample tests:** 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).

**Learning Outcomes:** The student will be able to:

- Test the significance based on chi-square distribution, t- distribution, and F distribution
- Test for independence of attributes
- Test the hypothesis of t-test for single, double and paired

#### Unit-V

**Non-parametric tests** - Advantages and Disadvantages. Two sample run test, Two sample Median test and Two sample sign test.

**Learning Outcomes:** The student will be able to:

- Test non-parametes
- Explain two sample run test
- Explain two sample median test
- Explain two sample sign test

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

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

#### TEXT BOOKS

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.

#### *List of Reference Books:*

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. PrtirupaSidhanthamulu - Telugu Academy.
8. PrayogaRachana and Visleshana - Telugu Academy.

## **B.Sc. Statistics**

### **MATH2081: Statistical Methods Lab**

**No. of hrs/week: 2**

**Credits: 1**

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:

- Fit a straight line and parabola
- Fit exponential curves
- Fit power curves
- Compute correlation coefficient and rank correlation coefficient
- Evaluate regression lines

## B.Sc. Statistics

### MATH2091: Statistical Inference Lab

No. of hrs/week: 2

Credits: 1

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 Doublet-test.
6. Small sample tests for Paired t-test.
7. F-Test.
8. Chi square test for independence of attributes.
9. Non-parametric testst – 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:

- Estimate the population mean for large samples
- Estimate the population proportion for large samples
- Explain large sample tests for single and double test
- Evaluate Chi square test for independence of attributes
- Evaluate run test, median test, sign test

## B.Sc. Statistics

### MATH2101: Optimization Techniques

No. of hrs/week: 3

Credits: 3

**Preamble:** 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 Objectives:

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

#### UNIT-I

**Linear Programming:** 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.

**Learning Outcomes:** The student will be able to:

- define an objective function and constraint functions in terms of design variables, and then state the optimization problem.
- state single variable and multi variable optimization problems, without and with constraints.

#### UNIT-II

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

**Learning Outcomes:** The student will be able to:

- explain linear programming technique to an optimization problem, define slack and surplus variables, by using Simplex method.
- Explain Big-M method
- Explain Two-phase simplex method
- Explain degeneracy in Linear Programming

#### UNIT-III

**Duality in Linear programming:** Introduction, Formulation of a dual problem, Properties of duality, Application of duality to solve LPP, Dual simplex method.

**Learning Outcomes:** The student will be able to:

- Formulate dual problem
- Explain properties of duality
- Explain application of duality to solve Linear programming problem
- Explain dual simplex method

#### UNIT-IV

**Transportation and Assignment Problems:** 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.

**Learning Outcomes:** The student will be able to:

- state transportation and assignment problem as a linear programming problem to determine optimality conditions by using Simplex method.

#### UNIT-V

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

**Learning Outcomes:** The student will be able to:

- explain optimal solutions for sequencing problems with n jobs

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

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

#### List of reference books:

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

## B.Sc. Statistics

### MATH2111: Optimization Techniques Lab

No. of hrs/week: 2

Credits: 1

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:

- Solve linear programming problem using simplex method
- Solve linear programming problem using Big-M method and two phase simplex method
- Evaluate LPP using dual simplex and revised simplex method
- Evaluate transportation problem
- Evaluate job sequencing problem

## B.Sc. Statistics

### MATH3061: Sampling Techniques and Design of Experiments

No. of hrs/week: 3

Credits: 3

**Preamble :** 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 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, Randomised block design, and Latin square design

#### Unit-I

**Sampling Theory:** Principle steps in a sample survey, Censuses versus sample survey, sampling and Non-sampling errors. Types of sampling - subjective, probability and mixed sampling methods.

**Learning Outcomes:** The student will be able to:

- Define sampling
- Explain types of sampling
- Explain subjective, probability and mixed sampling methods

#### Unit-II

**Simple Random Sampling:** Meaning of Samples and methods to draw, estimation of population mean, variances in SRSWR & SRSWOR.

**Learning Outcomes:** The student will be able to:

- Estimate population mean
- Estimate population variance

#### Unit-III

**Stratified random sampling:** 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.

**Learning Outcomes:** The student will be able to:

- Explain proportional and optimum allocation of sample sizes in stratification



- Evaluate variance in stratified random sampling
- Explain advantages and disadvantages for methods of sampling

#### **Unit-IV**

**Analysis of Variance:** One way with equal and unequal classifications and two way classifications.

**Learning Outcomes:** The student will be able to:

- Explain analysis of variance for one way classification
- Explain analysis of variance for two way classification

#### **Unit - V**

**Design of Experiments:** 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.

**Learning Outcomes:** The student will be able to:

- Analyze completely randomized design
- Analyze randomized block design
- Analyze Latin square design

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

- Explain types of sampling
- Explain subjective, probability and mixed sampling methods
- Analyze completely randomized design
- Analyze randomized block design
- Analyze Latin square design

#### **Text Books:**

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.

#### **Reference Books:**

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

## B.Sc. Statistics

### MATH3071: Statistical Quality Control and Reliability

No. of hrs/week: 3

Credits: 3

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

#### Course 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-I

**Statistical Quality Control:** 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.

**Learning Outcomes:** The student will be able to:

- Explain importance of statistical quality control in industry
- Explain uses of control charts
- Interpret control charts and control limits

#### Unit – II

**Variable Control Chart:** Construction of  $\bar{X}$ ,  $\bar{R}$  charts for variables, Attribute control charts- NP, P charts, C chart.

**Learning Outcomes:** The student will be able to:

- Construct X-bar and R charts for variables
- Construct NP charts
- Construct P and C charts

#### Unit-III

**Acceptance sampling plans:** Scope, Producer's risk and consumer's risk. Concepts of AQL and LTPD.

**Learning Outcomes:** The student will be able to:

- Explain sampling plans
- Explain Producer's and consumer's risk

#### Unit-IV

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

**Learning Outcomes:** The student will be able to:

- Explain single and double sampling plans
- Explain double and single sampling plans

## **Unit-V**

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

**Learning Outcomes:** The student will be able to:

- Define hazard function
- Estimate reliability
- Explain exponential distribution as life model

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

- Explain uses of control charts
- Interpret control charts and control limits
- Construct X-bar and R charts for variables
- Construct NP charts
- Explain sampling plans

### ***List of Reference Books:***

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

## B.Sc. Statistics

### **MATH3081: Sampling Techniques and Design of Experiments Lab**

No. of hrs/week: 2

Credits: 1

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:

- Estimate population mean and population variance
- Compare proportional, optimum allocations
- Analyze systematic sampling
- Analyze completely randomized design
- Analyze randomized block design

## B.Sc. Statistics

**MATH3091: Statistical Quality Control and Reliability Lab**  
**No. of hrs/week: 2** **Credits: 1**

1. Construction of  $(\bar{X}, R)$  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:

- Construct X-Bar
- Construct R charts
- Construct P , NP
- Construct C- charts
- Evaluate problems on reliability

## B.Sc. Statistics

### MATH3101: Applied Statistics

**No. of hrs/week: 3**

**Credits: 3**

**Preamble :** 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 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-I

**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.

**Learning Outcomes:** The student will be able to:

- Illustrate time series and its components
- develop additive, multiplicative and mixed models
- explain Growth cures and their fitting

#### Unit-II

**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.

**Learning Outcomes:** The student will be able to:

- study the concept of index numbers
- evaluate criterion of a good index number
- explain the cost of living index numbers

#### Unit-III

**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.

**Learning Outcomes:** The student will be able to:

- define vital statistics
- evaluate crude death rates
- measure population growth
- explain life tables
- construct life tables and abridged life tables

#### **Unit-IV**

**Demand Analysis:** Introduction. Demand and supply, price elasticity of supply and demand. Methods of determining demand and supply curves, Leontief's, Pigou'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.

**Learning Outcomes:** The student will be able to:

- study demand supply
- explain methods of determining demand and supply curves
- explain methods from time series data

#### **Unit-V**

**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.

**Learning Outcomes:** The student will be able to:

- explain organization of CSO and NSSO
- explain agricultural statistics
- evaluate national income
- estimate national income

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

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

#### **List of reference books:**

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.

## **B.Sc. Statistics**

### **MATH3111: Applied Statistics Lab**

**No. of hrs/week: 2**

**Credits: 1**

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:

- Determine the trend by method of least squares
- Determine the trend by method of moving averages
- Determine the seasonal indices by the method of ratio
- Compute all weighted indices
- Compute cost of living index number



## B.Sc. Statistics

### MATH2201: Statistical Demography

**No. of hrs/week: 3**

**Credits: 3**

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

#### Course 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-I

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.

Learning Outcomes:

At the end of the unit, student will be able to:

- Scope of the population
- Knowledge about the census of India
- Different types of errors in demographic data

#### UNIT-II

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.

Learning Outcomes:

At the end of the unit, student will be able to:

- Acquire the knowledge about the measures of fertility
- Learn about the distributions of time to first birth
- Learn about the live birth intervals and number of births

#### UNIT-III

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.

Learning Outcomes:

At the end of the unit, student will be able to:

- Acquire the knowledge about the measures of mortality
- Learn about the relations between functions of life tables
- Learn about the distributions of life table functions

#### **UNIT-IV**

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

Learning Outcomes:

At the end of the unit, student will be able to:

- Acquire the knowledge about stable and quasi-stable populations
- Learn about intrinsic growth rate
- Different methods for population projection
- Use of Leslie matrix

#### **UNIT-V**

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).

Learning Outcomes:

At the end of the unit, student will be able to:

- Learn the models for population growth
- Different types of curves for population growth
- Acquire the knowledge of stochastic models

#### **Course Outcomes:**

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

- Knowledge about the census of India
  - Acquire the knowledge about the measures of fertility
  - Learn about the distributions of time to first birth
- Acquire the knowledge about the measures of mortality
- Acquire the knowledge of stochastic models

**Text Books:**

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

**References Books:**

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, Sprinmger Verlag.
6. Spiegelman, M. (1969): Introduction to Demographic Analysis; Harvard University Press.

## **B.Sc. Statistics**

### **MATH2211: Actuarial Statistics**

**No. of hrs/week: 3**

**Credits: 3**

**Preamble :** 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 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 I**

Theory of interest rates: rate 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 II**

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

#### **UNIT III**

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 IV

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 and varying benefit insurance. Life annuities. single payment, continuous life annuities, discrete life annuities, life annuities with monthly payments, recursions, complete annuities-immediate and apportionable annuities-due.

## UNIT V

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.

### Course Outcomes :

**CO1:** Understand the utility theory, insurance products and life tables.

**CO2:** Understand the concept of utility theory and interest.

**CO3:** Understand the concept of life life tables and to know some analytical laws of mortality.

**CO4:** Know insurance and the existing insurance products of different insurance company, life annuities, net premium and net premium reserves.

**CO5:** Know the concept of multiple life functions and decrement models.

### Text Books:

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.
2. Nall, A. (1977). Life Contingencies. Heinemann.

## **B.Sc. Statistics**

### **MATH2221: Statistical Demography Lab**

**No. of hrs/week: 2**

**Credits: 1**

1. United Nations Index
2. Reproduction Rate
3. Infant Mortality Rate
4. Life Tables
5. Population Growth
6. Urban-Rural Growth difference

**Course Outcomes :** At the end of the course, student will be able to:

- Understand the utility theory, insurance products and life tables.
- Understand the concept of utility theory and interest.
- Understand the concept of life life tables and to know some analytical laws of mortality.
- Know insurance and the existing insurance products of different insurance company, life annuities, net premium and net premium reserves.
  - Know the concept of multiple life functions and decrement models.

## **B.Sc. Statistics**

### **MATH2231: Actuarial Statistics Lab**

**No. of hrs/week: 2**

**Credits: 1**

2. Stoodley formula for the force of interest
3. Basic compound interest function, equations of values and yield on transaction-annuities
4. Models for individual claims and their sums
5. The deterministic survivorship group
6. Life annuities. single payment, continuous life annuities, discrete life annuities, life annuities with monthly payments
7. Multiple decrement models, deterministic and random survivorship groups

## **B.Sc. Statistics**

### **MATH2241: Testing of Hypothesis**

**No. of hrs/week: 3**

**Credits: 3**

**Preamble:** 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 on the basis of 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 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 I**

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

#### **UNIT II**

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 III**



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 and A.S.N. functions. Examples of binomial and normal cases for testing hypothesis on  $\mu$  and  $\sigma^2$

#### **UNIT IV**

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 V**

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

#### **Course Outcomes:**

**CO1:** To learn Neyman Pearson lemma and UMP tests.

**CO2:** To understand unbiased tests and uniformly most powerful unbiased tests.

**CO3:** To study OC and ASN functions in case of Binomial and Normal distributions.

**CO4:** To apply Run test, Sign test, Wilcoxon and Mann Whitney test and Median test.

**CO5:** To understand Chi square test for goodness of fit, Kolmogorov and Smirnov test and Kendall's and Spearman's test

#### **Text Books :**

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.

## B.Sc. Statistics

### MATH2251: Stochastic Process

No. of hrs/week: 3

Credits: 3

**Preamble :** 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 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 – I

**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.

**Learning Outcomes:** The student will be able to:

- Define stochastic process
- Classify general stochastic processes into discrete and continuous time
- Explain types of stochastic processes

#### UNIT – II

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

**Learning Outcomes:** The student will be able to:

- Define Markov chain
- Explain transition probability matrix
- Classify the states

#### UNIT – III

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

**Learning Outcomes:** The student will be able to:

- Explain basic limit theorem of Markov chain
- Explain applications of Markov chains

#### UNIT – IV

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

**Learning Outcomes:** The student will be able to:

- Explain pure birth process
- Explain poisson process
- Explain birth and death process

#### **UNIT – V**

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

**Learning Outcomes:** The student will be able to:

- Define discrete time branching process
- Explain probability generating function

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

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

#### **List of Reference Text Books :**

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

## B.Sc. Statistics

### MATH2261: Estimation Theory

No. of hrs/week: 3

Credits: 3

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

#### Course Objectives:

To enable students to

- 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 I

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.

#### Learning Outcomes:

At the end of the unit, the student will be able to:

- Learn about the concept of unbiasedness, consistency and Minimum Unbiased Variance estimation
- Learn about Cramer-Rao Inequality theorem and its applications
- Acquire the applications under Chapman-Robin's inequality
- Learn about CAN estimator

#### UNIT II

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.

#### Learning outcomes:

At the end of the unit, the student will be able to:

- Gain the knowledge about the concept of sufficiency in single and several parameter

cases

- Learn about Fisher-Neyman Factorization theorem and its applications
- Learn about the concept of minimal sufficient statistic
- Acquire the knowledge of transformation of sample space and parameter space

### UNIT III

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

#### **Learning outcomes:**

At the end of the unit, the student will be able to:

- Learn the concept of sufficient statistics
- Acquire the knowledge about Rao-Blackwell theorem and its applications
- Learn the concept of completeness
- Acquire the knowledge about Lehman-Scheffe theorem and its applications

### UNIT IV

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

#### **Learning outcomes:**

At the end of the unit, the student will be able to:

- Learn about the method of maximum likelihood and its applications
- Acquire the knowledge about CAN estimators for one parameter
- Learn about Cramer-Huzurbazar theorem and its applications
- Learn about the concept of method scoring

### UNIT V

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.

#### **Learning outcomes:**

At the end of the unit, the student will be able to:

- Acquire the knowledge of Censored and truncated distributions

- Learn about censoring some probability distributions and their maximum likelihood estimators
- Learn about the concept of Interval estimation
- Acquire the knowledge of shortest expected length confidence intervals

**Course Outcomes:**

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

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

**Text Books .**

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.
3. 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.

## B.Sc. Statistics

### MATH2271: Sampling Methods

**No. of hrs/week: 3**

**Credits: 3**

**Preamble :** 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 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 I**

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

#### **UNIT II**

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 III**

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 ppsampling.

#### **UNIT IV**

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 V**

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 Harvitz technique, Deming's model.

#### **Course Outcomes :**

**CO1:** Understand the basic principles underlying survey design and estimation.

**CO2:** Apply the concept of systematic sampling along with centrally located sampling and circular systematic sampling.

**CO3:** Implement Cluster sampling, Two Stage Sampling and Optimum allocation in real life problems.

**CO4:** 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.

**CO5:** Apply Multi-phase sampling techniques, double sampling for regression estimator, Non-sampling errors, Hansen and Harvitz technique, Deming's model.

#### **Text Books:**

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



## B.Sc. Statistics

### MATH3161: Machine Learning

No. of hrs/week: 3

Credits: 3

#### Preamble:

*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 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 – I

**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.(10 hours)

#### Learning outcomes

After completion of this unit, student will be able to

- Define a well-posed learning problem. (L1)
- Illustrate the designing of a learning system. (L1)
- Understand a concept learning task. (L2)
- Name what are version spaces. (L1)

#### UNIT – II

**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.(10 hours)

#### Learning outcomes

After completion of this unit, student will be able to

- Define a decision tree. (L1)
- Illustrate the decision tree learning algorithm and hypothesis space search. (L2)
- List various issues in decision tree learning. (L1)

### UNIT - III

**Artificial Neural Networks:** Introduction, Neural Network Representations, Appropriate Problems for Neural Network Learning, Perceptrons, 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.(10 hours)

#### Learning outcomes

After completion of this unit, student will be able to

- Define what is a neural network and associated fundamentals. (L1)
- Demonstrate the working of multilayer neural networks. (L2)
- Learn the methods of evaluating the accuracy of hypotheses. (L2)

### UNIT - IV

**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 Algorithm. (8 hours)

#### Learning outcomes

After completion of this unit, student will be able to

- Define Bayes theorem. (L1)
- Summarize the importance of Bayesian methods in machine learning. (L2)
- Show how Bayes theorem and concept learning are related. (L2)
- Learn how EM algorithm provides a quite general approach in the presence of unobservable variables. (L1)

### UNIT-V

**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.(8 hours)

#### Learning outcomes

After completion of this unit, student will be able to

- Contrast instance-based learning with other methods of learning. (L4)
- Model genetic learning method by an analogy to biological evolution. (L3)
- Experiment with hypothesis space search in genetic learning. (L3)

**Course Outcomes:**

Upon completion of this course student will be able to

- Define a well-posed learning problem. (L3)
- Illustrate the decision tree learning algorithm and hypothesis space search. (L4)
- Use the Bayes theorem and EM Algorithm in machine learning . (L3)
- Model genetic learning method by an analogy to biological evolution. (L3)
- Experiment with hypothesis space search in genetic learning. (L3)

**Text Book:**

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

**Reference Books:**

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

## **B.Sc. Statistics**

### **SEMESTER –V**

#### **MATH3171: Big Data Analytics**

**No. of hrs/week: 3**

**Credits: 3**

#### **Preamble:**

*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 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 – I**

**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. (8 hours)

#### **Learning Outcomes:**

After completion of this unit, student will be able to

- Learn various sources of data and forms of data generation. (L2)
- Understand the evolution and elements of Big Data. (L2)
- Explore different opportunities available in the career path. (L3)
- Understand the role and importance of Big Data in various domains. (L2)

#### **UNIT – II**

**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, Combining 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.(10 hours)

### **Learning Outcomes:**

After completion of this unit, student will be able to

- Identify the difference between distributed and parallel computing. (L3)
- Learn the importance of Virtualization in Big Data. (L2)
- Learn the details of Hadoop and Cloud Computing. (L2)
- Learn the architecture and features of HDFS. (L2)
- Understand Hadoop Ecosystem, MapReduce and HBase. (L2)
- Apply the technique in optimizing MapReduce job. (L3)

## **UNIT- III**

**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.(10 hours)

### **Learning Outcomes:**

After completion of this unit, student will be able to

- Explore the layers of Big Data Stack. (L2)
- Learn virtualization approaches in handling Big Data operations. (L2)
- Able to develop simple applications using map and reduce function. (L5)
- Learn the classes available in MapReduce framework. (L2)
- Understand the role of Combiner and Partitioners in a MapReduce applications. (L3)

## **UNIT – IV**

**Understanding Hadoop YARN Architecture:** Background of YARN, Advantages of YARN, YARN Architecture, Working of YARN, YARN Schedulers, Backward Compatibility with YARN, YARN Configurations, YARN commands, YARN containers, Registry.( 8 hours)

**Learning Outcomes:**

After completion of this unit, student will be able to

- Learn the importance of YARN.(L2)
- Understand the use and importance of schedulers and backward compatibility in YARN.(L3)
- Learn the commands, log management and configuration for handling Big Data. (L3)

## UNIT – V

**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.(10 hours)

**Learning Outcomes:**

After completion of this unit, student will be able to

- Learn the working of Hive and query execution. (L2)
- Learn the importance of Pig. (L2)
- Choose the operators in Pig. (L2)
- Understand various types of analytical approaches. (L3)

**Course Outcomes:**

Upon completion of this course student will be able to

- Able to handle a real time big data application. (L4)
- Able to develop Map Reduce Applications. (L4)
- Perform YARN Configuration for handling Big Data. (L3)
- Learn to execute queries in Hive. (L3)
- Learn how Pig Latin is used for programming in Hadoop. (L3)

**Text book:**

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

**Reference Book :**

2.Hadoop The Definitive Guide by Tom White, O’reilly ,4<sup>th</sup> Edition,2016.

## B.Sc. Statistics

### MATH3181: Multivariate Analysis

No. of hrs/week: 3

Credits: 3

**Preamble:** 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 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 on the basis of observations.
- ❖ To apply classification and discrimination procedures between two multivariate normal distributions
- ❖ To sensitize the basic ideas and concepts in Cluster analysis

#### Unit I

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 II

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 III

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 IV

Principle components, dimension reduction. Canonical variables and canonical correlation- definition, use, estimation and computation.

#### Unit V

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

#### Course Outcomes:

**CO1:** To understand the concept of Hotelling's  $T^2$  and its sampling distribution.

**CO2:** To learn the concept of Wishart matrix and its properties.

**CO3:** To apply classification and discrimination procedures between two multivariate normal distributions.

**CO4:** To understand Principal components and dimension reduction.

**CO5:** To sensitize the basic ideas and concepts in Cluster analysis.

**Text books:**

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

**Reference books**

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



## B.Sc. Statistics

### MATH3191: Econometrics

No. of hrs/week: 3

Credits: 3

**Preamble:** 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 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-I

**Review of Statistics Descriptive statistics:** (a) the univariate case, (b) the bivariate case Random Variables and Probability distributions Estimation of parameters, Testing of hypotheses.

#### Unit-II

**Classical Linear Regression Model:** Two Variable Case Descriptive Aspects, Properties of Least Squares estimates; tests of hypotheses and confidence intervals; Gauss - Markov Theorem Forecasting

#### Unit-III

**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-IV

Violations of Classical Assumptions and Remedies Multicollinearity Heteroscedasticity  
Auto-correlation

### **Unit-V**

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

#### **Course Outcomes:**

**CO1:** To learn General linear model, OLS method of estimation and tests of hypothesis.

**CO2:** To understand tests of structural change in two variable and K variable linear model.

**CO3:** To learn about Generalized least squares estimators and Durbin Watson statistic.

**CO4:** To understand the sources of lagged variables and its estimation methods.

**CO5:** To learn simultaneous equation models and its estimation.

#### **Text books:**

- 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.
- 3.Christopher Dougherty, Introduction to Econometrics, 4th edition, OUP, Indian edition
- 4.Maddala, G.S and KajaLahiri, Introduction to Econometrics, 4th Wiley publication,2009