# 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.** Mathematics

(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 mathematics and science to understand the real world problems.
- To develop complexity problem solving techniques using mathematical tools.
- To establish the methodologies for core mathematical problems.
- To implement computer solution methods for large systems.
- To imbibe professional and ethical responsibility towards the society

# Program Outcomes (POs)

- Apply basic knowledge of mathematics and science to understand the real world problems.
- Develop complexity problem solving techniques using mathematical tools.
- Establish the methodologies for core mathematical 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 engineering and science 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 Outcomes (PSOs)

- Create Mathematical Models (along with solution) for various physical needs.
- Use Mathematics, not only in the discipline of Mathematics, but also in other disciplines and in their future endeavours
- Develop the computer programming skill for solving various physical problems.

#### **CURRICULUM STRUCTURE OF B.Sc. MATHEMATICS**

#### (2021-22 ADMITTED BATCH)

#### University Core (UC)

| Course code | Level | Course title  | L | Т | Р | S | J | С  |
|-------------|-------|---|---|---|---|---|---|----|
| CSEN1001    | 1     | IT Productivity Tools^  | 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<br>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^  | 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
 ^ Online/Swayam/NPTEL Courses

#### Softskills courses 5 and 6

| Course code | Level | Course title  | L | Т | 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<br>(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<br>(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 | Т | Р | S | J | С |
|-------------|-------|--------------|---|---|---|---|---|---|
| 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 | Т | Р | S | J | С |
|-------------|-------|--------------------------------|---|---|---|---|---|---|
| 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 | Т | Р | S | J | С |
|-------------|-------|--------------------------------|---|---|---|---|---|---|
| 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 | С |
|-------------|-------|--|---|---|---|---|---|---|
| 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 C | Core/ Major | Core | (PC/MaC) |
|-------------|-------------|------|----------|
|-------------|-------------|------|----------|

| Course code | Level | Course title                   | L | Т | P | S | J | С |
|-------------|-------|--------------------------------|---|---|---|---|---|---|
| MATH1151    | 1     | Differential Calculus          | 3 | 0 | 0 | 0 | 0 | 3 |
| MATH1161    | 1     | Differential Calculus Lab      | 0 | 0 | 2 | 0 | 0 | 1 |
| MATH1231    | 1     | Differential Equations         | 3 | 0 | 0 | 0 | 0 | 3 |
| MATH1241    | 1     | Differential Equations Lab     | 0 | 0 | 2 | 0 | 0 | 1 |
| MATH2001    | 2     | Real Analysis                  | 3 | 0 | 0 | 0 | 0 | 3 |
| MATH2011    | 2     | Algebra                        | 3 | 0 | 0 | 0 | 0 | 3 |
| MATH2021    | 2     | Real Analysis Lab              | 0 | 0 | 2 | 0 | 0 | 1 |
| MATH2031    | 2     | Algebra Lab                    | 0 | 0 | 2 | 0 | 0 | 1 |
| MATH2041    | 2     | Linear Algebra                 | 3 | 0 | 0 | 0 | 0 | 3 |
| MATH2051    | 2     | Linear Algebra Lab             | 0 | 0 | 2 | 0 | 0 | 1 |
| MATH3001    | 3     | Numerical Methods              | 3 | 0 | 0 | 0 | 0 | 3 |
| MATH3011    | 3     | Vector Calculus                | 3 | 0 | 0 | 0 | 0 | 3 |
| MATH3021    | 3     | Numerical Methods using MATLAB | 0 | 0 | 2 | 0 | 0 | 1 |
| MATH3031    | 3     | Vector Calculus Lab            | 0 | 0 | 2 | 0 | 0 | 1 |
| MATH3041    | 3     | Discrete Mathematics           | 3 | 0 | 0 | 0 | 0 | 3 |
| MATH3051    | 3     | Discrete Mathematics Lab       | 0 | 0 | 2 | 0 | 0 | 1 |

#### **Programme Elective (PE)\***

| Course code  | Level | Course title                             | L | Т | Р | S | J | С |
|--|-------|--|---|---|---|---|---|---|
| MATH2121   | 2     | Linear Programming                       | 3 | 0 | 0 | 0 | 0 | 3 |
| MATH2131   | 2     | Transportation and Game Theory           | 3 | 0 | 0 | 0 | 0 | 3 |
| MATH2141   | 2     | Linear Programming Lab                   | 0 | 0 | 2 | 0 | 0 | 1 |
| MATH2151   | 2     | Transportation and Game Theory Lab       | 0 | 0 | 2 | 0 | 0 | 1 |
| MATH2161   | 2     | Complex Analysis                         | 3 | 0 | 0 | 0 | 0 | 3 |
| MATH2171   | 2     | Functional Analysis                      | 3 | 0 | 0 | 0 | 0 | 3 |
| MATH2181   | 2     | Number Theory                            | 3 | 0 | 0 | 0 | 0 | 3 |
| MATH2191   | 2     | Graph Theory                             | 3 | 0 | 0 | 0 | 0 | 3 |
| MATH3121   | 3     | Classical Mechanics                      | 3 | 0 | 0 | 0 | 0 | 3 |
| MATH3131   | 3     | Theory of Computation                    | 3 | 0 | 0 | 0 | 0 | 3 |
| MATH3141   | 3     | Fluid Dynamics                           | 3 | 0 | 0 | 0 | 0 | 3 |
| MATH3151   | 3     | Transform Techniques and Tensor Analysis | 3 | 0 | 0 | 0 | 0 | 3 |
| <i>Note 1:</i> 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 MATH2121 then he/she has to study MATH2141 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

| Stream                   | Major<br>course | Minor course (Select one) |
|--------------------------|-----------------|---------------------------|
|                          |                 | Physics                   |
| Mathemetical<br>Sciences | Mathemeti       | Electronics               |
|                          | cs              | Chemistry                 |
|                          |                 | Data Science              |

| Eligible MINOR courses to be offered to the students of B.Sc Biotehcnology Prog |
|---|
|---|

|                     | Minor Courses in Physics*   |  |   |   |   |   |   |   |  |  |  |
|---------------------|---|--|---|---|---|---|---|---|--|--|--|
| Course code         | Level   | Course title                                   | L | Т | Р | S | J | С |  |  |  |
| PHYS1171            | 1   | Thermal Physics and Statistical Mehanics       | 3 | 0 | 0 | 0 | 0 | 3 |  |  |  |
| PHYS1181            | 1   | Thermal Physics and Statistical Mehanics 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 | * Eligibility: This minor course is offered to the students of B.Sc Electronics/ Mathematics/ Chemistry/ Statistics |  |   |   |   |   |   |   |  |  |  |

| Course code   | Level | Course title                       | L | Т | Р | S | J | С |
|---|-------|------------------------------------|---|---|---|---|---|---|
| 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 Electronics\***

## **Minor Courses in Chemistry**

| Course code  | Level | Course title              | L | Т | Р | S | J | С |
|--|-------|---------------------------|---|---|---|---|---|---|
| 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 |       |                           |   |   |   |   |   |   |

| Course code   | Level | Course title                                | L | Т | Р | S | J | С |
|---|-------|---|---|---|---|---|---|---|
| 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/<br>Chemistry |       |   |   |   |   |   |   |   |

#### Minor courses in Data Science

#### 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**

| L | Т | Р | S | J | С  |
|---|---|---|---|---|----|
| 0 | 0 | 2 | 0 | 0 | 1* |

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, bibilography, index, etc.
- 3. Compose and send customized mail / e-mail using mail-merge.
- 4. Create / modify a power point presentation with text, multimedia using templates with animation.
- 5. Create spreadsheet with basic calculations with relative reference, absolute reference and mixed reference methods.
- 6. Simple report preparation using filtering tool / advanced filtering commands / pivot tables in spreadsheet application.
- 7. 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 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. <u>https://edu.google.com/</u>

## **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 / createpivot tables / chart using a spreadsheet application.
- Create simple diagrams / charts using online tools like: www.draw.io .
- Manage documents, presentations, spreadsheets and websites in collaborative mode.

# LANG1001: Communication Skills in English - Beginners

| L | Т | Р | S | J | С  |
|---|---|---|---|---|----|
| 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 Cunninhum, S. & Moor, P. (nd). New Cutting Hedge (Intermediate). Longman
- 2. Cambrdige Academic English: An Integrated Skills Course for EAP (Intermediate) By Craig Thaine, CUP (2012)
- 3. Rutherford, Andrea J. (2007). Basic Communication Skills for Technology: Second Edition. Delhi: Pearson Education.
- 4. McCarthy, M., O'Dell, F., Mark, G. (2005). English Vocabulary in Use. Spain: Cambridge University Press.
- 5. New Headway Academic Skills: Reading, Writing, and Study Skills Student's Book, Level-1 by Sarah Philpot. OUP
- 6. Philpot, S. & Curnick, L. (2017). Headway: Academic Skills: Reaing, Writing, and Study Skills. Introductory Level. OUP.
- 7. Thaine, C. (2012). Cambridge Academic English: An Integrated Skills for EAP . Intermediate. CUP.

## **Online References**

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

### **Course Outcomes**

- 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 | Т | Р | S | J | С |
|---|---|---|---|---|---|
| 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)

| S. No. | Tasks  | Activities  |
|--------|--|---|
| 1      | Listening to subject related short discussions/<br>explanations/ speech for comprehension          | Pre-reading group discussion, Silent reading<br>(Note-making), Modelling (questioning), Post-<br>reading reflection /Presentation |
| 2      | Asking for information: asking questions related to<br>the content, context maintaining modalities | Group role-play in a context (i.e. Identifying the situation and different roles and enacting their roles)                        |

#### List of Tasks and Activities

| 3  | Information transfer: Verbal to visual (familiar<br>context), demonstration by teacher, learners' task<br>(guided with scaffolding), learners' task (free),<br>presentation and feedback   | Pair work for discussion & feedback,<br>Presentations, question-answer  |
|----|--|---|
| 4  | Information transfer: Visual to verbal (unfamiliar<br>context); demonstration by teacher, learners' task<br>(guided with scaffolding), learners' task (free),<br>presentation and feedback   | Pre-reading game/modelling, discussion in small groups, individual writing, and feedback  |
| 5  | Introducing officials to peers and vice versa -<br>Formal context  | AV support, noticing, individual performance (3-<br>4), pair work (in context), teacher modelling,<br>group work for Introducing self and others in a<br>formal context   |
| 6  | Introducing friends to family and vice versa -<br>Informal context   | Teacher modelling/AV support, noticing<br>structure & note-taking, Introducing friends and<br>family in an informal context   |
| 7  | Vocabulary in context: Find clues in a text and use<br>them to guess the meaning of words/phrases.<br>Apply the newly learnt vocabulary in<br>communication (speaking and writing).  | Comprehending verbal communication:<br>Identifying the contextual clues in oral and<br>written texts; guessing the meaning of<br>words/phrases in context while reading texts and<br>listening to discussions/talks |
| 8  | A five-day journal (diary) writing based on<br>learners reading from newspaper on a single<br>relevant/current social issue. Individual oral<br>presentation and feedback from peers and<br>instructor.  | Note-making (group work), Discussion,<br>Feedback   |
| 9  | Follow the essentials of lectures, talks,<br>discussions, reports and other forms of academic<br>presentations and mak2 individual and group<br>presentations aided with images, audio, video,<br>tabular data, etc.   | Making power point presentation aided with<br>images, audio, video, etc. with a small group by<br>listening to academic lectures/talks/ discussions,<br>etc.  |
| 10 | Self-reflection: Re-reading one's own drafts,<br>identifying errors, correcting the errors, and giving<br>rationalize the changes  | Pre-task discussion/modelling, Editing the texts<br>by careful reading and identifying the errors,<br>peer-exchange (Pair work),<br>feedback/consolidation  |
| 11 | Collaborative work (speaking and writing) in<br>small groups of 3 or 4 learners: discussing a<br>general/discipline-specific topic: creating outline,<br>assigning specific roles to members of the group;<br>and group presentation followed by peer and<br>instructor feedback | Pre-task modelling (peer/teacher), general<br>discussion on structure, group work<br>(collaboration), feedback  |
| 12 | Independent reading of different text types using<br>appropriate reference sources by adapting suitable<br>reading styles and speed. Focus on active reading<br>for vocabulary: low-frequency collocations and<br>idiomatic expressions.   | Brain-storming, mapping of key terms (content<br>specific), reading and note-making (individual),<br>oral questioning, discussion   |
| 13 | Role-play (specific social and academic<br>situations): planning (making notes),<br>understanding nuances of speaking in context,<br>coordinating with situational clues and fellow<br>speakers/participants   | Peer discussion for outline, A-V support,<br>observing (teacher modelling), role play<br>(guided), role-play (free), feedback   |
| 14 | Writing instructions: Guidelines - Flowcharts -<br>Procedures to be followed   | Pre-task reading, pair work, teacher/peer-<br>discussion, feedback  |
| 15 | Speaking spontaneously on topics of interest and<br>writing short structured essays on the same topics<br>adopting appropriate academic conventions and<br>grammatical accuracy.   | Reading for task preparation, note-making,<br>speaking, reflection and corrective peer and<br>teacher feedback  |

## **Reference Books**

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

### **Online Resources**

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

### **Course Outcomes**

- 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

| $\mathbf{L}$ | Т | Р | S | J | С |
|--------------|---|---|---|---|---|
| 0            | 0 | 4 | 0 | 0 | 2 |

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

#### **Course 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   | со |
|-------|---|--|----|
| 1     | Evaluative and extrapolative reading of a long<br>text/short texts on a current topic related to<br>technology and society, identifying and<br>questioning the author's intention, post-<br>reading discussion in small groups,<br>maintaining group dynamics, arriving at a<br>consensus                   | Pre-reading group discussion, silent<br>reading (Note-making), modelling<br>(questioning), post-reading reflection<br>and brief presentation of<br>thoughts/ideas/opinions on the theme<br>of the text             | 3  |
| 2     | Debate in pairs based on listening to two<br>recorded contemporary speeches by well-<br>known leaders in different fields. Peer<br>feedback and instructor feedback.  | Pre-recorded audio/video for listening,<br>student checklist for noticing key<br>words/concepts, pre-task orientation<br>(by teacher), pair work, feedback   | 1  |
| 3     | Information transfer: Verbal to visual<br>(unfamiliar context); demonstration by<br>teacher, learners' task (guided with<br>scaffolding), learners' task (free),<br>presentation, question-answer(among<br>students), modification and feedback before<br>the final version is done                         | Pair work for discussion and feedback,<br>presentations, question-answer   | 2  |
| 4     | Information transfer: Visual to verbal<br>(unfamiliar context); demonstration by<br>teacher, learners' task (guided with<br>scaffolding), learners' task (free),<br>presentation, question-answer(among<br>students), modification, editing, proofreading,<br>and feedback before the final version is done | Pre-reading game/modelling,<br>discussion in small groups,<br>independent writing and feedback   | 4  |
| 5     | Expressing opinion on a short argumentative<br>text (e.g. a journal article or a newspaper<br>editorial) and justifying one's opinion/stance;<br>focus on the use of appropriate conventions of<br>formal and polite speech, and managing bias  | Listening to group discussions/debates,<br>reading news-paper articles on the<br>current issues and expressing opinions<br>in favour or against the topic (in GDs,<br>debates or writing argumentative<br>essays). | 3  |
| 6     | Role-play (complex social and<br>academic/professional situations): Focus on<br>significant aspects of delivery including<br>clarity, tone, and use of contextually<br>appropriate vocabulary and conventions,<br>observation, reflective discussion, and self-<br>reflective writing                       | Reading newspaper/magazine<br>articles/blog posts on current social<br>issues, listening to<br>talks/discussions/debates etc. and<br>participating in role-plays using<br>expressions appropriate to the context.  | 1  |
| 7     | Collborative writing in groups of 3 -4 on<br>topics that would require data collection and<br>reading followed by recorded peer-reflection<br>and peer-feedback, group presentation and<br>feedback   | Pre-task modelling (peer), general<br>discussion on structure, group work<br>(collaboration), presnetation, peer<br>feedback, Open-class discussion  | 5  |
| 8     | Formal Group Discussion on topics of current<br>interest and relevance; focus on effective<br>participation, reflection on control over<br>argument/counter argument, and adherence to<br>the conventions of formal GD  | Noticing strategies from AV<br>modelling, teacher scafolding though<br>open-house discussion, Note-making<br>(Group work), Group Discussion<br>(free), post perfromance discussion,<br>Feedback                    | 2  |

| 9  | Mind-mapping for advanced reading, making<br>correlations across texts, extending author's<br>point of view  | Reading texts on abstract topics and<br>comprehending the author's perspective<br>by inferring the unknown words'<br>meaning in the context and making<br>notes using mind-map strategy and<br>presenting it orally.   | 3 |
|----|--|--|---|
| 10 | Handling question and answer sessions after<br>presentations: justifying arguments, taking<br>counter-arguments, agreeing and disgreeing<br>with rationale   | Listening to some lectures, talks, and<br>presentations in the academic seminars<br>and adapting some strategies to handle<br>the Q&A sessions using polite and<br>formal expressions to agree or disagree<br>with the statements.   | 1 |
| 11 | Modelling an interview: with a panel of four judges (peers)  | Pre-task activity for<br>orientation/strategies<br>(controlled/guided), Model interview<br>(AV support), Group work (role play),<br>interview in pair (one-to-one),<br>Interview in group (many -to-one), oral<br>corrective feedback (peer/teacher)   | 2 |
| 12 | Writing a short reflective report of an event -<br>incident/meeting/celebration  | Writing a report on<br>meetings/celebrataions/events etc. by<br>actively involving in such events and<br>giving a short oral presentation on the<br>same.  | 4 |
| 13 | Speaking on abstract and complex topics<br>beyond his/her own area of interest/field of<br>study, using the language flexibly and<br>effectively.  | Reading texts on abstract topics and<br>comprehending the author's<br>perspectives. Similarly, listening to<br>talks and discussions on an abstract<br>topic of other discipline and making<br>short oral presentation by sharing<br>views and opinions.   | 3 |
| 14 | Self-relfection on own speech in<br>context(recorded): tone, pitch, relevance,<br>content; extending the reflections/ideas to<br>others  | Listening to selected general<br>discussions (audios and videos) and<br>observing the language production.<br>Recording own speech on some general<br>topic and providing a critical review<br>(self-reflection) on it by focusing on<br>the tone, expressions and relevance of<br>the content, etc. | 1 |
| 15 | Collaborative and individual task: planning,<br>preparing (preparing an outline, structure,<br>setting objectives and presenting the plan of<br>action) and executing a mini-project, and<br>submitting a brief report on the same peer and<br>instructor feedback after the planning stage<br>and on completion of the mini project | Pre-task modelling (peer/teacher),<br>general discussion on structure, group<br>work (collaboration), oral corrective,<br>task distribution, presentation,<br>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.
- Cambrdige Academic English: An Integrated Skills Course for EAP (Advanced) By Martin Hewings and Craig Thaine, CUP (2012)

- 4. Berlin, A. (2016). 50 Conversation Classes: 50 Sets of Conversation Cards With an Accompanying Activity Sheet Containing Vocabulary, Idioms and Grammar. Poland: CreateSpace Independent Publishing Platform
- 5. Zemach, D. E., Islam, C. (2011). Writing Paragraphs: From Sentence toParagraph. Germany: Macmillan Education.
- 6. Stewart, J. P., Fulop, D. (2019). Mastering the Art of Oral Presentations: Winning Orals, Speeches, and Stand-Up Presentations. United Kingdom: Wiley.
- 7. Kroehnert, Gary. (2010). Basic Presentation Skills. Sidney: McGraw Hill.
- 8. Cunninghum, S. & Moor, P. (nd). Cutting Edge (Advanced) With Phrase Builder. Longman Publishers. CUP
- 9. McCarthy, M & O'Dell, F. (2017). English Idioms in Use (Advanced). Cambridge: CUP.

### **Online Resources**

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

### **Course Outcomes**

- 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)

| $\mathbf{L}$ | Т | Р | S | J | С |
|--------------|---|---|---|---|---|
| 0            | 0 | 2 | 0 | 0 | 1 |

#### **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

| Unit | Topics  | Hours |
|------|---|-------|
| 1    | Self Awareness & Self Regulation: Introduction to Emotional Intelligence,<br>Self Awareness: Self Motivation, Accurate Self Assessment (SWOT Analysis),<br>Self Regulation: Self Control, Trustworthiness & Adaptability                | 3     |
| 2    | Importance, Practising Social Awareness, Building Relationships, Healthy and<br>Unhealthy Relationships, Relationship Management Competencies-<br>Influence, Empathy, Communication, Types of Conflicts, Causes, Conflict<br>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,<br>Prioritization, Urgent Vs Important, Q2 Organization  | 3     |
| 5    | Teamwork: Team Spirit, Difference Between Effective and IneffectiveTeams,<br>Characteristics of High Performance Teams, Team Bonding, Persuasion,<br>Team Culture, Building Trust, Emotional Bank Account                               | 4     |
| 6    | Verbal Reasoning: Introduction, Coding-decoding, Blood relations, Ranking,<br>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     |
|      | Total Hours   | 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)

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

| 4 | Group Discussion: Understanding GD, Evaluation Criteria, Nine Essential Qualities<br>for Success, Positive and Negative Roles, Mind Mapping, Structuring a Response,<br>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,<br>Partnerships & Averages, Percentages, Profit-Loss & Discounts, Mixtures,<br>Problems<br>on Numbers & ages                    | 6  |
| 7 | Data Interpretation: Interpretation and analysis of data in Tables, Caselets, Line-<br>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  |
|   | Total Hours   | 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 Specify, Specify to General, Idea-Example, Idea-Explanation, Etc.

- 4. **Grammar Usage:** Rules Governing the Usage of Nouns, Pronouns, Adjectives, Adverbs, Conjunctions, Prepositions and Articles
- 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)

| $\mathbf{L}$ | Т | Р | S | J | С |
|--------------|---|---|---|---|---|
| 0            | 0 | 2 | 0 | 0 | 1 |

#### **Course Description:**

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

#### **Course 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], Cryptarithmetic & Modular Arithmetic (Cryptarithmetic, 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, Cryptarithmetic, 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**

| $\mathbf{L}$ | Т | Р | S | J | С |
|--------------|---|---|---|---|---|
| 0            | 0 | 0 | 2 | 0 | 2 |

#### **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 <u>expected</u> 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 heavilydependent 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.

<u>Talking to customers</u> 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.

<u>"Design"</u> 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.

<u>Business modeling</u> 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 <u>the final outcome</u>, you will be required to come up with Pitch that can 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 Steps and activities in this course]

## <u>Deliverables</u>

There are a number or 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 ImpactHand-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 InsightHand-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 you 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 IntegrationHand-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 toocomplex 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 Journalsas 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, yourcareer, 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 aswell 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**

| We<br>ek | Sessi<br>on | Topics and<br>Steps  | Key CONCEPTS Introduced in Class   | <b>Class Focus Activity</b>   |
|----------|-------------|--|--|---|
| 1        | 1           | Course<br>Overview   | <ol> <li>Why is entrepreneurship important?</li> <li>What is Personal Discovery through<br/>Entrepreneurship?</li> <li>Four Stages; Personal Discovery,<br/>Solution Discovery, Business Model<br/>Discovery, Discovery Integration</li> <li>Preparation (finding interesting areas)</li> </ol>                  | Lecture and Discussion  |
|          | 2           | Personal<br>Discovery<br>(Step 01, Step<br>02)                   | <ol> <li>Personal Values</li> <li>Strength and Weakness</li> </ol>   | <ul> <li>Individual:</li> <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           | Find<br>Teammates<br>(Step 03)                                   | <ol> <li>Review Problem Area Template at the<br/>beginning of the book to find<br/>classmates who want to work on the<br/>same problem area.</li> <li>Findteammates         <ol> <li>Shared values</li> <li>Levels of commitment</li> <li>Skills and experiences (Same or<br/>Different?)</li> </ol> </li> </ol> | <ul> <li>Problem template: Page 9</li> <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           | Define<br>Purpose<br>(Step 04)<br>Create<br>Mission<br>(Step 05) | <ol> <li>Methods for defining and refining a<br/>venture's purpose</li> <li>Defining a Venture's Purpose</li> <li>Creating a Vision Statement</li> </ol>   | <ul> <li>Team:</li> <li>Purpose and Mission<br/>Templates: Pages 49 and 52</li> <li>Be prepare to present to the<br/>class.</li> <li>Personal Discovery Reflection<br/>Journal Due</li> </ul>   |

| We<br>ek     | Sess<br>ion                            | Topics and<br>Steps  | Key CONCEPTS Introduced in<br>Class   | Class Focus Activity   |
|--------------|--|--|---|--|
| 3            | 5                                      | Ideation &<br>Impact   | Ideation Methods<br>• An in-class ideation exercise   | Team:<br>• Problem to Solve<br>Templates, Step 4, Page<br>62, and 63   |
|              | 6                                      | (Step 06)  | Increasing the Impact of an Idea.<br>(The Eat-Your-Coffee Video – a good<br>example of ideation)  | Team:<br>• Idea Impact Template,<br>Step 6, Page 69  |
| 4            | 7                                      | 7<br>User<br>Insights  | <ul> <li>Identifyand find the right target<br/>users.</li> <li>Interview style and methods</li> <li>The Customer Interview<br/>template.</li> </ul> | <ul> <li>Team:</li> <li>Customer Interviews<br/>Template, Step 7, Pages 75</li> <li>Edit interview template for<br/>your project.</li> </ul> |
|              | 8                                      | (Step 07)  | Laddering methods for interviews  | Team:<br>• Latent Needs Template,<br>Step 7, Page 93   |
| 9<br>5<br>10 | 9                                      | User<br>Insights<br>Customer<br>Interviews<br>(Step 07)                                      | <ul> <li>Finding latent needs</li> <li>Field work check-in</li> </ul>   | <ul> <li>Team:</li> <li>Latent Needs Template,<br/>Step 7, Page 93</li> <li>Field work – customer<br/>interviewing</li> </ul>                |
|              | 10                                     |  | <ul> <li>Think about innovation across the entire use case</li> <li>Field work check-in</li> </ul>  | <ul> <li>Team:</li> <li>Full Use Case Template,<br/>Step 7, Page 99</li> <li>Field work – customer<br/>interviewing</li> </ul>               |
| 6            | 11<br>User<br>Insights<br>Interpreting | <ul> <li>Interpreting customer interview<br/>results</li> <li>Field work check-in</li> </ul> | <ul> <li>Team:</li> <li>Field work – customer<br/>interviewing</li> <li>Also talk to<br/>retailers/dealers if<br/>appropriate</li> </ul>            |  |
|              | 12                                     | Results<br>(Step 07)   | <ul> <li>Idea Reshaping based on Customer<br/>Interviews</li> <li>Field work check-in</li> </ul>  | Teams prepare results of<br>results from customer<br>interviews and how the<br>original ideas have been<br>reshaped& improved.               |
| 7            | 13<br>14                               | User<br>Insights<br>Interpreting<br>Results<br>(Step 07)                                     | <ul> <li>Customer Research Reports</li> <li>Implications for product and service design</li> </ul>  | <ul> <li>Teams prepare PPTs for<br/>class presentation</li> <li>Customer Insight<br/>Template Hand-in<br/>Package</li> </ul>                 |

| We<br>ek | Sess<br>ion | Topics and<br>Steps  | Key CONCEPTS Introduced in Class   | Class Focus Activity  |
|----------|-------------|--|--|---|
| 8        | 15          | Concept<br>Design  | <ul> <li>Defining Customer Value</li> <li>Understanding Customer Value<br/>Proposition</li> </ul>  | <ul> <li>Team:</li> <li>Customer Value<br/>Proposition</li> <li>Template: Step 8, Page<br/>107</li> <li>Draft the CVP</li> </ul>  |
|          | 16          |  | • Presentation and review of CVPs  | Team:<br>• Complete CVP   |
| 9        | 17          | Competitive<br>Analysis and  | <ul> <li>Understanding of Competitive Matrix</li> <li>Competitive positioning: creating<br/>your separate space</li> </ul>   | <ul> <li>Team:</li> <li>Identify major competitors,<br/>and dimensions for analysis</li> <li>Template: Step 8, Page 109</li> </ul>  |
|          | 18          | Positioning<br>(Step 08)   | <ul> <li>Presentations of Competitive<br/>Analyses and Positionings</li> </ul>   | <ul> <li>Team:</li> <li>Perform the competitive analysis and present results, including positioning</li> </ul>  |
| 10       | 19          | Product Line<br>Strategy<br>(Step 09)  | <ul> <li>Product line framework: good, better,<br/>best on underlying platforms, plus<br/>application to Services.</li> </ul>  | <ul> <li>Team:</li> <li>Identify good, better, best variations based on the underlying concept.</li> <li>Product line template: Page 115</li> </ul>   |
|          | 20          | Product<br>Visioning<br>Subsystem<br>Design, and<br>Prototype<br>Sketch<br>(Step 10) | <ul> <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> | <ul> <li>Team:</li> <li>Prototype sketch, and for<br/>Web apps, a wireframe.<br/>For physical products, an<br/>initial bill of materials.</li> <li>Underlying bubble chart<br/>showing your decision<br/>process.</li> <li>Product Vision and<br/>Subsystem Design<br/>Templates: Step 10, Pages<br/>121 and 126</li> </ul> |
| We<br>ek | Sess<br>ion | Topics and<br>Steps  | <ul> <li>Key CONCEPTS Introduced in<br/>Class</li> </ul>   | Team or Individual Activity   |
| 11       | 21          | Reality<br>Check<br>(Step 11)  | • The purpose of the Reality Check,<br>testing the product concept, channel<br>preferences, and much other.  | <ul> <li>Team:</li> <li>Reality Check Survey</li> <li>Template and Results: Step 11, Page 141, 143-144</li> </ul>   |
|    | 22 |                                   | <ul> <li>Guidance on the number or additional<br/>customers for the reality check survey</li> <li>How to analyze and interpret the<br/>results</li> </ul>                                  | <ul> <li>Customize the Reality<br/>Check template for your<br/>venture.</li> <li>Do a quick round of<br/>customer surveying. Aim<br/>for 12 more interviews.</li> </ul>  |
|----|----|-----------------------------------|--|--|
| 12 | 23 | Industry<br>Analysis<br>(Step 12) | <ul> <li>Team reports on Reality Check<br/>Results</li> <li>Examine major components of an<br/>Industry Analysis</li> <li>Review Templates</li> </ul>                                      | <ul> <li>Team:</li> <li>Prepare and present the results of your reality check, plus any pivots you wish to make.</li> <li>Concept Design (and Test) Hand-in Package</li> <li>Industry Analysis Templates: Step 12, Pages 153 and 154s</li> </ul> |
|    | 24 | Business<br>Model<br>(Step 13)    | <ul> <li>Defining the Business Model:</li> <li>Lecture on basic structure and<br/>different types.</li> <li>Illustrating it as the flow of product,<br/>money, and information.</li> </ul> | <ul> <li>Team:</li> <li>Business Model Illustration<br/>Template, Step 13, Page<br/>170</li> </ul>   |

| We<br>ek | Sess<br>ion    | Topics and<br>Steps                            | <ul> <li>Key CONCEPTS Introduced in<br/>Class</li> </ul>   | Team or Individual Activity  |
|----------|----------------|--|--|--|
|          | 25<br>Business |  | <ul> <li>Revenue and Expenses</li> <li>The key decision points in the<br/>Revenue Model</li> </ul>   | Team <ul> <li>Step 14, Page 177</li> <li>Step 15, Page 187</li> <li>Step 16, Page 195</li> <li>Step 17, Pages 199 and</li> </ul>   |
| 13       | 26             | Business<br>Model<br>(Steps 14, 15,<br>16, 17) | <ul> <li>The key decision points in the<br/>Operating Model</li> <li>Designing the Customer Journey</li> <li>Validating the Business Model<br/>(The Polka Dog Bakery Video: an<br/>example of creating a new retail<br/>experience, plus new products.)</li> </ul> | <ul> <li>200</li> <li>Validate the Revenue and<br/>Operating Model by trying<br/>to have phone calls with a<br/>few Sellers and<br/>Manufacturers to<br/>validating pricing,<br/>channels, and costs.</li> </ul> |
| 14       | 27             | Impact<br>Visioning<br>(Step 18)               | <ul> <li>Develop clear statements for business<br/>and societal impact.</li> <li>Look at good existing examples of<br/>companies that do both.</li> </ul>  | <ul> <li>Team:</li> <li>Start integrating your research and templates towards the final presentation, provided in Step 20, Page 264</li> <li>Business Model Design Hand-in Package</li> </ul>                    |
|          | 28             | Creating<br>Value<br>(Step 19)                 | <ul> <li>Develop a project of the profitability<br/>in make low volumes for a product, a<br/>service, and a Web app.</li> <li>Discuss applications of the<br/>framework to your venture.</li> </ul>  | <ul> <li>Team:</li> <li>Develop and present Unit<br/>of 1 Economics Template,<br/>Step 19, Page 229</li> <li>Keep working on the Final<br/>presentation</li> </ul>   |

| We<br>ek                     | Sess<br>ion | Topics and<br>Steps  | Key CONCEPTS Introduced in<br>Class  | Team or Individual Activity  |
|------------------------------|-------------|----------------------|--|--|
|                              | 29          |                      | <ul> <li>Presentation Format and Style</li> <li>Format:         <ul> <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> </ul> </li> </ul>   | Team:<br>• The PPT Presentation<br>1. The target customer & 2. The market opportunity represented<br>7. Action steps<br>6. The team<br>5. The customer<br>journey<br>() The target customer<br>() The target customer & 2. The market opportunity<br>() The target customer & 2. The target |
| 15                           | 30          | Tell Your<br>Story   | <ul> <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> <li>If you have built a prototype during the class, please bring it and show it to us!</li> <li>(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.)</li> </ul> | <ul> <li>&amp; Business Model Story</li> <li>&amp; The venture as the revenue as the reve</li></ul>         |
| Final Course<br>Deliverables |             | l Course<br>verables | Due on the Monday after the weekend of the final class meeting.  | Team: Your Venture PPTs<br>Individual: Insight<br>Learning Reflection Journal  |

## **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 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

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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 Kabadddi International Kabaddi Federation

## **DOSP1091: Basketball**

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 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**

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 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-curicular activities
- Learn to manage time effectively
- gain confidence

## **DOSL1011: Club Activity – Member of the Club**

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This course encourages and acknowledges student members' work in organizing events and activities organized by various student organizations that pursue specific co-curricular and extracurricular 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-curicular 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-curicular activities
- Develop management skills through hands on experience
- Explore different managerial roles and develop competencies

## DOSL1021: Club Activity – Leader of the Club

| L | Т | Р | S | J | С  |
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| 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-curicular 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**

| L | Т | Р | S | J | С  |
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| 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-curicular 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**

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#### **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**

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

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

6 hrs

## 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 | Т | Р | S | J | С  |
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#### **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 -noncooperation 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**

| L | Т | Р | S | J | С  |
|---|---|---|---|---|----|
| 0 | 0 | 0 | 0 | 2 | 2* |

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**

| L | Т | Р | S | J | С  |
|---|---|---|---|---|----|
| 0 | 0 | 0 | 0 | 2 | 2* |

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 SherylWuDunn)
- 2. The story of My Experiments with Truth (author: M. K. Gandhi)
- 3. List of student run and and other Government and nongovernment community serviceorganizations 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**

## L T P S J C 3 0 0 0 0 3\*

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:

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

**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

No of Hours: 10

No of Hours:

10

## No of Hours: 10

#### UNIT – Environmental Pollution III

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 No of Hours: Act and Field work 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. <u>https://library.lclark.edu/envs/corejournals</u>

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 | Т | Р | S | J | С  |
|---|---|---|---|---|----|
| 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.

- 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)

| L | Т | Р | S | J | С |
|---|---|---|---|---|---|
| 0 | 0 | 2 | 0 | 0 | 1 |

## **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)

| L | Т | Р | S | J | С |
|---|---|---|---|---|---|
| 0 | 0 | 2 | 0 | 0 | 1 |

## **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:**

- 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
- Quantitative Ability: Arithmetic, Algebra, Geometry, Mensuration, Calculus, Trigonometry
- 2. Data Interpretation: Data Interpretation and Data Sufficiency
- Logical Reasoning: Data Management, Deductions, Verbal Reasoning and Non-Verbal Reasoning
- 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:**

 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 | Т | Р | S | J | С |
|---|---|---|---|---|---|
| 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
- 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:**

 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)

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

# **Course Description:**

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

### **Course Objectives:**

- 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)

| L | Т | Р | S | J | С |
|---|---|---|---|---|---|
| 0 | 0 | 2 | 0 | 0 | 1 |

#### **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:**

- Prepare the students to solve all types of questions from all four relevant areas of CAT/ XAT/ MAT, etc.
- Quantitative Ability II: Arithmetic, Algebra, Geometry, Mensuration, Calculus, Trigonometry
- 2. Data Interpretation II: Data Interpretation and Data Sufficiency
- 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

| L | Т | Р | S | J | С  |
|---|---|---|---|---|----|
| 0 | 0 | 2 | 0 | 0 | 1* |

#### **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 nonmedical 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.

# **SEMESTER –I**

# **MATH1171 : Descriptive Statistics and Probability Theory**

#### No. of hrs/week: 3 Preamble:

### Credits: 3

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 geometic 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 descrite 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.Vijavalakshmi
- 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.

# **SEMESTER –I**

# MATH1191 : Statistical Methods

#### No. of hrs/week: 3 Preamble:

### Credits: 3

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 Cahnd& Sons, New Delhi

2.. BA/BSc II year statistics - statistical methods and inference - Telugu Academy by A.

Mohanrao, N.Srinivasa Rao, DrR.Sudhakar Reddy, Dr T.C. Ravichandra Kum.

3. K.V.S. Sarma: Statistics Made Simple: Do it yourself on PC. PHI.

#### 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 matechematical statistics, Asia Publishing house.

# B.Sc. Mathematics SEMESTER- I

### 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. Mathematics SEMESTER-I 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 fuction
- 9. Program to check a given string is a palindrome or not
- 10. Using pointers copying a string to another string
- 11. Using pointers and functions sorting of number
- 12. Computer binomial coefficients using recursive function for factorial

#### **Course Outcomes:**

- 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

# **SEMESTER –II**

# MATH1211: Mathematical Expectation and Probability Distributions

Credits: 3

# No. of hrs/week: 3

### Preamble:

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

# **Course Objectives:**

- To understand mathematical expections
- 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 expections
- 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. Possion approximation to Binomial distribution.

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

- Distinguish between binomial distribution and poission distribution
- Evaluate central moments for binomial distribution and poission 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 geometic 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 poission 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 expections
- Evaluate central moments for binomial distribution and poission 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. Mathematics** SEMESTER – II

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

Hours per 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:**

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

# SEMESTER –II 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.

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

### B. Sc. Mathematics SEMESTER – II 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 overrding.
- 10. Write a C++ program to demonstrate operator overloading.
- 11. Write a C++ program to demonstrate Polymorphism.

- 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. Mathematics SEMESTER –I

# 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 offunctions, 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 Cauch's forms of remainder

# UNIT-V

Taylor's series, Maclaurin's series of sin x,  $\cos x$ ,  $e^x$ ,  $\log(l+x)$ ,  $(l+x)^m$ , 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 Cauch's forms of remainder
- Evaluate Maxima and minima of a function

#### **Books Recommended :**

- 2. "Elements of Real Analysis" by Shanthi Narayan and Dr. M.D. Raisinghania, published by S.Chand& Company Ltd., New Delhi
- 3. "A Text Book of B.Sc. Mathematics Volume-II" by V.Venkateswara Rao, N Krishna Murthy, B.V.S.S. Sarma and S. AnjaneyaSastry, published by S.Chand& Company Ltd., New Delhi.
- 4. "Calculus Single Variable" by Howard Anton, IrlBivens and Stephen Davis, published by John Wiley and Sons, Inc., 2002.
- 5. "Calculus and Analytic Geometry" by George B. Thomas, Jr. and Ross L. Finney, published by Pearson Education, 2007, 9<sup>th</sup> edition.

# SEMESTER -I

#### MATH1161: Differential Calculus Lab

Hours per week: 2

Credits: 1

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

- Evaluate limits and continuity of a function
- Solve problems on partial differentiation
- Explain applications of Rolle's theorem, Mean value theorems
- Explain applications of Taylor's and Maclaurin's series
- Define maxima and minima of functions

# **SEMESTER –II**

### **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

- 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. Mathematics SEMESTER –II

# MATH1241: Differential Equations Lab

Hours per week: 2

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. Soving total differential equations
- 8. Formation of first order partial differential equations
- 9. Problems using Lagrange's method
- 10. Problems using Charpit's method
- 11. Classification of second order partial differential equations

- 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

# **SEMESTER –III**

# MATH2001: Real Analysis

# No. of hrs/week: 3

### Credits: 3

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

# **Course Objectives:**

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

# UNIT-I

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

Learning Outcomes: The student will be able to:

- Define and recognize the basic properties of field of real numbers
- Find suprema and infima of sets
- Discuss the cluster points of sets

# **UNIT-II**

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

Learning Outcomes: The student will be able to:

- Define sequences and its properties
- Verify the convergence of sequence
- Prove fundamental theorems on convergence

# **UNIT-III**

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

Learning Outcomes: The student will be able to:

- Define Infinite series and its properties
- Discuss the convergence of Geometric series
- Verify the convergence of series

# UNIT-IV

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

Learning Outcomes: The student will be able to:

- Define alternating series
- Explain the absolute and conditional convergence of the series
- Explain the Root, Ratio and Leibnitz's test

# UNIT-V

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

Learning Outcomes: The student will be able to:

- Define sequence and series of functions
- Understand the difference between point wise and uniform convergence
- Apply M-test Course Learning

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

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

#### **Books Recommended**

1. T. M. Apostol, Calculus (Vol. I), John Wiley and Sons (Asia) P. Ltd., 2002.

- 2. R.G. Bartle and D. R Sherbert, *Introduction to Real Analysis*, John Wiley and Sons (Asia) P. Ltd., 2000.
- 3. E. Fischer, Intermediate Real Analysis, Springer Verlag, 1983.

4. K.A. Ross, *Elementary Analysis- The Theory of Calculus Series-* Undergraduate Texts in Mathematics, Springer Verlag, 2003.

# **SEMESTER –III**

# MATH2011: Algebra

### No. of hrs/week: 3

# Credits: 3

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

# **Course Objectives:**

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

#### UNIT – I GROUPS

# GROUPS :

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

Learning Outcomes: The student will be able to:

- Explain algebraic structures
- Verify group properties of a given algebraic structure
- Define order of a group and order of an element

#### UNIT – II SUBGROUPS :

Complex Definition – Multiplication of two complexes Inverse of a complex-Subgroup definition – examples-criterion for a complex to be a subgroups.Criterion for the product of two subgroups to be a subgroup-union and Intersection of subgroups.

# **Co-sets and Lagrange's Theorem :**

Cosets Definition – properties of Cosets–Index of a subgroups of a finite groups–Lagrange's Theorem.

Learning Outcomes: The student will be able to:

- Define and explain the properties of complexes, subgroups and co-sets
- Explain the index of a subgroups with examples
- Prove Lagranges theorem

# UNIT –III

# NORMAL SUBGROUPS :

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

Sub group of index 2 is a normal sub group – simple group – quotient group – criteria for the existence of a quotient group.

Learning Outcomes: The student will be able to:

- Explain normal subgroups and its properties
- Define quotient groups and criteria for the existence of a quotient group

# UNIT – IV

# **HOMOMORPHISM :**

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

Learning Outcomes: The student will be able to:

- Discuss the structure preserving mappings
- Prove the properties of Homomorphism and Isomporphism
- Define Kernal of Isomorphism and its properties

### UNIT –V

# **PERMUTATIONS AND CYCLIC GROUPS :**

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

### Cyclic Groups :

Definition of cyclic group – elementary properties – classification of cyclic groups.

Learning Outcomes: The student will be able to:

- Define and give examples of permutation and cyclic groups
- Perform permutation multiplication
- Find generators of cyclic group
- Prove fundamental properties of permutation and cyclic groups

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

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

#### **Books Recommended**

1.A text book of Mathematics for B.A. / B.Sc. by B.V.S.S. SARMA and others Published byS.Chand& Company New Delhi.

**2** A. First course in Abstract Algebra, by J.B. Fraleigh Published by Narosa Publishing house.

**3.** Modern Algebra by M.L. Khanna.

4. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.

5. M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.

### **SEMESTER –III**

#### MATH2021 : Real Analysis Lab

Hours per week: 2

Credits: 1

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

- Calculate the infima, suprema and limit points of a set.
- Apply tests to verify the convergence or divergence of sequences.
- Verify the convergence, divergence of series
- Verufy absolute convergence of series
- Verify conditional convergence of series

#### **SEMESTER –III**

### MATH2031: Algebra Lab

#### Hours per week: 2

Credits: 1

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

- Verify group properties of given algebraic structure
- demonstrate the subgroups, normal subgroups, quotient groups with examples
- Recognize the structure preserving mappings
- Find the generators of a group
- Discuss about permutations and their product

# **SEMESTER –IV**

# MATH2041: Linear Algebra

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

### Credits: 3

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

### **Course Objectives :**

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

### UNIT – I

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

Learning Outcomes: The student will be able to:

- Define rank of a matrix
- Evaluate rank of a matrix using normal form and echelon form
- Define rank of product of matrices
- Explain the method to solve system of homogeneous equations

# UNIT – II

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

Learning Outcomes: The student will be able to:

- Explain consistency of matrices
- Evaluate Crammer's rule
- Explain characteristic values and characteristic vectors of a matrix
- Evaluate minimal polynomial of a matrix

#### UNIT – III

#### Linear Algebra -I

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

Learning Outcomes: The student will be able to:

• Define vector spaces and vector subspaces with examples

- Explain linear combination of vectors
- Explain basis of vector space
- Explain dimension of a vector space

# UNIT – IV

# Linear Algebra - II

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

Learning Outcomes: The student will be able to:

- Explain the concepts of linear transformations and linear operators
- Evaluate range and null space of linear transformation
- Explain rank and nullity of linear trasformations

# UNIT – V

# Inner product spaces

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

Learning Outcomes: The student will be able to:

- Define inner product spaces, Euclidean and unitary spaces
- Explain orthogonality, orthonormality of sets
- Explain Gram-Schmidt orthogonalisation process

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

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

#### **Books Recommended**

- 1. "A Text Book of B.Sc. Mathematics Volume-III" by V.Venkateswara Rao, N Krishna Murthy, B.V.S.S. Sarma and S. AnjaneyaSastry, published by S.Chand& Company Ltd., New Delhi.
- 2. "Linear Algebra" by A.R. Vasishtha and J.N. Sharma published by Krishna Prakashan Media (P) Ltd.
- 3. "Linear Algebra" by Kenneth Hoffman and Ray Alden Kunze published by Pearson Education (low priced edition), New Delhi.
- 4. "Linear Algebra" by Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, published by Prentice Hall of India Pvt. Ltd., 4<sup>th</sup> edition New Delhi, 2007.
- 5. "Rings and Linear Algebra" by Pundir, Pundir published by PragathiPrakashan

# **SEMESTER –IV**

### MATH2051: Linear Algebra Lab

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

Credits: 1

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

- Define vector space
- Differentiate linear independent and linear dependent of vectors
- Evaluate eigen values and eigen vectors of a matrix
- Solve problems on subspaces and dimension of a vector space
- Define inner product space
### SEMESTER – V

#### **MATH3001:** Numerical Methods

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

#### Credits: 3

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

#### **Course Objectives:**

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

#### UNIT – I

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

**Learning Outcomes:** After studying this unit the student can Understand the different types of errors in numerical computation Know the rules to round off a given number Understand a general error formula and also error in a series approximation

#### UNIT – II

**Solution of Algebraic and Transcendental Equations**: The bisection method, The iteration method, The method of false position, Newton Raphson method, Generalized.

Learning Outcomes: After studying this unit the student can

- Understand the usage of intermediate value theorem in locating the roots of an equation
- Understand the techniques of bisection method, iteration method, method of false position and also Newton-Raphson method and generalized Newton-Raphson method to find a real root of the given equation

UNIT – III

**System of Simultaneous Equations :** Direct methods, Gauss Elimination Method, LU decomposition,

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

Learning Outcomes: After studying this unit the student can

- Understand the direct methods such as Gauss elimination method and LU decomposition method to solve the given system of equations
- Understand the iterative techniques such as Gauss-Jacobi, Gauss-Siedel and SOR iterative methods to solve the given system of equations numerically

#### UNIT – IV

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

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

Learning Outcomes: After studying this unit the student can

- Understand the problem of interpolation Know the interpolation techniques when the nodes are evenly spaced
- Know the interpolation techniques when the nodes are unevenly spaced

#### UNIT –V

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

Learning Outcomes : After studying this unit the student can

- Understand the problem of numerical differentiation and numerical integration
- Know the techniques for numerical differentiation with finite difference operators
- Know the techniques of Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule

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

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

#### **Recommended Books**

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

### SEMESTER – V

#### MATH3011: Vector Calculus

#### No. of hrs/week: 3 Course Objectives :

# • To define limit of vector function demonstrate the vector differentiation with examples

- To define gradient of a scalar function, divergence and curl of a vector function
- To explain line, surface and volume integrals
- To evaluate applications on Stokes theorem,
- To evaluate Gauss divergence theorem, and Green's theorem

#### UNIT-I

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

#### UNIT-II

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

#### UNIT-III

Vector identities: Gradient, Divergence, Cur, their geometrical interpretations and Successive operations

#### UNIT-IV

Line, surface and Volume integrals : Line Integral, Surface Integral, Volume Integral

#### UNIT-V

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

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

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

#### **TEXT BOOKS :**

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

#### Credits: 3

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

#### **SEMESTER –**V

### MATH3021: Numerical Methods using MATLAB No. of hrs/week: 2 Credits: 1

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

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

- Evaluate solution of algebraic and transcendental equations
- Understand the numerical techniques for various category of problems
- Evaluate problems on system of simultaneous equations
- Solve problems on interpolation to estimate the function and function value.
- Solve problems on Numerical integration

#### **SEMESTER –**V

#### MATH3031: Vector Calculus Lab

No. of hrs/week: 2

Credits: 1

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

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

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

### SEMESTER – VI

#### **MATH3041:** Discrete Mathematics

## No. of hrs/week: 3

#### Preamble :

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

#### **Course Objectives:**

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

#### UNIT-I

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

#### **Learning Outcomes :**

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

- discuss connectives and well formed formulas
- evaluate normal forms
- illustrate theory of inference for statement calculus

#### UNIT-II

**Predicate calculus:** predicates, predicates formulas, quantifiers, free and bound variables, inference theory of predicate calculus.

Theory of recursion: Recursive functions, primitive recursive functions, partial recursive functions and Ackerman's functions.

#### **Learning Outcomes :**

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

- describe predicates and predicate formulas
- explain quantifiers
- describe recursive functions
- explain primitive and partial recursive functions

#### UNIT-III

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

**Relations and ordering**: partially ordered relations, partially ordered sets, representation and associated terminology.

#### Learning Outcomes :

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

• define different types of sets and operations on sets

#### Credits: 3

- explain representation of Venn diagrams
- describe Cartesian products of sets
- explain partial ordered relations and posets
- explain representation and associated terminology of relations

#### UNIT-IV

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

#### **Learning Outcomes :**

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

- define lattice using partially ordered set
- explain some properties of lattices
- describe algebraic system of lattices
- explain sub-lattices, direct product and homomorphism of lattices

#### UNIT-V

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

#### **Learning Outcomes :**

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

- define Boolean algebra and sub-algebra
- explain Boolean functions and free Boolean algebras
- explain representation and minimization of Boolean functions

#### **Course Outcomes:**

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

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

#### Text Books:

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

#### **Reference Books:**

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

### **SEMESTER – VI**

#### **MATH3051: Discrete Mathematics Lab**

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

Credits: 1

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

#### **Course Outcomes:**

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

- evaluate normal forms and illustrate theory of inference for statement calc
- describe Cartesian products of sets
- explain partial ordered relations and posets
- explain sub-lattices, direct product and homomorphism of lattices
- explain representation and minimization of Boolean functions

### **SEMESTER –III**

#### **MATH2121:** Linear Programming

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

#### Credits: 3

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

#### **Course Objectives:**

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

#### Unit-I

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

Learning Outcomes: The student will be able to:

- Formulate linear programming model for a business problem
- Explain graphical approach to solve linear programming problem
- Evaluate problems on convex sets
- Explain about hyperplanes

#### Unit-II

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

Learning Outcomes: The student will be able to:

- Explain simplex method to solve linear programming problem
- Evaluate optimality and unboundedness in a linear programming problem
- Evaluate problems using simplex algroithm

#### Unit-III

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

Learning Outcomes: The student will be able to:

- Solve problems on two phase method
- Explain problems on Big-M method
- Compare two phase method and Big-M method

#### Unit-IV

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

interpretation of the dual

Learning Outcomes: The student will be able to:

- Explain duality and formulation of the dual problem
- Differentiate primal- dual problems
- Explain economic interpretation of the dual problem over primal problem

#### Unit-V

Sensitivity analysis.

Learning Outcomes: The student will be able to:

- Study the uncertainty in the output of a mathematical model which can be divided and allocated to different sources of uncertainty in its inputs
- Provide examples using sensitivity analysis
- Apply sensitivity analysis on various problems

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

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

#### **Recommended Books**

- 1. "Operations Research" by S.D. Sharma published by Kedarnath and Ramnath Co.
- 2. "Linear Programming and Network Flows" by Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali published by John Wiley and Sons, India, 2004, 2<sup>nd</sup> edition.
- 3. "Introduction to Operations Research" by Frederick S. Hiller and Gerald J. Lieberman published by TataMcGraw Hill, Singapore, 2004, 8<sup>th</sup> edition.
- 4. "Operations Research: An Introduction" byHamdy A. Taha published byPrentice-HallIndia, 2006, 8th edition.

### **SEMESTER –III**

### MATH2131: Transportation and Game Theory

#### Credits: 3

#### No. of hrs/week: 3 Course Objectives:

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

methods

#### Unit- I

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

### Unit- II

Non- Degeneracy and Degeneracy in transportation Problems

#### Unit-III

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

#### Unit-IV

Game theory-1: formulation of two person zero sum games, solving two person zero sum games, games with mixed strategies, Dominance principle, Graphical solution procedure

#### Unit -V

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

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

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

#### **Books Recommended:**

- 1. "Linear Programming and Network Flows" by Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali published by John Wiley and Sons, India, 2004, 2<sup>nd</sup> edition.
- 2. "Introduction to Operations Research" by Frederick S. Hiller and Gerald J. Lieberman published by Tata McGraw Hill, Singapore, 2009, 9<sup>th</sup> edition.
- 3. "Operations Research: An Introduction" byHamdy A. Taha published byPrentice-HallIndia, 2006, 8th edition.

### **SEMESTER –III**

#### MATH2141: Linear Programming Lab

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

Credits: 1

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

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

- Formulate Linear Programming Model
- Evaluate Linear programming problems using graphical approach
- Understand convex sets with examples
- Evaluate LP problems using simplex method
- Solve LP problems using two phase method and Big- M method

### **SEMESTER –III**

#### MATH2151: Transportation and Game Theory Lab

No. of hrs/week: 2

Credits: 1

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

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

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

### **SEMESTER –IV**

#### **MATH2161:** Complex Analysis

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

#### Credits: 3

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

Course Objectives: To introduce

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

#### UNIT-I

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

Learning Outcomes: The student will be able to:

- Define limits and continuity
- Explain properties of complex numbers
- Evaluate problems using Cauchy Riemann equations
- Explain differentiation formulas and conditions for differentiability

#### UNIT-II

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

Learning Outcomes: The student will be able to:

- Define analytical function with examples
- Evaluate analytical functions for exponential, logarithmic, and trigonometric
- Explain derivatives of functions

#### UNIT-III

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

Learning Outcomes: The student will be able to:

- Explain definite integrals of functions
- Describe contours, contour integrals and its properties
- Evaluate problems on upper bounds for moduli of contour integrals

#### **UNIT-IV**

Cauchy-Goursat theorem, Cauchy integral formula.Liouville's theorem and the fundamental theorem of algebra.Convergence of sequences and series, Taylor series and its examples. **Learning Outcomes:** The student will be able to:

- Explain Cauchy Goursat theorem and its applications
- Explain Cauchy integral formula with applications
- Evaluate problems on convergence of sequences and series
- Explain Taylor's series with examples

#### **UNIT-V**

Laurent series and its examples, absolute and uniform convergence of power series. **Learning Outcomes:** The student will be able to:

- Evaluate problems on Laurent series
- Explain absolute convergence of power series
- Explain uniform convergence of power series

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

- discuss the basic properties of complex numbers
- determine Cauchy-Riemann equations
- evaluate problems on Analytical functions
- discuss Contours and their properties
- demonstrate the expansion of the function using taylor's series

#### **Books Recommended**

- 1. "Complex Analysis for Mathematics and Engineering" by John H. Mathews and Russell W. Howell published by Jones and Bartlett publishers, 5<sup>th</sup> edition.
- 2. "Complex Variables and Applications" by James Ward Brown and Ruel Vance Churchill published by Mc Graw-Hill Higher Education, 8<sup>th</sup> edition.
- "Complex Analysis" by Joseph Bak and Donald J. Newman published by Springer-Verlag New York, Inc., New York, 1997,2<sup>nd</sup> edition.

### **SEMESTER –IV**

#### **MATH2171:** Functional Analysis

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

#### Credits: 3

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

#### **Course Objectives:**

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

#### UNIT-I

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

#### **Learning Outcomes:**

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

- explain the concept of a general topological space
- classify the standard examples.
- explain the properties of topological spaces

#### UNIT-II

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

#### **Learning Outcomes:**

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

- explain the concept of compactness in topological spaces
- differentiate the basic properties of compact topological spaces
- explain the continuous functions they carry one these spaces

#### UNIT-III

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

#### Learning Outcomes:

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

- explain the concepts of Banach space and classify the standard examples.
- use properly the specific techniques for bounded operators over Banach Spaces.
- explain the fundamental results in the theory with accuracy and proper formalism

### UNIT-IV

Hilbert spaces: The definition and some simple properties, orthogonal complements, orthonormal sets, the conjugate space H<sup>\*</sup>, the adjoint of an operator, self adjoint operators. **Learning Outcomes:** 

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

- differentiate between the Banach and Hilbert Spaces
- explain the concepts of Hilbert space and classify the standard examples.
- explain operators over Hilbert Space.
- explain the fundamental results in the theory with accuracy and proper formalism

#### UNIT-V

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

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

- explain the importance of normal operators in defining a spectral resolution
- explain spectral theorem
- recognize the importance of finite dimension of Hilbert space in discussing spectral theory

#### **Course Outcomes**

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

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

#### **Text Book**:

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

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

### **SEMESTER –IV**

#### MATH2181: Number Theory

Credits: 3

#### Course Objectives : • To define division algorithm

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

#### Unit -I

No. of hrs/week: 3

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

#### Unit-II

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

#### Unit-III

Binary and decimal representation of integers, linearcongruences, complete set of residues.

#### Unit-IV

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

#### Unit-V

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

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

- Define division algorithm
- Demonstrate the fundamental theorem of arithmetic
- Explain prime number theorem
- Explain complete set of residues
- Evaluate problems using Möbius inversion formula

#### **Books Recommended:**

- 1. David M. Burton, *Elementary Number Theory* 6th Ed., Tata McGraw-Hill Edition, \Indian reprint, 2007.
- 2. Richard E. Klima, Neil Sigmon, Ernest Stitzinger, *Applications of Abstract Algebra with Maple*, CRC Press, Boca Raton, 2000.
- 3. Neville Robinns, *Beginning Number Theory*, 2nd Ed., Narosa Publishing House Pvt. Limited, Delhi, 2007.

### **SEMESTER –IV**

#### MATH2191: Graph Theory

#### No. of hrs/week: 3 Preamble :

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

#### **Course Objectives:**

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

#### UNIT-I

**GRAPHS AND DIGRAPHS :** Introduction, Graph Isomorphism, Subgraphs, Degrees, Indegrees, and Outdegrees, Adjacency Matrices and Incidence Matrices, Degree Vectors of Simple Graphs

#### **Learning Outcomes**

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

- define graph, subgraph, degree of a vertex
- explain directed graphs, indegree of a vertex and outdegree of a vertex
- explain adjacency matrices

#### **UNIT-II**

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

#### **Learning Outcomes**

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

- understand paths, circuits and cycles
- explain connected graphs
- explain trees and spanning trees

#### UNIT-III

EULERIAN AND HAMILTONIAN GRAPHS: Eulerian Graphs and

Digraphs, Hamiltonian Graphs and Digraphs, Tournaments

#### **Learning Outcomes**

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

- define Eulerian graphs
- explain Hamiltonian graphs
- explain tournaments

#### UNIT-IV

**OPTIMIZATION INVOLVING TREES:** Minimum Weight Spanning Trees ,Maximum Weight Branchings, Minimum Weight Arborescences , Matroids and the Greedy Algorithm

#### Credits: 3

### **Learning Outcomes**

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

- explain about minimum weight spanning trees
- explain maximum weight brachings
- explain Greedy algorithm

#### UNIT-V

SHORTEST PATH PROBLEMS: Two Shortest Path Algorithms ,The Steiner Network Problem , Facility Location Problems

#### Learning Outcomes

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

- explain shortest path algorithms
- evaluate problems on shortest path
- explain the Steiner Network Problem
- explain Facility Location Problems

#### **Course Outcomes**

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

- define graph, subgraph, degree of a vertex
- explain trees and spanning trees
- explain Hamiltonian graphs
- explain about minimum weight spanning trees
- explain the Steiner Network Problem

#### **Text Books:**

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

#### **Reference Books:**

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

### SEMESTER – V

#### MATH3121: Classical Mechanics

#### No. of hrs/week: 3 Preamble :

#### Credits: 3

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

#### **Course Objectives:**

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

#### UNIT-I

**Introductory Concepts of Newtonian Mechanics:** Mechanics of particle-law of conservation of Linear Momentum, Angular Momentum and conservation of Energy. Mechanics of System of Particles-Conservation of linear and Angular Momentum and conservation of energy.

#### Learning Outcomes:

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

- explain conservation of linear momentum
- explain concept of conservation of energy
- use mechanics of system of particles
- use conservation of linear and angular momentum and conservation of energy

#### UNIT-II

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

#### Learning Outcomes:

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

- explain types of constraints of generalized coordinates
- use D Alemberts principle and Lagranges equation
- explain difference between Lagrangian mechanics over Newtonian approach

#### UNIT-III

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

#### Learning Outcomes:

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

- use generalized momentum and cyclic coordinates
- explain conservation of angular momentum and Jacobi integral

• demonstrate principle of least action

#### UNIT-IV

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

#### Learning Outcomes:

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

- explain Legendre transformations
- evaluate problems using Lagrange's brackets
- explain application of Harmonic Oscillator

#### UNIT-V

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

#### Learning Outcomes:

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

- explain principle of relativity
- use postulates of special theory of relativity
- differentiate Lorentz transformations and inverse transformations

#### **Course Outcomes:**

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

- explain conservation of linear momentum
- explain concept of conservation of energy
- use mechanics of system of particles
- explain difference between Lagrangian mechanics over Newtonian approach
- explain conservation of angular momentum and Jacobi integral

#### **Text Book**

Classical Mechanics by J.C.Upadhya, Himalaya Publishers

#### **Reference Books**

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

### **SEMESTER – V**

### MATH3131: Theory of Computation

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

#### Credits: 3

#### Preamble:

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

#### **Course Objectives:**

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

#### UNIT-I

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

#### **Learning Outcomes :**

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

- define deterministic and non-deterministic finite state machines
- explain the equivalences of DFA and NDFA
- differentiate Melay and Moore models
- explain minimization of finite automata

#### UNIT-II

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

#### **Learning Outcomes :**

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

- define phrase structure grammar and language
- explain languages and their relation
- understand the concept of recursive and recursively enumerable sets

#### UNIT-III

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

#### **Learning Outcomes :**

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

• explain regular expression and finite automata

- understand the concept of pumping lemma for regular sets
- explain application of pumping lemma
- explain properties of regular sets and regular grammars

#### UNIT-IV

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

#### **Learning Outcomes :**

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

- explain context-free languages
- understand the concept of derivation trees and ambiguity in context free grammars
- explain normal forms of context- free grammars

#### UNIT-V

**Turing Machines and Linear Bounded Automata**: Turing Machine model, Representation of Turing Machines, Language acceptability by Turing Machines, Design of Turing Machines, Universal Turing Machines and other modifications.

#### **Learning Outcomes :**

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

- define Turing machine model
- explain representation of Turing machines
- design a Turing machine

#### **Course Outcomes**

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

- define deterministic and non-deterministic finite state machines
- explain minimization of finite automata
- understand the concept of derivation trees and ambiguity in context free grammars
- explain representation of Turing machines
- design a Turing machine

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

### **SEMESTER – VI**

### MATH3141: Fluid Dynamics

#### No. of hrs/week: 3 Preamble :

Credits: 3

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

#### **Course Objectives:**

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

#### UNIT-I

General equations of motion – Equation of continuity, Equations of motion of an inviscid fluid, irrotational motion, Persistence of irrotational motion, Bernoulli's equation, motion of a fluid element, Kinetic energy, uniqueness theorem, Euler's momentum theorem. (Chapter 2 of the Ref.1.2.1 to 2.6)

#### Learning Outcomes

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

- establish equation of continuity
- understand the concept of Bernoulli's equation
- explain the concept of kinetic energy and uniqueness theorem

#### UNIT-II

Two dimensional motion introduction, Basic singularities source, sink, doublet, Ranking technique of constructing stream lines method of images circle theorem, Blasius theorem lift force. (Chapter 3 of the Ref.1 3.1 to 3.5 and 3.7.4, 3.75)

#### Learning Outcomes

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

- explain two dimensional motion
- evaluate problems on ranking technique of construction stream lines
- explain Blasius theorem lift force

#### UNIT-III

Dynamics of real fluids- introduction, Navier stokes equations of motion- vorticity and circulation in a Viscous fluid, Exact solutions of N.S. equations. Unsteady of flows. (Chapter 5 of the Ref.1.5.1 to 5.3 – excluding 5.3.4)

#### Learning Outcomes

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

- explain Navier stokes equations of motion
- understand the concept of vorticity and circulation in a viscous fluid
- explain unsteady of flows

### UNIT-IV

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

#### **Learning Outcomes**

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

- explain boundary layer theory
- understand derivation of two dimensional boundary layer equations
- explain integral equations of the boundary layer

#### UNIT-V

Analytical solutions of the boundary layer equation. Flow parallel to a semi-infinite flat plate. Flow near the stagnation points of a cylinder. (Chapter 6 of the Ref.1 - 6.1, 6.2 and 6.3.1 and 6.3.2)

#### **Learning Outcomes**

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

- explain analytical solutions of the boundary layer equation
- evaluate problems on flow parallel to a semi-infinite flat plate
- understand the concept of flow near the stagnation points of a cylinder

#### **Text Book**:

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

#### **Reference Books:**

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

### SEMESTER – VI

#### MATH3151: Transform Techniques and Tensor Analysis No. of hrs/week: 3 Credits: 3

### Preamble :

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

#### **Course Objectives:**

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

#### UNIT-I

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

#### Learning Outcomes:

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

- explain transformation of elementary functions and properties
- illustrate the concepts of transforms of derivatives and integrals
- develop application to differential equations

#### **UNIT-II**

**Integral equations**: Classification of integral equations, connection with differential equations, integral equations of convolution type, method of successive approximations. **Learning Outcomes:** 

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

- classify integral equations
- describe the connection with differential equations
- explain method of successive approximations

#### **UNIT-III**

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

#### Learning Outcomes:

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

- explain Euler's equations and other forms
- explain calculus of variations

• evaluate functions involving higher order derivatives

#### UNIT-IV

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

#### **Learning Outcomes:**

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

- explain properties of Fourier sine and cosine transforms
- explain applications to boundary value problems

#### UNIT-V

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

#### **Learning Outcomes:**

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

- explain properties of covariant and contra variant vectors
- evaluate problems on second and higher order tensors
- define Christoffel symbols

#### **Course Outcomes:**

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

- explain transformation of elementary functions and properties
- illustrate the concepts of transforms of derivatives and integrals
- classify integral equations and describe the connection with differential equations
- explain calculus of variations
- explain properties of Fourier sine and cosine transforms

#### Text Books:

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

#### **Reference Books:**

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