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

Accredited by NAAC with A^+ Grade

CURRICULUM AND SYLLABUS

of

B.Sc. Environmental Science

(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 (PEOs)

- Exhibit their proficiency for solving contemporary environmental issues through measurement, modelling, monitoring and management.
- Engross in environmental science profession at local and global levels through ethical contribution in terms of professional and skilled practice of science and allied professions.
- Acclimatize to the dynamically changing world through sustained learning and professional development.
- Present skills of entrepreneurship and leadership through incorporating goals of the organization and through providing facilities for peer associates with defined objectives.
- Acquire communication skills and exhibit commitment towards teamwork which is necessary for functioning productively and professionally on multidisciplinary teams.

Programme Outcomes

- To gain understanding on relationships among natural and man-made systems.
- To integrate principles of biology, physical, chemical and social sciences and apply them to resource conservation.
- To understand ecological principles and management of resources, communities and ecosystems.
- To gain understanding in chemistry of environment and its application on natural processes that sustain life.
- To comprehend consequences of human actions atmospheric pollution and realize the importance of microorganisms in environment and pollution abatement.
- To cognize concepts of ecology, understand energy resources and need for their conservation, alternatives sources of energy.
- To develop core concepts and methods from earth sciences, waste management systems and their applications in solving environmental issues
- To appreciate the treatment process of drinking water and wastewater towards reducing their effects on natural environment. Apprehend the environmental toxicity studies.
- To develop standards and attitudes to understand complicated environmental, economic and social challenges and participating actively in resolving contemporary environmental issues and averting future issues using tools of remote sensing.
- To appreciate the management of solid waste and grasp the concepts of soil pollution. Empathise the effects of human activities on global warming.
- To understand and comprehend industrial safety and disaster management and nature of various environmental issues and search means and methods to address the same.
- To gain ability to design, execute a scientific project, write scientific reports, develop research and communication skills

Program Specific Outcomes (PSOs)

- Recognize, devise and resolve concerns related to environment towards providing competent solutions
- Evaluate and devise techniques and methods of varying intricacies in the emergent areas of pollution abatement.
- Provide a platform for involving in research with proficient and ethical responsibilities towards meeting societal needs.

CURRICULUM STRUCTURE OF B.Sc. ENVIRONMENTAL SCIENCE

(2021-22 ADMITTED BATCH)

University Core (UC)

Course code	Level	Course title	L	T	P	S	J	C
CSEN1001	1	IT Productivity Tools^	0	0	2	0	0	1*
LANG1001	1	Communication Skills in English - Beginners	0	0	4	0	0	2*
LANG1011	1	Communication Skills in English	0	0	4	0	0	2
LANG1021	1	Advanced Communication Skills in English	0	0	4	0	0	2
CLAD1001	1	Emotional Intelligence & Reasoning Skills (Softskills 1)	0	0	2	0	0	1
CLAD1011	1	Leadership Skills & Quantitative Aptitude (Softskills 2)	0	0	2	0	0	1
CLAD1021	1	Verbal Ability & Quantitative Ability (Softskills 3)	0	0	2	0	0	1
CLAD1031	1	Practicing Verbal Ability & Quantitative Aptitude (Softskills 4)	0	0	2	0	0	1
VEDC1001	1	Venture Development	0	0	0	2	0	2
DOSP10XX	1	Sports 1#	0	0	0	2	0	2*
DOSL10XX	1	Club Activity#	0	0	0	2	0	2*
POLS1001	1	Indian Constitution and History	2	0	0	0	0	2*
PHPY1001	1	Gandhi for the 21st Century	2	0	0	0	0	2*
DOSL10XX	1	Community Service#	0	0	0	0	2	2*
ENVS1001	1	Environmental Studies^	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	T	P	S	J	C
CLAD2001	2	Preparation for Campus Placement - 1 (Softskills 5A)	0	0	2	0	0	1
CLAD2011	2	Preparation For Higher Education (GRE/ GMAT) - 1 (Softskills 5B)	0	0	2	0	0	1
CLAD2021	2	Preparation for CAT/ MAT - 1 (Softskills 5C)	0	0	2	0	0	1
CLAD2031	2	Preparation For Campus Placement - 2 (Softskills 6A)	0	0	2	0	0	1
CLAD2041	2	Preparation For Higher Education (GRE/ GMAT) - 2 (Softskills 6B)	0	0	2	0	0	1
CLAD2051	2	Preparation for CAT/ MAT - 2 (Softskills 6C)	0	0	2	0	0	1

Sports courses

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

Club Activity courses

Course code	Level	Course title	L	T	P	S	J	C
DOSL1001	1	Club Activity (participant)	0	0	0	2	0	2
DOSL1011	1	Club Activity (Member of club)	0	0	0	2	0	2
DOSL1021	1	Club Activity (Leader of CLub)	0	0	0	2	0	2
DOSL1031	1	Club Activity (Competitor)	0	0	0	2	0	2

Community Service courses

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

Faculty Core (FC)

Course code	Level	Course title	L	T	P	S	J	C
CHEM1011	1	Chemistry - I	3	0	0	0	0	3
CHEM1031	1	Chemistry - II	3	0	0	0	0	3
CSCI1001	1	Basics of Information Technology	3	0	0	0	0	3
CHEM1021	1	Chemistry - I Lab	0	0	2	0	0	1
CHEM1051	1	Chemistry - III	3	0	0	0	0	3
PHYS1091	1	Biophysics	3	0	0	0	0	3
PHYS1101	1	Biophysics Lab	0	0	2	0	0	1
CHEM1041	1	Chemistry - II Lab	0	0	2	0	0	1

Programme Core/ Major Core (PC/MaC)

Course code	Level	Course title	L	T	P	S	J	C
ENVS1011	1	Understanding Environment & Ecology	3	0	0	0	0	3
ENVS1021	1	Understanding Environment & Ecology Lab	0	0	2	0	0	1
ENVS1031	1	Environmental Chemistry	3	0	0	0	0	3
ENVS1041	1	Environmental Chemistry Lab	0	0	2	0	0	1
ENVS2001	2	Air Pollution and Control	3	0	0	0	0	3
ENVS2021	2	Geological Sciences and its resources	3	0	0	0	0	3
ENVS2011	2	Air Pollution and Control Lab	0	0	2	0	0	1
ENVS2031	2	Geological Sciences and its resources Lab	0	0	2	0	0	1
ENVS2041	2	Environmental Microbiology	3	0	0	0	0	3
ENVS2051	2	Environmental Microbiology Lab	0	0	2	0	0	1
ENVS3001	3	Solid Waste Management and Soil Pollution	3	0	0	0	0	3
ENVS3021	3	Environmental Impact Assessment	3	0	0	0	0	3
ENVS3011	3	Solid Waste Management and Soil Pollution Lab	0	0	2	0	0	1
ENVS3031	3	Environmental Impact Assessment Lab	0	0	2	0	0	1
ENVS3041	3	Industrial Safety	3	0	0	0	0	3
ENVS3051	3	Industrial Safety Lab	0	0	2	0	0	1

Programme Elective (PE)*

Course code	Level	Course title	L	T	P	S	J	C
ENVS2061	2	Biodiversity Conservation	3	0	0	0	0	3
ENVS2071	2	Biodiversity Conservation Lab	0	0	2	0	0	1
ENVS2081	2	Environmental Problems Indian context	3	0	0	0	0	3
ENVS2091	2	Environmental Problems Indian context Lab	0	0	2	0	0	1
ENVS2101	2	Industrial Waste Management	3	0	0	0	0	3
ENVS2121	2	Environmental Toxicology	3	0	0	0	0	3
ENVS2111	2	Water and Wastewater Treatment	3	0	0	0	0	3
ENVS2131	2	Environmental Biotechnology	3	0	0	0	0	3
ENVS3061	3	Global warming and climate change	3	0	0	0	0	3
ENVS3071	3	Remote Sensing and GIS	3	0	0	0	0	3
ENVS3071	3	Green Technologies	3	0	0	0	0	3
ENVS3081	3	Environment and Sanitation	3	0	0	0	0	3
Note 1: *Students should acquire a minimum of 16 credits from the program elective courses*								
Note 2: *Theory and corresponding lab course are co-requisites (For example if a student opts to study ENVS2061 then he/she has to study ENVS2071 in the same semester)*								

Open Elective (OE)*

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

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

Stream	Major course	Minor course (Select one)
Life sciences	Environmental Science	Biochemistry
		Bioinformatics
		Microbiology
		Food Science & Technology
		Biotechnology

Minor Courses in Biochemistry*								
Course code	**Level**	**Course title**	**L**	**T**	**P**	**S**	**J**	**C**
BCBI1021	1	Protein Chemistry and Enzymology	3	0	0	0	0	3
BCBI1031	1	Protein Chemistry and Enzymology Lab	0	0	2	0	0	1
BCBI2001	2	Metabolism and Bioenergetics	3	0	0	0	0	3
BCBI2021	2	Biochemical Techniques	3	0	0	0	0	3
BCBI2041	2	Molecular Biology	3	0	0	0	0	3
BCBI2051	2	Molecular Biology Lab	0	0	2	0	0	1
BCBI3001	3	Genetic Engineering	3	0	0	0	0	3
BCBI3021	3	Clinical Biochemistry	3	0	0	0	0	3
BCBI3031	3	Clinical Biochemistry Lab	0	0	2	0	0	1
BCBI3041	3	Immunology	3	0	0	0	0	3

Minor Courses in Bioinformatics

Course code	Level	Course title	L	T	P	S	J	C
BCBI1081	1	Computational Biology	3	0	0	0	0	3
BCBI1091	1	Computational Biology Lab	0	0	2	0	0	1
CSCI1261	1	Basics of Python Programming	3	0	0	0	0	3
BCBI2241	2	Immunology and Immunoinformatics	3	0	0	0	0	3
CSCI2341	2	Fundamentals of Database Management System	3	0	0	0	0	3
BCBI2251	2	Genomics and Proteomics	3	0	0	0	0	3
BCBI2261	2	Genomics and Proteomics Lab	0	0	2	0	0	1
BCBI3151	3	Molecular Modeling and Structural Bioinformatics	3	0	0	0	0	3
BCBI3161	3	Molecular Modeling and Structural Bioinformatics Lab	0	0	2	0	0	1
BCBI3171	3	Drug Designing	3	0	0	0	0	3

Minor Courses in Microbiology

Course code	Level	Course title	L	T	P	S	J	C
MFST1051	1	Introductory Microbiology	3	0	0	0	0	3
MFST1061	1	Introductory Microbiology Practical	0	0	2	0	0	1

MFST1071	2	Microbial Genetics	3	0	0	0	0	3
MFST2061	2	Cell and Molecular Biology	3	0	0	0	0	3
MFST2071	2	Microbial Physiology and Biochemistry	3	0	0	0	0	3
MFST2081	2	Microbial Physiology and Biochemistry Practical	0	0	2	0	0	1
MFST3061	2	Immunology	3	0	0	0	0	3
MFST3071	3	Industrial Microbiology	3	0	0	0	0	3
MFST3091	3	Industrial Microbiology lab	0	0	2	0	0	1
MFST3101	3	Medical Microbiology	3	0	0	0	0	3
* Eligibility: This minor course is offered to the students of B.Sc Biochemistry/Biotechnology/Food Science & Tech/Environmental Science/Chemistry								

Minor Courses in Food Science and Technology*

Course code	Level	Course title	L	T	P	S	J	C
MFST1001	1	Principles of Food Science	3	0	0	0	0	3
MFST1011	1	Principles of Food Science Practical	0	0	2	0	0	1
MFST1021	1	Fundamentals of Food Technology	3	0	0	0	0	3
MFST2001	2	Technology of Plantation Crops	3	0	0	0	0	3
MFST2011	2	Food Processing and Preservation Technology	3	0	0	0	0	3
MFST2031	2	Food Processing and Preservation Technology Practical	0	0	2	0	0	1
MFST2041	2	Food Microbiology	3	0	0	0	0	3
MFST3001	3	Technology of Animal Foods	3	0	0	0	0	3
MFST3021	3	Technology of Animal Foods Practical	3	0	0	0	0	3
MFST3011	3	Food Biochemistry	3	0	0	0	0	3
* Eligibility: This minor course is offered to the students of B.Sc Biochemistry/Microbiology/ Biotechnology/ Environmental Science/Chemistry								

Minor courses in Biotechnology

Course code	Level	Course title	L	T	P	S	J	C
BTSC1021	1	Cell Biology	3	0	0	0	0	3
BTSC1031	1	Cell Biology Lab	0	0	2	0	0	1
BTSC2011	2	Bioanalytical Techniques	3	0	0	0	0	3
BTSC2001	2	Enzymology & Metabolism	3	0	0	0	0	3
BTSC3011	3	General Immunology	3	0	0	0	0	3
BTSC2041	3	Molecular Biology & rDNA technology	3	0	0	0	0	3
BTSC2031	3	Molecular Biology & rDNA technology Lab	0	0	2	0	0	1
BTSC3001	3	Plant & Animal Biotechnology	3	0	0	0	0	3
BTSC3021	3	Plant & Animal Biotechnology Lab	0	0	2	0	0	1
BTSC3041	3	Industrial Biotechnology	3	0	0	0	0	3
* Eligibility: This minor course is offered to the students of B.Sc Biochemistry/ Microbiology/ Food Science & Tech/ Environmental Science/Chemistry.								

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	T	P	S	J	C
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. https://edu.google.com/

Course Outcomes

- Create / alter documents / Technical Paper / Project report with text, pictures, graphs of different styles.
- Create / modify power point presentations with text, multimedia and to add animation using / creating templates.
- Perform basic calculations / retrieve data / 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	T	P	S	J	C
0	0	4	0	0	2*

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

Course Objectives

- Train learners to listen actively, follow what is spoken in standard English, and answer questions to demonstrate their understanding of the main points of the speech, repeat part of what someone has said to confirm mutual understanding, though occasionally, there may be a need to ask for repetition or clarification. (Bloom's Taxonomy Level/s: 2 & 3)

- Equip learners with the skills to read and comprehend straightforward texts and simple argumentative writing to identify the topic, the desired/relevant information, the main points of the argument, and the major conclusion/s. (Bloom's Taxonomy Level/s: 2 & 4)

- Help learners apply their knowledge and language skills to make mini oral presentations, and produce short coherent written texts using appropriate cohesive devices, suitable vocabulary and grammatical structures. (Bloom's Taxonomy Level/s:3)

- Enable learners to communicate with reasonable accuracy in familiar contexts with adequate fluency and generally good control by equipping them with a repertoire of frequently used vocabulary, structures, and speech patterns. (Bloom's Taxonomy Level/s: 2 & 3)

List of Activities & Tasks for Assessment

1. Listening to others and getting to know their experiences, interests and opinions
2. Introducing oneself: Salutation, basic information, relating to the context
3. Starting a conversation: Salutation, expressing purpose, expressing gratitude
4. Sharing one's experiences, interests and opinions
5. Reading short newspaper articles for gist
6. Picking new words from an article and working on them to know the meaning and usage
7. Using the new (unknown) words in own sentences
8. Sharing news with others - initiate, sustain and conclude
9. Understanding the relevance of intonation to meaning from recorded conversations, and applying the learning in pair work (role play)
10. Writing a summary of a story/personal narrative after listening to it twice and making individual notes
11. Reading graphs, charts and maps for specific information, making note of the important information and talking briefly about it within a small peer group
12. Writing a paragraph about oneself: a brief profile including major successes, failures, and goals. Giving compliments/gratitude to others

13. Writing a paragraph (descriptive, complimentary) about others (Family, friends, role model, etc.)
14. Correcting each other's' drafts: errors in language - word choice, structure, and conventions/etiquette
15. Writing a short structured descriptive/narrative essay in 3 paragraphs, reading others' essays and sharing feedback

References

1. V. Sasikumar, P. Kiranmayi Dutt, Geetha Rajeevan. (2007). Listening and Speaking - Foundation Books 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	T	P	S	J	C
0	0	4	0	0	2

Communication Skills in English (Intermediate) is the second of the three-level graded courses for a developmental enhancement of communication skills in English. Based on the learning outcomes set in the beginner level syllabus, this course focuses on giving learners more exposure to the use of language for communicative purposes and equip them with next level skills (ref. Bloom's taxonomy) and practice in terms of complexity and cognitive engagement. This course also includes inferential level of comprehension (listening and reading) that involves analysis and application of the language skills and decision-making skills while speaking/writing with an awareness for social and personality-based variations in communication. This course emphasizes guided writing through adequate tasks with pre and post context building. The focus is on stimulation and application of critical thinking in addition to schematic thinking for communication in real-life situations.

Course Objectives

- Train learners to actively listen to short audio texts with familiar content; guided activity like question-making and responding to others' questions based on the audio text would help learners engage in transactional dialogue; extended activities like extrapolating/critiquing the responses would help learners enhance their schematic thinking. (Bloom's Taxonomy Level/s: 2 & 4)
- Equip learners with strategies to read actively and critically and understand the writers' viewpoints and attitude by providing reading comprehension tasks using authentic texts such as op-ed articles from newspapers, and reports on contemporary problems. (Bloom's Taxonomy Level/s: 4 & 5)
- Help learners understand various aspects and techniques of effective presentations (group/individual) through demonstration and modelling, and enabling them to develop their presentation skills by providing training in using the tips and strategies given. Learners would be encouraged to observe and express opinion on teacher-modelling. Reflection on issues like anxiety, stage-fear, confidence, and levels of familiarity with topic and audience would be addressed. Practice would be given on tone, pitch, clarity and other speech aspects. Detailed peer feedback and instructor's feedback would cover all the significant aspects. (Bloom's Taxonomy Level/s: 2 & 4)
- Enable learners to become aware of the structure and conventions of academic writing through reading, demonstration, scaffolding activities, and discussion. Corrective individual feedback would be given to the learners on their writing. (Bloom's Taxonomy Level/s: 2 & 3)

List of Tasks and Activities

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

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

Reference Books

1. P. Kiranmayi Dutt, Geetha Rajeevan. (2007). Basic Communication Skills. Foundation Books. CUP
2. Harmer, J. (1998). How to teach English. Longman
3. Sanjay Kumar & Pushp Lata. (2018). Communication Skills: A Workbook. OUP.
4. Cambridge IGCSE: English as a Second Language Teacher's Book Fourth Edition. By Peter Lucantoni. CUP (2014).
5. 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. 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

- 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

L	T	P	S	J	C
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 communication. This course provides opportunities with activity-based practice of advanced oral and written communicative skills besides building awareness on the finer nuances of language use for various purposes. This course emhasizes free writing through meaningfully engaging tasks with a pre and post context building. There is ample scope for application of critical thinking through simulated activities for effective communication in real life situations.

Course Objectives

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

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

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

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

List of Activities & Tasks for Assessment

S.No.	Tasks	Activities	CO
1	Evaluative and extrapolative reading of a long text/short texts on a current topic related to technology and society, identifying and questioning the author's intention, post-reading discussion in small groups, maintaining group dynamics, arriving at a consensus	Pre-reading group discussion, silent reading (Note-making), modelling (questioning), post-reading reflection and brief presentation of thoughts/ideas/opinions on the theme of the text	3
2	Debate in pairs based on listening to two recorded contemporary speeches by well-known leaders in different fields. Peer feedback and instructor feedback.	Pre-recorded audio/video for listening, student checklist for noticing key words/concepts, pre-task orientation (by teacher), pair work, feedback	1
3	Information transfer: Verbal to visual (unfamiliar context); demonstration by teacher, learners' task (guided with scaffolding), learners' task (free), presentation, question-answer(among students), modification and feedback before the final version is done	Pair work for discussion and feedback, presentations, question-answer	2
4	Information transfer: Visual to verbal (unfamiliar context); demonstration by teacher, learners' task (guided with scaffolding), learners' task (free), presentation, question-answer(among students), modification, editing, proofreading, and feedback before the final version is done	Pre-reading game/modelling, discussion in small groups, independent writing and feedback	4
5	Expressing opinion on a short argumentative text (e.g. a journal article or a newspaper editorial) and justifying one's opinion/stance; focus on the use of appropriate conventions of formal and polite speech, and managing bias	Listening to group discussions/debates, reading news-paper articles on the current issues and expressing opinions in favour or against the topic (in GDs, debates or writing argumentative essays).	3
6	Role-play (complex social and academic/professional situations): Focus on significant aspects of delivery including clarity, tone, and use of contextually appropriate vocabulary and conventions, observation, reflective discussion, and self-reflective writing	Reading newspaper/magazine articles/blog posts on current social issues, listening to talks/discussions/debates etc. and participating in role-plays using expressions appropriate to the context.	1
7	Collborative writing in groups of 3 -4 on topics that would require data collection and reading followed by recorded peer-reflection and peer-feedback, group presentation and feedback	Pre-task modelling (peer), general discussion on structure, group work (collaboration), presnetation, peer feedback, Open-class discussion	5
8	Formal Group Discussion on topics of current interest and relevance; focus on effective participation, reflection on control over argument/counter argument, and adherence to the conventions of formal GD	Noticing strategies from AV modelling, teacher scafolding though open-house discussion, Note-making (Group work), Group Discussion (free), post perfromance discussion, Feedback	2

9	Mind-mapping for advanced reading, making correlations across texts, extending author's point of view	Reading texts on abstract topics and comprehending the author's perspective by inferring the unknown words' meaning in the context and making notes using mind-map strategy and presenting it orally.	3
10	Handling question and answer sessions after presentations: justifying arguments, taking counter-arguments, agreeing and disgreeing with rationale	Listening to some lectures, talks, and presentations in the academic seminars and adapting some strategies to handle the Q&A sessions using polite and formal expressions to agree or disagree with the statements.	1
11	Modelling an interview: with a panel of four judges (peers)	Pre-task activity for orientation/strategies (controlled/guided), Model interview (AV support), Group work (role play), interview in pair (one-to-one), Interview in group (many -to-one), oral corrective feedback (peer/teacher)	2
12	Writing a short reflective report of an event - incident/meeting/celebration	Writing a report on meetings/celebrataions/events etc. by actively involving in such events and giving a short oral presentation on the same.	4
13	Speaking on abstract and complex topics beyond his/her own area of interest/field of study, using the language flexibly and effectively.	Reading texts on abstract topics and comprehending the author's perspectives. Similarly, listening to talks and discussions on an abstract topic of other discipline and making short oral presentation by sharing views and opinions.	3
14	Self-relfection on own speech in context(recorded): tone, pitch, relevance, content; extending the reflections/ideas to others	Listening to selected general discussions (audios and videos) and observing the language production. Recording own speech on some general topic and providing a critical review (self-reflection) on it by focusing on the tone, expressions and relevance of the content, etc.	1
15	Collaborative and individual task: planning, preparing (preparing an outline, structure, setting objectives and presenting the plan of action) and executing a mini-project, and submitting a brief report on the same peer and instructor feedback after the planning stage and on completion of the mini project	Pre-task modelling (peer/teacher), general discussion on structure, group work (collaboration), oral corrective, task distribution, presentation, feedback	5

Reference Books

1. Latham-Koenig, C. & Oxenden, C. (2014). American English File-5. Oxford: OUPRichards,
2. J.C. and Bohlke, D. (2012). Four Corners-4. Cambridge: CUP.
3. 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.

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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)

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

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

Course Description:

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

Course Objectives:

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

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

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

5. **Numerical Computation and Estimation - II:** Time and Work, Pipes and Cisterns, Time and Distance, Problems on Trains, Boats and Streams, Races and Games of Skill, Simple Interest & Compound Interest

6. **Geometry:** Lines and Angles, Triangles, Quadrilaterals & Polygons, and Circles

7. **Mensuration:** 2-Dimensional Mensuration (Triangles, Quadrilaterals and Circles), 3-Dimensional Mensuration (Cubes, Cuboids, Cylinder, Cone, Sphere)

Course Outcomes:

1. List and discuss word formation methods, selected high frequency words, their antonyms, synonyms, etc.
2. Analyze reading passages and quickly find out the correct responses to questions asked, including para jumbles, by using reading skills like skimming, scanning, reading between the lines, etc.
3. Solve different types of questions based on vocabulary, structure, grammar and verbal reasoning
4. Solve questions on numerical estimation, mensuration, data sufficiency based on quantitative aptitude

References:

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

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

L	T	P	S	J	C
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

L	T	P	S	J	C
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 expected to be prepared to discuss the readings/exercises assigned for each class. It's not optional! Students will be randomly asked to discuss and summarize the material. Your learning – and your success—in this course are 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.

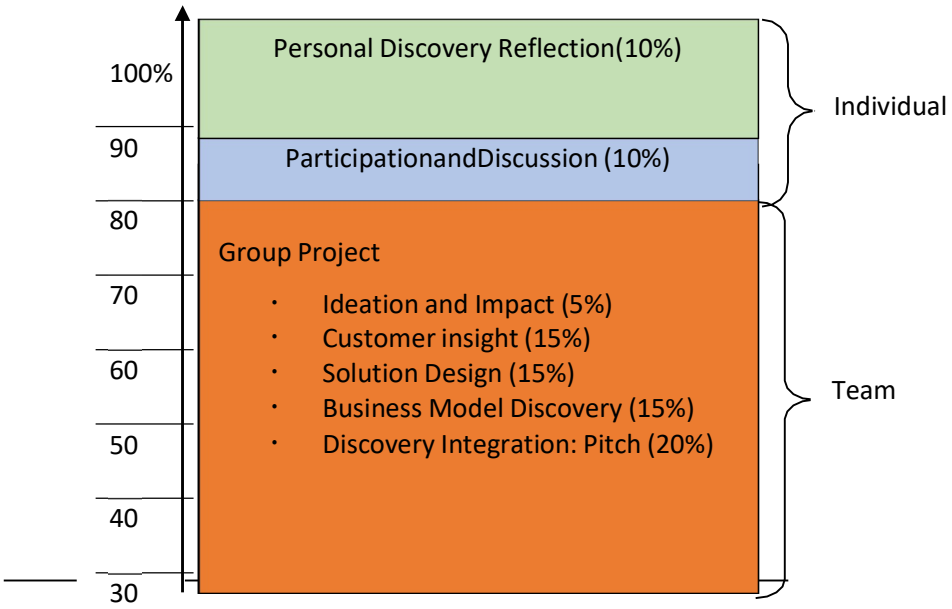
Talking to customers is one of the most important steps in investigating your business because your entrepreneurial vision must correspond to a true market opportunity. With your group, select 5-6 potential customers willing to be interviewed. They should represent a cross-section of our target market and should provide information that helps you refine your opportunity. This is not a simple survey: you are seeking in-depth understanding of the lifestyle and behaviors of your customer that can help you shape your opportunity. Please remember, you are not simply looking to confirm you have a great idea, but to shape your idea into a great opportunity. You will maximize your chances for success and your ability to execute your business cost-effectively by making early (rather than later) changes to your concept.
"Design" is fun, particularly when you merge customer insight with your own creativity. Enjoy! In this book, we provide structured methods to be an active listener and learner from customers as well as a product or service designer.

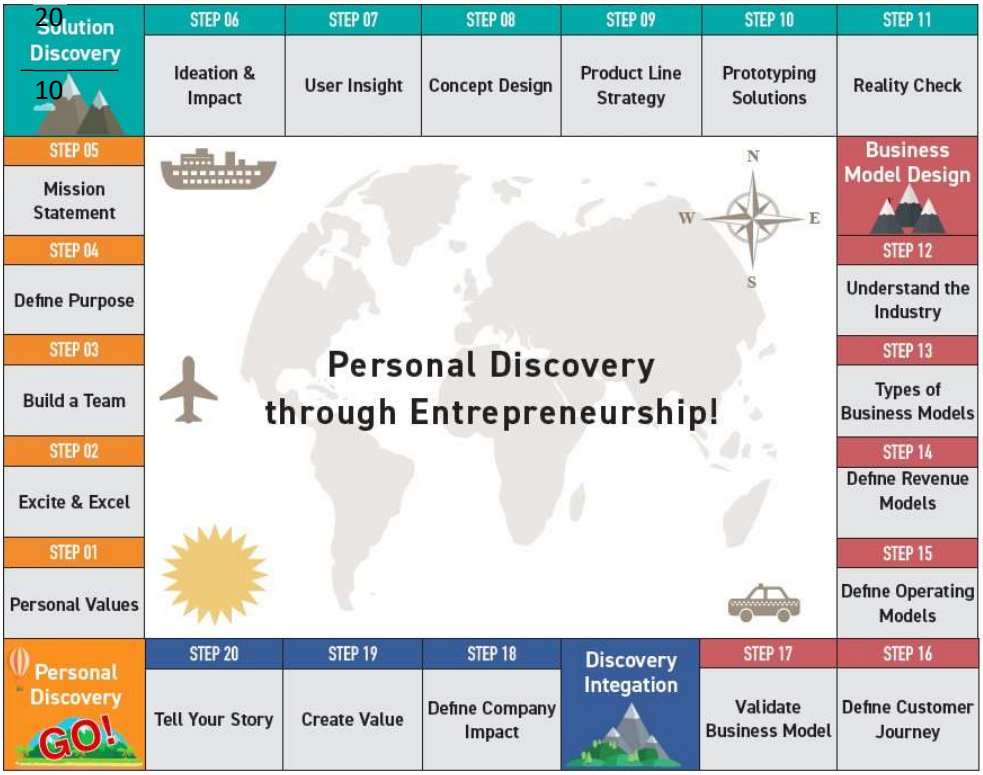
Business modeling is not as hard as it might sound. This is the design of your business – how it charges customers, what is spent producing and selling products or services, and the money that can be made for each unit sold. We keep it simple – so should you.

For the final outcome, you will be required to come up with Pitch that can 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]

Deliverables

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

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

Customer Interviews and Insight Hand-in Package: 15%
(1st 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 Integration Hand-in Package: 20%

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

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

Do not just regurgitate the templates in your pitch; rather, take the key points from them to create your own, unique presentation. The templates help you think – but most are toocomplex to present to outside people who have not taken the course. Therefore, design thispitch 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

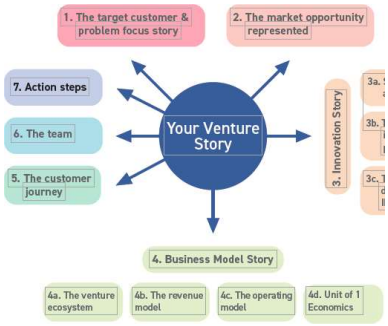
Week	Session	Topics and Steps	Key CONCEPTS Introduced in Class	Class Focus Activity
1	1	**Course Overview**	1. Why is entrepreneurship important? 2. What is Personal Discovery through Entrepreneurship? 3. Four Stages; Personal Discovery, Solution Discovery, Business Model Discovery, Discovery Integration 4. Preparation (finding interesting areas)	**Lecture and Discussion**
	2	**Personal Discovery** (Step 01, Step 02)	1. Personal Values 2. Strength and Weakness	Individual: · Work with the templates provided on pages: · Core values: 22, 23 · Skills: 27, 28, 29, 30, 31 · Societal Contribution: 33, 34
2	3	**Find Teammates** (Step 03)	1. Review Problem Area Template at the beginning of the book to find classmates who want to work on the same problem area. 2. Findteammates (1) Shared values (2) Levels of commitment (3) Skills and experiences (Same or Different?)	Problem template: Page 9 · 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. · Sit back and assess: Team templates on Pages 44, 45, and 46. · Prepare to present your team, the problem it is going to tackle, and its collective skills.
	4	**Define Purpose** (Step 04) **Create Mission** (Step 05)	1. Methods for defining and refining a venture's purpose 2. Defining a Venture's Purpose 3. Creating a Vision Statement	Team: · Purpose and Mission Templates: Pages 49 and 52 · Be prepare to present to the class. · Personal Discovery Reflection Journal Due

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

Week	Session	Topics and Steps	Key CONCEPTS Introduced in Class	Class Focus Activity
8	15	**Concept Design** (Step 08)	· Defining Customer Value · Understanding Customer Value Proposition	Team: · Customer Value Proposition · Template: Step 8, Page 107 · Draft the CVP
	16		· Presentation and review of CVPs	Team: · Complete CVP
9	17	**Competitive Analysis and Positioning** (Step 08)	· Understanding of Competitive Matrix · Competitive positioning: creating your separate space	Team: · Identify major competitors, and dimensions for analysis · Template: Step 8, Page 109
	18		· Presentations of Competitive Analyses and Positionings	Team: · Perform the competitive analysis and present results, including positioning
10	19	**Product Line Strategy** (Step 09)	· Product line framework: good, better, best on underlying platforms, plus application to Services.	Team: · Identify good, better, best variations based on the underlying concept. · Product line template: Page 115
	20	**Product Visioning Subsystem Design, and Prototype Sketch** (Step 10)	· The structured bubble chart, showing implementation options and the team's choices · Prototype sketching (The Bluereo Video is a good example of iterative prototyping driven by customer discovery.)	Team: · Prototype sketch, and for Web apps, a wireframe. For physical products, an initial bill of materials. · Underlying bubble chart showing your decision process. · Product Vision and Subsystem Design Templates: Step 10, Pages 121 and 126
Week	**Session**	**Topics and Steps**	**· Key CONCEPTS Introduced in Class**	**Team or Individual Activity**
11	21	**Reality Check** (Step 11)	· The purpose of the Reality Check, testing the product concept, channel preferences, and much other.	Team: · Reality Check Survey Template and Results: Step 11, Page 141, 143-144

	22		・ Guidance on the number or additional customers for the reality check survey ・ How to analyze and interpret the results	・ Customize the Reality Check template for your venture. ・ Do a quick round of customer surveying. Aim for 12 more interviews.
12	23	**Industry Analysis** (Step 12)	・ Team reports on Reality Check Results ・ Examine major components of an Industry Analysis ・ Review Templates	Team: ・ Prepare and present the results of your reality check, plus any pivots you wish to make. ・ **Concept Design (and Test) Hand-in Package** ・ Industry Analysis Templates: Step 12, Pages 153 and 154s
	24	**Business Model** (Step 13)	・ Defining the Business Model: ・ Lecture on basic structure and different types. ・ Illustrating it as the flow of product, money, and information.	Team: ・ Business Model Illustration Template, Step 13, Page 170

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

Week	Session	Topics and Steps	Key CONCEPTS Introduced in Class	Team or Individual Activity
15	29 30	**Tell Your Story**	· Presentation Format and Style · Format: (1) Title Slide with names and contact information (2) The Target Customer and the Problem to be Solved (3) The Market Opportunity (4) The Innovation Story (5) The Business Model Story (6) The Customer Journey (7) The Team (8) The Proposed Action Steps. (9) Appendices (if needed or desired) · If you have built a prototype during the class, please bring it and show it to us! (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.)	Team: · The PPT Presentation  · Practice, practice, practice! · Not too many words on one slide · Use pictures · Use template to develop your thinking, but try to create slides that are not just the templates.
Final Course Deliverables			Due on the Monday after the weekend of the final class meeting.	**Team: Your Venture PPTs** **Individual: Insight 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

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 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

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

This course encourages and acknowledges student members' work in organizing events and activities organized by various student organizations that pursue specific co-curricular and extra-curricular interests. These activities allow students to actively learn from the process of conceptualizing and organizing such activities as part of a team.

Course Objectives

- Create opportunities for students to learn from organizing club activities
- Learn teamwork, leadership, planning and management of events and activities
- Learn to appreciate multiple perspectives, cultures, and individual capabilities
- Learn to manage time effectively

List of Student Club Activities

1. Music (vocals, instruments, technical, recording, mixing, production, management)
2. Dance (Indian classical, western, jazz, latin, contemporary, folk, production, event management)
3. Theatre (classical, experimental, one-act, street, production, direction, casting, etc.)
4. Arts (fine arts, painting, calligraphy, sketching, caricaturing, etc)
5. Craft (origami, model making, sculpture, pottery, etc)
6. Cooking (home-style, baking, confectionery, Indian, intercontinental, etc.)
7. Graffiti (street, mural, collage, multi media, etc)
8. Workshops, quizzes, debates, elocution, etc
9. Filmmaking (adventure, drama, film appreciation, documentary, etc)
10. Photography (conventional, immersive (360), landscape, portrait, technical, editing, etc.)
11. College Fests
12. Designing (graphic design, landscape, interior, etc)
13. Competitive coding
14. Recreational sports activities
15. Other club activities organized by student clubs

List of Activities

1. Be a member of a club and organize activities in that particular interest area
2. Learn from diverse perspectives and experiences
3. Learn to design and execute extra-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	T	P	S	J	C
0	0	0	2	0	2*

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

Course Objectives

- Create opportunities for students to learn from organizing club activities
- Learn teamwork, leadership, planning and management of events and activities
- Learn to appreciate multiple perspectives, cultures, and individual capabilities
- Learn to manage time effectively

List of Student Club Activities

1. Music (vocals, instruments, technical, recording, mixing, production, management)
2. Dance (Indian classical, western, jazz, latin, contemporary, folk, production, event management)
3. Theatre (classical, experimental, one-act, street, production, direction, casting, etc.)
4. Arts (fine arts, painting, calligraphy, sketching, caricaturing, etc)
5. Craft (origami, model making, sculpture, pottery, etc)
6. Cooking (home-style, baking, confectionery, Indian, intercontinental, etc.)
7. Graffiti (street, mural, collage, multimedia, etc)
8. Workshops, quizzes, debates, elocution, etc
9. Filmmaking (adventure, drama, film appreciation, documentary, etc)
10. Photography (conventional, immersive (360), landscape, portrait, technical, editing, etc.)
11. College Fests
12. Designing (graphic design, landscape, interior, etc)
13. Competitive coding
14. Recreational sports activities
15. Other club activities organized by student clubs

List of Activities

1. Be the leader of the club and implement the charter, vision and mission of the club
2. Learn from diverse perspectives and experiences
3. Learn to lead the team, design and execute extra-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	T	P	S	J	C
0	0	0	2	0	2*

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

Course Objectives

- Create opportunities for students to learn from organizing club activities
- Learn teamwork, leadership, planning and management of events and activities
- Learn to appreciate multiple perspectives, cultures, and individual capabilities
- Learn to manage time effectively

List of Student Club Activities

1. Music (vocals, instruments, technical, recording, mixing, production, management)
2. Dance (Indian classical, western, jazz, latin, contemporary, folk, production, event management)
3. Theatre (classical, experimental, one-act, street, production, direction, casting, etc.)
4. Arts (fine arts, painting, calligraphy, sketching, caricaturing, etc)
5. Craft (origami, model making, sculpture, pottery, etc)
6. Cooking (home-style, baking, confectionery, Indian, intercontinental, etc.)
7. Graffiti (street, mural, collage, multimedia, etc)
8. Workshops, quizzes, debates, elocution, etc
9. Filmmaking (adventure, drama, film appreciation, documentary, etc)
10. Photography (conventional, immersive (360), landscape, portrait, technical, editing, etc.)
11. College Fests
12. Designing (graphic design, landscape, interior, etc)
13. Competitive coding
14. Recreational sports activities
15. Other club activities organized by student clubs

List of Activities

1. Be the leader of the club and implement the charter, vision and mission of the club
2. Learn from diverse perspectives and experiences
3. Learn to lead the team, design and execute extra-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

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

Course Description:
This course analyzes the basic structure and operative dimensions of the Indian Constitution. It explores various aspects of the Indian political and legal system from a historical perspective highlighting the various events that led to the making of the Indian Constitution. The course also deals with various challenges faced by the constitution and its coping mechanisms. Broadly, the students would understand and explain the working of different institutions and political debates ensuing from the operation of the Indian constitution in action.

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

Course Outcomes:

On the successful completion of the course students would be able to:

1. Demonstrate an understanding of the Constitution of India and how constitutional governance is carried out in India
2. Interpret knowledge of the Fundamental Rights and Duties of the Citizens as well as the Obligation of the state towards its citizens
3. Correlate familiarity with key political developments that have shaped the Constitution and amended it from time to time.
4. Equip themselves to take up other courses in law after having done a foundation course on Indian Constitution

Unit I: India as a Nation **6 hrs**

Khilani, S. (2004). *Introduction, The Idea of India*, Chapter 1. New Delhi: Penguin Books, pp. 1-15.
Rowat, D. (1950). 'India: The Making of a Nation', *International Journal, 5*(2), 95-108. doi:10.2307/40194264
Brass, P. (2018). 'Continuities and Discontinuities between pre- and post-Independence India', Chapter 1. *The Politics of Idea since independence*, New Delhi: Cambridge University Press. pp. 1-30.

Module Learning Outcomes

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

Unit 2: Understanding the Constitution **6 hrs**

Mehta, U.S. (2011). 'Constitutionalism' in *The Oxford Companion to Politics in India*, (ed) by Nirja Gopal Jayal, and Pratap Bhanu Mehta, New Delhi: Oxford University Press. pp. 15-27.
Austin, G. (2016), 'The Constituent Assembly: Microcosm in Action' in *The Indian Constitution: Cornerstone of a Nation*, New Delhi: Oxford University Press, pp. 1-25.
Beteille, Andre (2008): "Constitutional Morality," *Economic and Political Weekly,* Vol 43, Issue No 40
Prahladan, Vivek (2012): "Emergence of the Indian Constitution," *Economic and Political Weekly*, Vol 47, Issue No 07.

Module Learning Outcomes
Understand the concept of constitutionalism. Demonstrate strength or weakness of constitutional morality in India
Evaluate constituent assembly debates in framing Indian Constitution.

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

Bhakshi, P.M. (2011). 'Preamble' in *The Constitution of India*, New Delhi: Universal Law. Pp. 1-5.
Laxmikanth, M. (2017). 'Chapter IV: Preamble of the Constitution' in *Indian Polity*, Chennai: McGraw Hills.
Kumar, Virendra (2007): "Basic Structure of The Indian Constitution: Doctrine of Constitutionally Controlled Governance [From Kesavananda Bharati to I.R. Coelho]" *Journal of the Indian Law Institute*, Vol 49, No 3, pp 365-398.
Austin, G (2016), ' ' in *The Indian Constitution: Cornerstone of a Nation*, New Delhi: Oxford University Press, pp.63-105.
Reddy, S (1980). Fundamental Ness of Fundamental Rights and Directive Principles in the Indian Constitution. *Journal of the Indian Law Institute*, 22(3), pp. 399-407.
Bhatia, Gautam (2017): "The Supreme Court's Right to Privacy Judgement," *Economic and Political Weekly*, Vol 52, Issue No 44

Module Learning Outcomes

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

Unit 4: Citizenship **6 hrs**

Jayal, N.G. (2019). 'Reconfiguring citizenship in contemporary India' in *South Asia Journal of South Asian Studies*, pp.33-58.
Roy, Anupama. (2010). 'Chapter I: Enframing the citizen in contemporary times' in *Mapping Citizenship in India*, New Delhi: Oxford University Press.
Das, Veena (2010): "State, Citizenship and the Urban Poor," *Citizenship Studies,* Vol 15, pp 319-333.
Valerian Rodrigues

Module Learning Outcomes

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

Unit 5: Separation and Distribution of Powers 6 hrs

Pal, Ruma. (2016). 'Separation of Powers' in *The Oxford Handbook of the Indian Constitution*, (ed) by Sujit Choudhry, Madhav Khosla, and Pratap Bhanu Mehta, Delhi: Oxford University Press.
Bakshi, P. (1956). 'Comparative Law: Separation of Powers in India'. *American Bar Association Journal, 42*(6), 553-595.
Rao, P. (2005). 'Separation of Powers in a Democracy: The Indian Experience'. *Peace Research, 37*(1), 113-122.
Kumar, Ashwani (2019): "Constitutional Rights, Judicial Review and Parliamentary Democracy," *Economic and Political Weekly*, Vol 51, Issue 15
Tillin, Louise. (2015). 'Introduction' in *Indian Federalism*. New Delhi: Oxford University Press. pp. 1-30.
Chakrabarty, Bidyut and Rajendra Kumar Pandey. (2008). *Federalism' in Indian Government and Politics*, New Delhi: Sage Publications. pp. 35-53.
Arora, B. and Kailash, K. K. (2018). 'Beyond Quasi Federalism: Change and Continuity in Indian Federalism', in *Studies in Indian Politics*, pp. 1-7.
Agrawal, Pankhuri (2020): "COVID-19 and dwindling Indian Federalism," *Economic and Political Weekly,* Vol 55, Issue No 26

Module Learning Outcomes

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

Recommended Readings:

De, Rohit. (2018). *A People's Constitution – The Everyday Life of Law in the Indian Republic*, USA: Princeton University Press.
Granville Austin, *The Indian Constitution: Cornerstone of a Nation*, Oxford University Press, Oxford, 1966.
Lahoti, R.C. (2004). *Preamble: The Spirit and Backbone of the Constitution of India*. Delhi: Eastern Book Company.
Rajeev Bhargava (ed), *Ethics and Politics of the Indian Constitution*, Oxford University Press, New Delhi, 2008.
Subhash C. Kashyap, *Our Constitution*, National Book Trust, New Delhi, 2011.
Tillin, Louise. (2015). *Indian Federalism*. New Delhi: Oxford University Press.
Zoya Hassan, E. Sridharan and R. Sudarshan (eds), *India's Living Constitution: Ideas, Practices, Controversies*, Permanent Black, New Delhi, 2002.

PHPY1001: Gandhi for the 21st Century

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

Course Description
This course provides the students with basic knowledge on Gandhi's early life, transformations in South Africa and his entry into India's national movement. While going through the social-political, economic and educational philosophies of Gandhi, the course analyses how his ideologies are relevant even in the 21st century.

Course Objectives

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

Module I : MK Gandhi: Childhood and Education
M K Gandhi, Formative Years (1869-1893): Early childhood - study in England - Indian influences, early Western influences.

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

Module III: Gandhi and Indian National Movement
Gandhi and Indian National Movement (1915-1947): Introduction of Satyagraha in Indian soil -non-cooperation movement - call for women's participation - social boycott - Quit-India movement - fighting against un-touchability - Partition of India- independence.

Module IV: Gandhi and Sustainable Development
Gandhian Constructive Programs-Eleven Vows-Sarvodaya-Seven Social Sins-Gandhian Economics and Sustainable Development

Module V: Gandhi and Contemporary Issues
Conflict Resolution Techniques of Gandhi-Ecological Challenges and Gandhian solutions-Gandhian Ethics-An Analysis

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

5. To examine the significance of constructive programs today

Course Outcomes

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

References

1. Gandhi, M K. (1941). *Constructive Programme*. Ahmadabad: Navjivan Publishing House
2. Gandhi, M. K. (1948). *The Story of My Experiments with Truth*. Ahmadabad: Navjivan Publishing House
3. Gandhi, M K. (1968). *Satyagraha in South Africa*. Ahmadabad: Navjivan Publishing House.
4. Khoshoo, T N (1995). *Mahatma Gandhi: An Apostle of Applied Human Ecology*. New Delhi:TERI
5. Kripalani, J.B. (1970). *Gandhi: His Life and Thought*. New Delhi: Publications Division.
6. Narayan, Rajdeva (2011). *Ecological Perceptions in Gandhism and Marxism*. Muzaffarpur: NISLS
7. Pandey, J. (1998). *Gandhi and 21st Century*. New Delhi: Concept.
8. Weber, Thomas (2007).Gandhi as Disciple and Mentor. New Delhi: CUP

DOSL1041: Community Services - Volunteer

L	T	P	S	J	C
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	T	P	S	J	C
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 non-government 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:** No of Hours: 10

Multidisciplinary nature of environmental studies Definition, scope and importance. Need for public awareness. Natural resources and associated problems. Uses and over exploitation of Forest resources, Water resources, Mineral resources, Food resources, Energy resources. Role of an individual in conservation of natural resources.

Activity:

1. Planting tree saplings
2. Identification of water leakage in house and institute-Rectify or report
3. Observing any one day of a week as Car/bike/vehicle free day.

UNIT – II **Ecosystem and biodiversity** No of Hours: 10

Ecosystem: Structure components of ecosystem: Biotic and Abiotic components. Functional components of an ecosystem: Food chains, Food webs, Ecological pyramids, Energy flow in the ecosystem (10% law), Ecological succession.

Biodiversity: Definition, Biogeographical classification of India, Values of biodiversity: consumptive use, productive use, social, ethical, aesthetic. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching, man wildlife conflicts. Conservation of biodiversity: In – situ and Ex-situ

Activity"

1. Visit to Zoological Park-Noting different ecosystem
2. Biodiversity register- Flora and fauna in the campus

UNIT – III **Environmental Pollution** No of Hours: 10

Definition Causes, effects, and control measures of: -Air pollution. Water pollution. Soil pollution. Marine pollution. Noise pollution. Nuclear hazards. Solid waste Management: Causes, effects, and control measures. Role of an individual in prevention of pollution. Pollution case studies.

Activity

1. Visit to treatment plant and documentation.
2. Documentation of segregation of solid waste-Dry and Wet

Learning Outcomes:

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

UNIT – IV **Social Issues and the Environment** No of Hours: 10

From Unsustainable to Sustainable development Urban problems related to energy. Water conservation, rainwater harvesting, watershed management. Environmental ethics: Issues and possible solutions. Green building concept.

Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies.

Activity:

1. Observing zero hour at individual level-documentation.
2. Eco friendly idols.
3. Rainwater harvesting-creating storage pits in nearby area.

UNIT – V **Human Population and the Environment and Environment Protection Act and Field work** No of Hours: 10

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

Activity:

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

Text Book(s)

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

Additional Reading

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

Reference Book(s):

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

Journal(s):

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

Website(s):

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

From Climate Science to Action | Coursera

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

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

MFST1001: Health & Wellbeing

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

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

Course Objectives

- To provide an understanding of the relationship between food and nutrition
- To emphasize the role of exercise, sports and physical fitness in obtaining a good health
- To explain about the mindfulness and emotional well being
- To teach the role of yoga and meditation in maintaining the body balance

UNIT-I

Understand the relationship between Food and Nutrition and how food composition affects nutritional characteristics. Knowledge about regulatory principles in determining diets and recommended daily allowances. Understand how to create personalised diet/nutrition plans.

UNIT-II

Understand how exercise, activity and sports helps in developing good health. Experiential exposure to the role of proper, specific nutritional interventions along with structured activities on developing proper physical health. Practical exercises and assignments in sports and exercise regimes.

UNIT-III

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

UNIT-IV

Introduction to Yoga theory and how Yoga helps in maintaining balance in the body. Practice of Yoga and meditation to improve overall emotional and physical balance. Practical yoga exercises and meditation techniques

Course outcomes:

By the end of the course, student will

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

CLAD2001: Preparation for Campus Placement-1

(Soft Skills 5A)

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

Course Description:

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

Course Objectives:

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

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

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

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

4. Reasoning: Logical and Verbal Reasoning

Course Outcomes:

1. Write a power resume and covering letter
2. Answer interview questions with confidence and poise
3. Exhibit appropriate social mannerisms in interviews
4. Solve placement test questions on verbal ability, quantitative aptitude and reasoning

References:

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

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

L	T	P	S	J	C
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	T	P	S	J	C
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:

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

1. Quantitative Ability: Arithmetic, Algebra, Geometry, Mensuration, Calculus, Trigonometry

2. Data Interpretation: Data Interpretation and Data Sufficiency

3. Logical Reasoning: Data Management, Deductions, Verbal Reasoning and Non-Verbal Reasoning
4. Verbal Ability: Critical Reasoning, Sentence Correction, Para Completion, Para Jumbles, Reading Comprehension

Course Outcomes:

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

References:

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

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

CLAD2031: Preparation for Campus Placement-2

(Soft Skills 6A)

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

Course Description:

This course builds on the previous course and focuses on all four major areas of campus placements, including career preparedness, mock interviews, verbal ability, quantitative aptitude and logical reasoning.

Course Objectives:

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

1. Career Preparedness II: Mock Interviews, Feedback and Placement Readiness

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

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

4. Reasoning II: Logical and Verbal Reasoning

Course Outcomes:

1. Demonstrate career preparedness and confidence in tackling campus interviews
2. Solve placement test questions of a higher difficulty level in verbal ability, quantitative aptitude and logical reasoning.
3. Practice test-taking skills by solving relevant questions accurately and within time.

References:

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

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

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

(Soft Skills 6B)

L	T	P	S	J	C
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 at a higher difficulty-level and includes fully solved mock tests as well.

Course Objectives:

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

1. Verbal Reasoning II: Reading Comprehension, Sentence Equivalence, Text Completion, Sentence Correction, Critical Reasoning

2. Quantitative Reasoning II: Arithmetic, Algebra, Geometry, Data Analysis

3. Analytical Writing Assessment II: Issue/ Argument

4. Integrated Reasoning II

Course Outcomes:

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

References:

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

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

L	T	P	S	J	C
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:

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

1. Quantitative Ability II: Arithmetic, Algebra, Geometry, Mensuration, Calculus, Trigonometry
2. Data Interpretation II: Data Interpretation and Data Sufficiency
3. Logical Reasoning II: Data Management, Deductions, Verbal Reasoning and Non-Verbal Reasoning
4. Verbal Ability II: Critical Reasoning, Sentence Correction, Para Completion, Para Jumbles, Reading Comprehension

Course Outcomes:

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

References:

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

FINA3001: Personal Financial Planning

L	T	P	S	J	C
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 non-medical problems. There are certain planned and unplanned events in our life. On the one hand, education of our children, their marriage, our retirement etc. are some of the planned events of our life, but at the same time, some medical urgency, accident or death of an earning member might be some unplanned events. Many of these events are beyond our control, but the availability of funds can be planned to avoid any financial distress. In other words, we cannot stop the rain but can plan for an umbrella.
This course looks at the many challenges an individual faces in a complex financial environment and the rising uncertainties of one's life. It focuses on achieving long-term financial comfort of individual and family through goal setting, developing financial and life strategies, acquiring personal financial planning knowledge and managing risk throughout one's life.

Course Objectives:

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

Course Outcome:

1. Describe the financial planning process and application of time value of money
2. Application of life and non-life insurance products in financial planning
3. Understand the investment avenues and analysis of investment returns
4. Understand the retirement planning and its application
5. Describe and analysis the Tax Planning

Unit 1: Basics of Financial Planning

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

Unit 2: Risk and Insurance Management

Need for insurance, Requirement of insurance interest, Role of insurance in personal finance, Steps in insurance planning, Life and Non-life insurance products, Life insurance needs analysis (NP)

Unit 3: Investment Products and Measuring Investment Returns

Investment Products: Small Saving Instruments, Fixed Income Instruments, Alternate

Investments, Direct Equity
Measuring Investment Returns: Understanding Return and its concept, Compounding concept, Real vs Nominal Rate of Return, Tax Adjusted Return, Risk-Adjusted Return (NP)

Unit 4: Retirement Planning
Introduction to the retirement planning process, estimating retirement corpus, Determining the retirement corpus, Retirement Products (NP)

Unit: 5 Tax Planning
Income Tax: Income tax principles: Heads of Incomes, Exemptions and Deductions, Types of Assesses, Rates of Taxation, Obligations for Filing and Reporting, Tax aspects of Investment Products, Wealth Tax

Text Books

1. National Institute of Securities Management (NISM) Module 1 & XA
2. Madhu Sinha, Financial Planning, 2 Edition, McGraw Hill India
3. Simplified Financial Management by Vinay Bhagwat, The Times Group

Reference Books

1. Personal Financial Planning (Wealth Management) by S Murali and K R Subbakrishna, Himalaya Publishing House.
2. Mishra K.C., Doss S, (2009). Basics of Personal Financial Planning 1e. National Insurance Academy, New Delhi: Cengage Learning.
3. Risk Analysis, Insurance and Retirement Planning by Indian Institute of Banking and Finance.

FINA3001: Personal Financial Planning

L	T	P	S	J	C
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 non-medical problems. There are certain planned and unplanned events in our life. On the one hand, education of our children, their marriage, our retirement etc. are some of the planned events of our life, but at the same time, some medical urgency, accident or death of an earning member might be some unplanned events. Many of these events are beyond our control, but the availability of funds can be planned to avoid any financial distress. In other words, we cannot stop the rain but can plan for an umbrella.
This course looks at the many challenges an individual faces in a complex financial environment and the rising uncertainties of one's life. It focuses on achieving long-term financial comfort of individual and family through goal setting, developing financial and life strategies, acquiring personal financial planning knowledge and managing risk throughout one's life.

Course Objectives:

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

Course Outcome:

1. Describe the financial planning process and application of time value of money
2. Application of life and non-life insurance products in financial planning
3. Understand the investment avenues and analysis of investment returns
4. Understand the retirement planning and its application
5. Describe and analysis the Tax Planning

Unit 1: Basics of Financial Planning

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

Unit 2: Risk and Insurance Management

Need for insurance, Requirement of insurance interest, Role of insurance in personal finance, Steps in insurance planning, Life and Non-life insurance products, Life insurance needs analysis (NP)

Unit 3: Investment Products and Measuring Investment Returns

Investment Products: Small Saving Instruments, Fixed Income Instruments, Alternate

Investments, Direct Equity

Measuring Investment Returns: Understanding Return and its concept, Compounding concept, Real vs Nominal Rate of Return, Tax Adjusted Return, Risk-Adjusted Return (NP)

Unit 4: Retirement Planning

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

Unit: 5 Tax Planning

Income Tax: Income tax principles: Heads of Incomes, Exemptions and Deductions, Types of Assesses, Rates of Taxation, Obligations for Filing and Reporting, Tax aspects of Investment Products, Wealth Tax

Text Books

1. National Institute of Securities Management (NISM) Module 1 & XA
2. Madhu Sinha, Financial Planning, 2 Edition, McGraw Hill India
3. Simplified Financial Management by Vinay Bhagwat, The Times Group

Reference Books

1. Personal Financial Planning (Wealth Management) by S Murali and K R Subbakrishna, Himalaya Publishing House.
2. Mishra K.C., Doss S, (2009). Basics of Personal Financial Planning 1e. National Insurance Academy, New Delhi: Cengage Learning.
3. Risk Analysis, Insurance and Retirement Planning by Indian Institute of Banking and Finance.

CHEM1011: Chemistry – I

L	T	P	S	J	C
3	0	0	0	0	3

The students of undergraduate program in science in Chemistry need to be conversant with the various fields off chemistry. Therefore, one module each on in general, physical and organic chemistry is introduced which helps the student familiarize with the concepts of chemistry essential for allied and interdisciplinary fields of science.

Course Objectives

1. Introduce students to Schrodinger wave equation, quantization of energy and electronic configuration of atoms and ions.
2. Explain three types of chemical bonding – Ionic, covalent, and metallic and understand energetics of bond formation.
3. Introduce properties of organic compounds with emphasis on inductive effect, hyper conjugation and resonance effects.
4. Understand electrophilicity and nucleophilicity and impact of functional groups on reactions
5. Understand stereochemistry of compounds
6. Explain important reactions and reaction mechanisms.

Course outcomes

UNIT - I	**Inorganic Chemistry-1**	No of Hours : 9L
Atomic Structure: Review of: Bohr's theory and its limitations, dual behaviour of matter and radiation, de Broglie's relation, Heisenberg Uncertainty principle. What is Quantum mechanics? Time independent Schrodinger equation and meaning of various terms in it. Significance of ψ and ψ2, Schrödinger equation for hydrogen atom. Graphical representation of 1s, 2s, 2p, 3s, 3p and 3d orbitals. Rules for filling electrons in various orbitals, Electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy.		
Learning Outcomes:		
After completion of this unit, the student will be able to		
•	learn about the fundamental assumptions of atomic theory	L3
•	Explain the composition of atoms including electronic configuration	L3
•	Learn quantization of energy and determine electronic configuration of atoms and ions	L2
•	Learn Schrodinger equation and its significances	L5
•	Represent different atomic orbitals	L1
Pedagogy tools: Blended learning, Case let, video lectures, self-reading		
UNIT - II	**Inorganic Chemistry-1**	No of Hours : 9L
Chemical Bonding and Molecular Structure Ionic Bonding: General characteristics of ionic bonding. Energy considerations in Ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Statement of Born-Landé equation for calculation of lattice energy. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character.		
Covalent bonding: VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements.		
Learning Outcomes:		
After completion of this unit, the student will be able to		
•	The students will learn about ionic, covalent bonding in molecules.	L3
•	Compare/contrast the properties of molecular and ionic compounds.	L3
•	Draw homonuclear & heteronuclear diatomic molecules	L2

•	Learn shapes of covalent on the basis of VSEPR and hybridization L5	
•	Calculate lattice energy using Born-Haber cycle Born-Landé equation L1	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading		
UNIT - III	**Organic Chemistry-1**	**No of Hours : 9L**
Fundamentals of Organic Chemistry Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis. Structure, shape and reactivity of organic molecules: Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals. Aromaticity: Benzenoids and Hückel's rule.		
Learning Outcomes:		
After completion of this unit, the student will be able to		
•	The students learn about the fundamental concepts of reaction mechanism. L3	
•	To learn reactive species in organic chemistry L3	
•	To learn concept of aromaticity L2	
•	To learn various organic intermediates L5	
•	Compare the Strength of organic acids and bases L1	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading		
UNIT - IV	**Organic Chemistry-1**	**No of Hours : 9L**
Stereochemistry Conformations with respect to ethane, butane and cyclohexane. Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations. Concept of chirality (upto two carbon atoms). Configuration: Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso compounds). Threo and erythro; D and L; cis – trans nomenclature; CIP Rules: R/ S (for upto 2 chiral carbon atoms) and E / Z Nomenclature (for upto two C=C systems).		
Learning Outcomes:		
After completion of this unit, the student will be able to		
•	The student shall learn the essential concepts of chirality, configuration and isomerism L3	
•	The student shall learn nomenclature of isomers in organic chemistry L3	
•	Students lean different representations L2	
•	Students will familiarize with the elementary concept of saturated aliphatic hydrocarbons L5	
•	Students will learn various chemical properties L1	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading		
UNIT - V	**Organic Chemistry-1**	**No of Hours : 9L**
Aliphatic Hydrocarbons Functional group approach for the following reactions (preparations & reactions) to be studied. **Alkanes**: (Upto 5 Carbons). Preparation: Catalytic hydrogenation, Wurtz reaction, from Grignard reagent. Reactions: Free radical Substitution: Halogenation.		
Alkenes: (Upto 5 Carbons) Preparation: Elimination reactions: Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff's rule); cis alkenes (Partial catalytic hydrogenation) and trans alkenes (Birch reduction).		
Reactions: cis-addition (alk. $KMnO_4$) and trans-addition (bromine), Addition of HX (Markownikoff's and anti-Markownikoff's addition.		
Alkynes: (Upto 5 Carbons) Preparation: Acetylene from CaC_2 and conversion into higher alkynes;		
Reactions: formation of metal acetylides, addition of bromine.		
Learning Outcomes:		
After completion of this unit, the student will be able to		
•	The students will learn synthetic reactions L3	
•	To learn various reaction mechanisms L3	
•	To learn properties of aromatic alcohol, aromatic and aliphatic ether, aldehydes and ketones. L2	
•	To learn acidity of alkenes and alkynes L5	
•	To learn synthesis and reactions of alkenes and alkynes. L1	

Pedagogy tools: Blended learning, Case let, video lectures, self-reading
Textbook(s):
1. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
2. Cotton, F.A., Wilkinson, G. & Gaus, P.L. Basic Inorganic Chemistry, 3rd ed., Wiley.
3. Huheey, J.E., Keiter, E.A., Keiter, R.L. & Medhi, O.K. In organic Chemistry: Principles of Structure and Reactivity, Pearson Education India, 2006.
4. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
5. Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).
6. Eliel, E.L. Stereochemistry of Carbon Compounds, Tata McGraw Hill education, 2000.
7. Finar, I.L. Organic Chemistry (Vol. I & II), E.L.B.S.
8. Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.
9. Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010

CHEM1031: Chemistry – II

L	T	P	S	J	C
3	0	0	0	0	3

The students of undergraduate program in science need to be conversant with the various aspects of solution chemistry, phase equilibrium, electrochemistry and Functional group chemistry forms the foundation for training a undergraduate students as analytical and synthetic chemist.

Course Objectives

1. To introduce the concept of solution and phase chemistry in physical chemistry
2. To introduce functional group chemistry in organic chemistry
3. To impart knowledge on the essential functional groups in organic chemistry.
4. To impart knowledge on the essential functional groups reactions
5. To impart knowledge on the essential functional groups properties

Course outcomes:

UNIT – I	**Section A: Physical Chemistry-1**	**No of Hours: 9**
Solutions Thermodynamics of ideal solutions: Ideal solutions and Raoult's law, deviations from Raoult's law – non-ideal solutions. Vapour pressure-composition and temperature composition curves of ideal and non-ideal solutions. Distillation of solutions. Lever rule. Azeotropes.		
Phase Equilibrium Phases, components and degrees of freedom of a system, criteria of phase equilibrium. Gibbs Phase Rule and its thermodynamic derivation. Derivation of Clausius – Clapeyron equation and its importance in phase equilibria.		
Learning Outcomes:		
After completion of this unit, the student will be able to		
•	Comprehend the thermodynamics of ideal solutions L2	
•	Draw the vapour pressure-composition and temperature composition curves of ideal and non-ideal solutions.	
•	Learn the principle behind distillation of solutions L1	
•	learn about the essential concepts important principle and terms of phase rule. L3	
•	apply phase rule to one component and two component systems L3	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading		
UNIT - II	**Title Conductance**	**No of Hours: 9**
Conductance Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Kohlrausch law of independent migration of ions. Transference number and its experimental determination using Hittorf and Moving boundary methods. Ionic mobility. Applications of conductance measurements: determination of degree of ionization of weak electrolyte, solubility and solubility products of sparingly soluble salts, ionic product of water, hydrolysis constant of a salt. Conductometric titrations (only acid base).		
Learning Outcomes:		
After completion of this unit, the student will be able to		
•	Learn Transference number and its experimental determination L5	
•	Apply conductance measurements: determination of degree of ionization of weak electrolyte, solubility and solubility products of sparingly soluble salts, ionic product of water, hydrolysis constant of a salt. L1	
•	learn the elementary concepts of conductance and electrochemistry. L3	
•	learn the applications of Kohlrausch law. L3	
•	Calculate thermodynamic properties: G, H and S from EMF data. L2	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading		

UNIT – III	Section B: Organic Chemistry-3	No of Hours: 9
Carboxylic acids and their derivatives-Carboxylic acids (aliphatic and aromatic) Preparation: Acidic and Alkaline hydrolysis of esters. Reactions: Hell – Vohlard - Zelinsky Reaction.		
Carboxylic acid derivatives (aliphatic): (Upto 5 carbons)- Preparation: Acid chlorides, Anhydrides, Esters and Amides from acids and their interconversion. Reactions: Comparative study of nucleophilicity of acyl derivatives. Reformatsky Reaction.		
Amines and Diazonium Salts- Amines (Aliphatic and Aromatic): (Upto 5 carbons) Preparation: from alkyl halides, Hofmann Bromamide reaction.		
Reactions: Carbylamine test, Hinsberg test. Electrophilic substitution (case aniline): nitration, bromination, sulphonation.		
Learning Outcomes:		
After completion of this unit, the student will be able to		
•	learn the concept of synthesis and reactions carboxyl Functional group L3	
•	learn the concept of synthesis and reactions carboxyl Functional group derivatives. L3	
•	learn the concept of synthesis and reactions amine Functional group and derivatives L2	
•	learn the concept of synthesis and reactions diazonium Functional group and derivatives. L5	
•	learn the special named reactions of carboxyl, amine functional groups. L1	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading		
UNIT – IV	**Amino Acids, Peptides and Proteins**	**No of Hours: 9**
Preparation of Amino Acids: Strecker synthesis using Gabriel's phthalimide synthesis. Zwitter ion, Isoelectric point and Electrophoresis. Reactions of Amino acids: ester of –COOH group, acetylation of $–NH_2$ group, ninhydrin test.		
Overview of Primary, Secondary, Tertiary and Quaternary Structure of proteins. Synthesis of simple peptides (up to dipeptides) by N-protection (t-butyloxycarbonyl and phthaloyl) & C activating groups and Merrifield solid-phase synthesis.		
Learning Outcomes:		
After completion of this unit, the student will be able to		
•	learn the elementary reactions and properties	
•	mechanism of amines and diazonium salts L3	
•	learn the concept of applications of diazonium salts in synthetic organic chemistry. L2	
•	familiarize with synthetic approaches to simple amino acids and concept of proteins. L5	
•	familiarize with concept of proteins, their structures.	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading		
UNIT – V	**Carbohydrates**	**No of Hours: 9**
Carbohydrates: Classification, and General Properties, Glucose and Fructose (open chain and cyclic structure), Determination of configuration of monosaccharides, absolute configuration of Glucose and Fructose, Mutarotation, ascending and descending in monosaccharides. Structure of disaccharides (sucrose, cellobiose, maltose, lactose) and polysaccharides (starch and cellulose) excluding their structure elucidation.		
Learning Outcomes:		
After completion of this unit, the student will be able to		
•	learn about the classification of carbohydrates. L3	
•	learn general properties of carbohydrates. L3	
•	familiarize with the structure of mono, di and polysaccharides L2	
•	learn about the ascending and descending in monosaccharides L5	
•	familiarize the reactions and properties of mono, di and polysaccharides L1	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading		
Textbook(s):		
1. Barrow, G.M. Physical Chemistry Tata McGraw-Hill (2007).		
2. 2. Morrison, R. T. & Boyd, R. N. Organic Chemistry,		
3. Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).		
4. 3. Finar, I. L. Organic Chemistry (Volume 1),		
5. Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).		
6. 4. Finar, I. L. Organic Chemistry (Volume 2),		

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

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

CSCI1001: BASICS OF INFORMATION TECHNOLOGY

L	T	P	S	J	C
3	0	0	0	0	3

Introduction
Course objective
Course outcome

UNIT – I		
ta and Information: Introduction, Types of data, Simple model of a computer, Data processing using a computer, Desktop computer.		
Acquisition of Numbers and Textual Data: Introduction, input units, internal representation of numeric data, Representation of characters in computers, Error Detecting codes.		
Acquiring Image Data: Introduction, acquisition of textual data, acquisition of pictures, storage formats for pictures, Image compression fundamentals, Image acquisition with a digital camera.		
UNIT - II		
Acquiring Audio Data - Basics of Audio Signals, Acquiring and storing Audio Signals, Compression of Audio Signals.		
quisition of Video: Computing a moving Scene with a video camera, Compression of Video Data, MPEG Compression standard.		
ta storage: Introduction, Storage cell, Physical devices used as storage cells, Random access memory, Read only memory, Secondary storage, Compact disk read only memory (CDROM), Archival store.		
UNIT – III		
ntral Processing Unit: Introduction, Structure of a central processing unit, Specifications of a CPU, Interconnection of CPU with memory and I/O units, Embedded processors.		
tput Devices: Video Display Devices, Touch Screen, E-ink display, Printers, Audio Output.		
UNIT – IV		
Computer Networks: Introduction, Local Area Network (LAN), Applications of LAN, Wide Area Network (WAN), Internet, Naming computers connected to Internet, Future of Internet Technology.		
Computer Software: Introduction, Operating system, Programming languages, Classification of programming languages, Classification of Programming Languages based on applications.		
UNIT – V		
Data organization: Introduction, Organizing a database, Structure of a database, Database Management System, Example of database design, Non-text databases, Archiving databases. **Processing Numerical Data:** Introduction, Use of spreadsheets, Numerical computation examples.		
Some Internet Applications: Introduction, Email, World Wide Web, Information Retrieval from the WWW, Other facilities provided by Browsers, Audio on the internet, Accessing pictures and video via internet		
Textbook(s):		
1. 1.Introduction to Information Technology by V. Rajaraman, PHI Learning Pvt.Ltd. 2013.		
Reference Books:		
1. Computing Fundamentals by Peter Norton, Tata Mc. Graw Hill, 6th edition, 2006.		
2. Fundamentals of Computers by E.Balagurusamy, Tata McGraw Hill, 2009		

CHEM1021: Chemistry - I Lab

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

The students of undergraduate program in science in Chemistry need to be conversant with the various basic methodologies of chemistry. Therefore, one module each on in inorganic, physical and organic chemistry is introduced which helps the student familiarize with the techniques essential for developing the foundation of practical chemistry.

Course Objectives

1. Estimate various components in a mixture.
2. Estimation of oxalic acid, water of crystallizationin Mohr's salt, Fe(II) ions and Cu(II) ions by volumetric analysis.
3. Detect various elements in organic compounds.
4. Separate mixture by various types of chromatography.
5. To make student develop the fundamental skill required for quantitative and qualitative analysis in inorganic and organic chemistry.

Course outcome

Section A: Inorganic Chemistry - Volumetric Analysis	
1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.	
2. Estimation of oxalic acid by titrating it with KMnO4.	
3. Estimation of water of crystallization in Mohr's salt by titrating with KMnO4.	
4. Estimation of Fe (II) ions by titrating it with K2Cr2O7 using internal indicator.	
5. Estimation of Cu (II) ions iodometrically using Na2S2O3.	
Learning Outcomes:	
After completion of this unit, the student will be able to	
•	The student will learn about the quantitative analysis concepts of redox chemistry
•	Separate mixtures of Sodium carbonate and Sodium hydrogen carbonate
•	Determine strengths of solutions of oxalic acid and water of crystallization in Mohr's salt with $KMnO_4$.
•	Determine strengths of Fe(II) solutions with $K_2Cr_2O_7$
•	Determine strengths of Cu(II) solutions iodometrically with $Na_2S_2O_3$
Pedagogy tools: Blended learning, Case let, video lectures, self-reading	
Section B: Organic Chemistry	
1. Detection of extra elements (N, S, Cl, Br, I) in organic compounds (containing upto two extra elements)	
2. Separation of mixtures by Chromatography: Measure the Rf value in each case (combination of two compounds to be given).	
3. Identify and separate the components of a given mixture of 2 amino acids (glycine, aspartic acid, glutamic acid, tyrosine or any other amino acid) by paper chromatography.	
4. Identify and separate the sugars present in the given mixture by paper chromatography.	
Learning Outcomes:	
After completion of this unit, the student will be able to	
•	Detect heteroatoms (N, S, Cl, Br, I) in organic compounds
•	Separate amino acids with paper chromatography
•	Separate sugars with paper chromatography
Pedagogy tools: Blended learning, Case let, video lectures, self-reading	
Reference book(s):	
1. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.	
2. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.	
3. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbookof Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.	
4. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960.	

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

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

CHEM1051: Chemistry – III

L	T	P	S	J	C
3	0	0	0	0	3

This course enables the students to apply the various statistical tools in the analysis and acquire the basic principles of atomic, molecular techniques, Electro-analytical methods and separation methods and their applications. The knowledge gained in this course can be applied to the latest developments in technology.

Course objectives

- To familiarize the students with various types of basic statistical tools.
- To study about the basic principles of atomic, molecular techniques and separation methods.
- To emphasize the importance of UV Vis spectroscopy and atomic spectroscopy in quantitative determination of Metal ions.
- To impart knowledge on the basic concepts of pH metry and conductometry.
- To compare the different separation methods like chromatography and solvent extraction.

Course outcomes

After the completion of the course, the student will be able to

- List various types of statistical tools and the instruments for chemical analysis. (l-1)
- Explain the role of various parts of instrumentation of atomic and molecular techniques (l-2)
- Identify suitable analytical technique for chemical analysis. (l-3)
- Distinguish atomic and molecular techniques (L-4)

UNIT – I		
Evaluation of analytical data: errors, accuracy and precision. Types of errors and Methods for minimization of errors. Significant figures		
Statistical test of data: F, Q and t test, rejection of data, and confidence intervals.		
Learning Outcomes:		
After the completion of the Unit I, the student will be able to		
•	list out different types of errors in chemical analysis.	
•	explain the different types of errors in chemical analysis	
•	compare the accuracy and precision.	
•	illustrate the type of errors in Chemical Analysis.	
•	application of different statistical tools in the chemical analysis.	
UNIT - II		
UV-Visible spectrophotometry: Interaction of radiation with matter. fundamental laws of spectroscopy: Beer-Lambert's law and its validity.: source of radiation, wavelength dispersion: monochromator: gratings, prisms, interference filters. Detection of signal: photocells, photomultipliers, diode arrays. Schematic diagrams of Single and Double Beam instruments. applications in the quantitative determination of cations (Fe^{2+}, Ni^{2+}) and anions (PO_4^{3-}, NO_3^-).		
Learning Outcomes:		
After the completion of the Unit II, the student will be able to		
•	list out the different part of the instrumentation of UV Vis Spectrophotometry	
•	illustrate the procedure for the determination of various anions and cations	
•	explain the importance of double beam UV Vis Spectrophotometry.	
•	assess the differences between single beam and double beam spectrophotmetry (L-2)	
UNIT – III		
Flame Emission and Flame Absorption Spectrometry: Basic principle and instrumentation: source of excitation, atomization, nebulizer, types of burner, monochromator and detector. Interferences: Physical,		

Chemical and spectral. Quantitative estimation of metal ions in water samples by Flame emission and Flame absorption spectroscopy.		
Learning Outcomes:		
After the completion of the Unit III, the student will be able to		
•	state the principle of AAS and AES.	
•	explain the basic principle and working of AAS and AES	
•	compare the functioning the AAS and AES	
•	identify the significance of each part of AAS and AES Instruments.	
•	apply the knowledge of this concept in the analysis of samples.	
UNIT – IV		
Electroanalytical methods: Basic principle, Instrumentation and applications of pH metric, potentiometric and conductometric titrations.		
Learning Outcomes:		
After the completion of the Unit IV, the students will be able to		
•	state the principles of pH metry, potentiometry and conductometry	
•	explain the working of pH meter, potentiometer and conductivity bridge.	
•	identify the suitable electrodes for pH meter, potentiometer and conductivity bridge. (L-3)	
•	apply the knowledge of these instruments in various types of chemical analysis.(L-3)	
UNIT – V		
Separation techniques Solvent extraction: Principle of solvent extraction and efficiency of the technique. Technique of extraction: batch, continuous and counter current extractions. Solvent extraction systems: Metal chelates and ion association systems.		
Chromatography: Principle and classification of the technique. Mechanism of separation: adsorption and partition. Development of chromatograms		
Learning Outcomes:		
After the completion of the Unit V, the students will be able to		
•	explain the process of chromatography and solvent extraction techniques(L-3)	
•	identify suitable method for the separation of mixture of components. (L-3)	
•	distinguish between mechanism of different chromatographic and solvent extraction methods.	
•	compare various types of solvent extraction and chromatographic methods (L-4)	
Textbook(s):		
1. Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson, 2009.		
2. Christian, G.D. Analytical Chemistry, 6th Ed. John Wiley & Sons, New York, 2004.		
3. Harris, D.C.: Exploring Chemical Analysis, 9th Ed. New York, W.H. Freeman, 2016.		
4. Khopkar, S.M. Basic Concepts of Analytical Chemistry. New Age International Publisher, 2009.		
5. Skoog, D.A. Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning India Ed.		

PHYS1091: Biophysics

L	T	P	S	J	C
3	0	0	0	0	3

Introduction
Course objective
Course outcome

UNIT – I		
Radiation Biophysics Ionising radiation, Interaction of radiation with matter, Measurement of Radiation, Radioactive isotopes. Types of Radioactivity-Natural, Artificial and induced Radioactivity and radioactive decay law. Measurement of Radioactivity -Geiger Muller counter, proportional counter and scintillation counter. Biological effects of radiation and radiation protection and therapy.		
UNIT - II		
Transport process: Light scattering, Diffusion –factors effecting diffusion, Fick's law, diffusion of electrolytes, accelerated diffusion and biological significance sedimentation, osmosis, viscosity, chromatography and electrophoresis and optical activity .Biophysical phenomena in biochemical studies-pH meter - principle, electrode system and factors effecting in its measurement.		
UNIT – III		
Physical Techniques in structure determination Ultraviolet and Visible spectroscopy, fluorescence and phosphorescence methods, Infrared spectroscopy-bending, near, mid and far infrared region. Raman spectra- principle and instrumentation. NMR, ESR Instrumentation.		
UNIT – IV		
Microscopies Optical microscope, Electron microscopy, emerging trends in microscopy. X ray diffraction-diffraction of x rays, structure determination, phase determination procedures. Laser-characteristics, population inversion, stimulated and spontaneous and relation (no derivation) and Holography		
UNIT – V		
Biomolecular structures, Bioenergetics and Biological systems Biomolecular structures-Concepts of classical physics and limitations, quantum principles of atomic		
Structure. Bioenergetics-Thermodynamics-reversible thermodynamics and irreversible thermodynamics. Photo bioenergetics and chemo bioenergetics. Biological systems: Neuro biophysics-Molecular transport across cell membrane and nerve impulse generation.		
Recommended Books:		
1. Essentials of Biophysics: P.Narayanan.New Age India Intl.		
2. Handbook of Radiobiology by KT Jaypee Brothers, Medical Publishers Pvt. Ltd.		
3. An Introduction to radiation protection by A Martin & SA Harbison, 4th Edition, Springer Publishers.		
4. Laser Tissue Interactions: Fundamentals and Applications by MH Niemz, Springer Publishers.		
5. Understanding biophotonics- Fundamentals, Advances and Applications by K Tsia, 1st Edition, CRC press.		

PHYS1101: BIOPHYSICS LAB

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

Introduction
Course objective
Course outcomes

1.	Plateau characteristics of radioactive source
2.	Intensity variation of radioactive material
3.	Wavelength of colors using spectrometer
4.	Determination of wavelength of LASER
5.	Optical activity
6.	X-ray diffraction – determination of interplanar spacing from X-ray spectra
7.	Analysis of infrared spectra - Identification of various groups
8.	Analysis of UV spectra -Identification wavelength corresponding to absorption
Learning Outcomes:	
After completion of this unit, the student will be able to	
•	
•	
•	
•	
•	
Reference book(s):	
1.	Radiation Biophysics, Second Edition - by Edward L. Alpen
2.	Physical Chemistry: Principles and Applications in Biological Sciences by Tinoco. I. et al..
3.	Physics of the Life Sciences by Newman, J.
4.	Drenth, J. (2010) Principles of Protein X-ray Crystallography, Spri

CHEM1041: Chemistry - II Lab

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

The students of undergraduate program in science in Chemistry need to be conversant with the various basic methodologies of chemistry. Therefore, one module each on in inorganic, physical and organic chemistry is introduced which helps the student familiarize with the techniques essential for developing the foundation of practical chemistry

Course Objectives

1. To introduce practical application of solution, phase and electrochemistry for quantitative analysis
2. To familiarize students with construction of the phase diagram.
3. To impart knowledge concerning the conductance and potentiometric titrations.
4. To demonstrate heat capacities of calorimeter.
5. To purification of organic compounds by crystallisation and distillation.

Course outcomes

Section A: Physical Chemistry	
Distribution Study of the equilibrium of one of the following reactions by the distribution method: I_2(aq) + I-(aq) I_3-(aq) Cu2+(aq) + xNH2(aq) $[Cu(NH_3)x]^{2+}$	
Conductance I. Determination of cell constant II. Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid. III. Perform the following conductometric titrations: i. Strong acid vs. strong base ii. Weak acid vs. strong base	
Potentiometry Perform the following potentiometric titrations: i. Strong acid vs. strong base ii. Weak acid vs. strong base iii. Potassium dichromate vs. Mohr's salt	
Learning Outcomes:	
After completion of this unit, the student will be able to	
•	learn determination of conductance, cell constant. L3
•	apply the concepts of electrochemistry for redox titrations by instrumental methods of analysis L3
•	construct phase diagrams L1 Perform the following conductometric titrations
•	Perform the following conductometric titrations L5
•	learn determination of conductance, cell constant. L3
Pedagogy tools: Blended learning,Case let, video lectures, self-reading	
Section B: Organic Chemistry I	
Systematic Qualitative Organic Analysis of Organic Compounds possessing monofunctional groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines) and preparation of one derivative.	
Organic Chemistry II	
1. Separation of amino acids by paper chromatography	
2. Determination of the concentration of glycine solution by formylation method.	
3. Titration curve of glycine	

4.	Action of salivary amylase on starch
5.	Effect of temperature on the action of salivary amylase on starch.
6.	Differentiation between a reducing and a nonreducing sugar.
Learning Outcomes:	
After completion of this section, the student will be able to	
•	analyse an unknown organic compound having monofunctional group in a systematic .L3
•	Prepare derivatives of -COOH, phenolic, aldehydic, ketonic, amide, nitro, amines L3
•	learn separation of amino acids by paper chromatography L1
•	plot the Titration curve of glycine L2
Pedagogy tools: Blended learning, Case let, video lectures, self-reading	
Textbook(s):	
Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.	
Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960.	
Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).	
Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry, Universities Press	

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

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

ENVS1011: Understanding Environment & Ecology

L	T	P	S	J	C
3	0	0	0	0	3

Understanding Environment mainly focuses on the fundamental concepts. It provides basic knowledge on Environment and its components including environmental ethics. This course also helps in understanding the current environmental problems.

Course Objectives

- To enable the student in understanding the environment and its measurements including introduction and scope of Environmental Science and technology and its applications.
- To familiarize learners about the environment and its segments.
- To introduce learners about basic concepts of ecology.
- To acquaint learners with the historical background of ecology.
- To make learners understand the climate factors influencing ecology
- To impart knowledge on evolutionary ecology.

Course outcomes

UNIT-I	**Introduction to Environmental Science**	**No. of hrs. 12**
Definition, principles background and scope of environmental science, Understanding of environment and measurements. Environmental Science and technology, Media and people, decision making and applications of Environmental Science.		
Learning Outcomes:		
After the completion of Unit I, the student will be able to		
•	list out the scope of Environmental science.	
•	relate theoretical knowledge of the environment on its measurement.	
•	explain the role of the media in Environmental Science.	
•	summarize the applications of Environmental science.	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading.		
UNIT – II	**Environment and its Segments**	**No. of hrs. 12**
Segments of environment- Air, Water, Soil, Biosphere, Major regions of atmosphere-Troposphere, stratosphere, mesosphere, ionosphere, exosphere.Water-surface and groundwater (confined and unconfined aquifer), Soil-Layers of soil, profile of soil. Biosphere and its role in the environment.		
Learning Outcomes:		
After the completion of Unit II, the student will be able to		
•	classify the regions of the atmosphere.	
•	tell about the meaning and types of aquifers.	
•	explain the layers of soil.	
•	outline the role of the Biosphere in the environment.	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading.		
UNIT – III	**Ecological Concepts**	**No. of hrs. 12**
Basic concepts of ecology, Historical background of ecology, Cybernetic nature of ecosystems. Structural components (Abiotic and Biotic, Ecological pyramids), Functional components (Trophic structure, food chain, food web, biogeochemical cycles).		
Learning Outcomes:		
After the completion of Unit III, the student will be able to		
•	interpret the relationship between organisms and the environment.	
•	make use of ecological pyramids.	

•	identify the cybernetic nature of the ecosystem.	
•	utilize ecological concepts for its sustenance.	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading.		
UNIT– IV	**Ecology and Climate**	**No. of hrs. 12**
Climatic factors; Environmental complex; Interaction of Ecological factors - Light factor, Temperature factor; Precipitation (rainfall); Humidity of air; Atmosphere-gases; wind factor: fire factor, Topographic factors: Height of mountain chains; Direction of mountains and valleys; steepness of slope; Exposure of slope		
Learning Outcomes:		
After the completion of Unit IV, the student will be able to		
•	identify the imbalances of ecology with respect to climate change. (L-3)	
•	examine climatic factors.	
•	compare the directions of mountains and valleys with climate change.	
•	explain about the steepness of the slope.	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading.		
UNIT– V	**Evolutionary Ecology**	**No. of hrs. 12**
Evolutionary Ecology: Natural Selection and its ecological significance, modern concept of species, adaptation; Significance of mutation, isolating mechanism and ecological role and other evolutionary processes in ecology. Ecological sustainability.		
Learning Outcomes:		
After the completion of Unit V, the student will be able to		
•	analyse the significance of mutation.	
•	list the modern concepts of species.	
•	survey on adaptation.	
•	assesses the evolutionary processes in ecology. (L-5)	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading.		
Textbook(s):		
1. Chapman J. L. & Reiss M. J. Ecology: Principles and Applications' Cambridge University Press, U. K, 2nd Edition.1988		
2. Cunningham W. & Cunningham M.. Environmental Science: A Global Concern' WCB, McGraw Hill, 1st Edition. 2021.		
3. Santra S.C., Environmental Science, New Central Book Agency (P) LTD, 3rd Edition. 2011.		
4. M Asthana & D K Asthana Environment: Problems and Solutions S. Chand & Company. 2015		
5. Asthana D.K. Introduction to Problems & Solutions S. Chand Publishing. 1998.		
Reference Books:		
1. Kaushik A and Kaushik C.P. Perspectives in Environmental Studies. New Age International Publishers Edition-VI. 2018.		
2. Planka E. Evolutionary Ecology. 5th Edition. Pearson.1997.		
Journal: Ecology - Wiley Online Library		
Website(s): Ecology: from cells to Gaia | Coursera		

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

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

ENVS1021: Understanding Environment & Ecology Lab

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

This course enables the students to acquire knowledge on various aspects of understanding environment and ecology. The course focuses on using different instruments for sampling water and soil. The knowledge gained in this course can be applied to understand the quality of water and soil.

COURSE OBJECTIVES

1. To recall principles and working pH for analysing water and soil samples.
2. To illustrate conductivity of water and soil sample.
3. To demonstrate minimum number of quadrants.
4. To introduce determining frequency, density and abundance of different species present in the community.
5. To estimate moisture content of soil.
6.

Course outcomes

Specific Instructional Objective

1. To learn how pH works.
2. To learn how conductivity works.
3. To demonstrate the moisture content of soil.
4. To learn minimum size of quadrate by species.
5. To understand frequency, density, and abundance of different species.
6. To understand pond ecosystem.
7. To experiment with chlorides determining in water sample.
8. To learn DO of the water sample.
9.

1. Understanding environment and ecology laboratory protocol.
2. Determination of pH of collected water sample
3. Determination of pH of the soil sample
4. Estimation of DO of the water.
5. Estimation of chlorides in the collected water sample.
6. Determination of conductivity of water sample.
7. Determination of conductivity of soil sample.
8. Estimation of moisture content of the soil sample.
9. Determination minimum size of quadrate by species – area curve method.
10. A study of pond ecosystem.
11. Determination the minimum number of quadrates to be laid down in the fields
12. Study the community by Quadrate Method by determining frequency, density and abundance of different species present in the community
Text Books
Scheiner S. Design and Analysis of Ecological Experiments. Chapman and Hall/CRC. 2019.
Reference book(s):
Scheiner S. Design and Analysis of Ecological Experiments. Chapman and Hall/CRC. 2019.

	Programme Objectives (POs)												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1														1
CO2												1		2	
CO3							2						1		
CO4				2											1
CO5										2				2	

ENVS1031: Environmental Chemistry

L	T	P	S	J	C
3	0	0	0	0	3

This course is designed to provide foundation in understanding chemistry of environmental pollution. Students are taught to attain ability to understand the chemical nature of pollutants and their fate.

Course Objectives

1. To prepare students with the knowledge of the chemical properties of elements and compounds
2. Provides the existence of the cycling and accumulation of pollutants in the environment.
3. The course addresses the chemistry of elements and compounds in the atmosphere, water and soil,
4. Describes the lays special emphasis on the processes that define the connections and the dependence between individual segments of environment
5. To gain understanding on relationships among natural and man-made systems.
6. Integrate principles of biology, physical, chemical and social sciences and apply them to resource conservation.

Course outcomes

UNIT-I	**Pollution Chemistry**	
Pollutant, Contaminant, Receptor, Sink, Pathways of a pollutant. Biospheric chemistry - Bioaccumulation of pollutants - Chemical contaminants and eco-toxicology.		
Learning Outcomes:		
After the completion of Unit I, the student will be able to		
•	Comprehend pollutant, sink, bioaccumulation and eco-toxicology	
•	Accumulation of pollutants in day to day life	
•	Understands about various chemical contaminants	
•	Gains the through knowledge on toxicology and eco toxicology	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading.		
UNIT – II	**Atmospheric Chemistry**	
Chemical composition of the atmosphere; Chemical and photochemical reactions in the atmosphere - formation of smog, PAN, acid rain. Oxygen and ozone chemistry: Catalytic decomposition process of ozone, Concept of atmospheric aerosol chemistry, Greenhouse gases and their effects.		
Learning Outcomes:		
After the completion of Unit II, the student will be able to		
•	Appreciate atmospheric chemistry, oxygen and ozone chemistry	
•	Learns about the decomposition process for various compounds and substances	
•	Effects of green house gases in the environment and their study	
•	Various photochemical reactions	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading.		
UNIT – III	**Water Chemistry**	
Unusual physical properties, water as a solvent and solvent properties, changes in water properties by addition of solute. Water quality parameters – physical, chemical and biological parameters. Concept of D.O, B.O.D and C.O.D		
Learning Outcomes:		
After the completion of Unit III, the student will be able to		
•	Apprehend water chemistry	
•	water quality parameters	
•	Biological and chemical oxygen demand	
•	Understands the various biological parameters	

Pedagogy tools: Blended learning, Case let, video lectures, self-reading.		
UNIT– IV	**Soil Chemistry**	
Soil Composition and Characteristics Physical properties of soil. Chemical properties – Cation exchange capacity, pH, macro and micro nutrients		
Learning Outcomes:		
After the completion of Unit IV, the student will be able to		
•	Cognize soil chemistry including its physical properties	
•	Composition of soil and characteristics of soil	
•	Soil chemical properties	
•	Able to understand the various nutrients and their chemistry	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading.		
UNIT– V	**Chemistry in day to day life**	
Evolutionary Ecology: Natural Selection and its ecological significance, modern concept of species, adaptation; Significance of mutation, isolating mechanism and ecological role and other evolutionary processes in ecology. Ecological sustainability.		
Learning Outcomes:		
After the completion of Unit V, the student will be able to		
•	Gain knowledge on food adulteration	
•	Gain knowledge on milk adulteration	
•	General adulterants in food	
•	Effect of adulterants in the food	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading.		
Textbook(s):		
4. Engineering Chemistry by Jain & Jain, Dhanpat Rai Publishing Company. 15th Edition		
5. Chemistry for Environmental Engineering by Sawyer & McCarty, 5th Edition.		
Additional Reading		
Reference Book(s):		
3. Environmental Chemistry by A. K. De, New Age International Publication, New Delhi 3rd Edition.		
4. Environmental Chemistry by P. S. Sindhu, New Age International. 2nd Edition.		
Journal(s):		
https://www.hindawi.com/journals/aec/?utm_source=google&utm_medium=cpc&utm_campaign=HDW_MRKT_GBL_SUB_ADWO_PAI_DYNA_JOUR_X&gclid=Cj0KCQjwkIGKBhCxARIsAINMioKki70MZ-zIwq_R4EM2bNxiT7rlEP-xixJ_qc6W2wnQpFLckF41AJkaAj6EEALw_wcB		
Website(s):		
https://www.amazon.in/Text-Environmental-Chemistry-Pollution-Control/dp/8121908833		

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

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

ENVS1041: Environmental Chemistry Lab

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

This course enables the students to gain knowledge on various reactions in chemistry lab which is useful to day to day life. The course tours the students through different titrations The course enables the students to gain knowledge on various, instrumental methods of analysis, measurements of physical parameters, volumetric analysis, preparation of polymers, analysis of water, and chromatographic separation techniques. The knowledge gained in this course can be applied to develop various applications to different chemicals, reagents etc.,

Course Objectives

- To familiarize the reactions in between two solutions.
- To illustrate the Environmental analysis by taking the different samples those are collected from various places.
- To demonstrate various types of Inheritance mechanisms.
- To train designing mathematical calculations related to various analysis.
- Identify different ores (Fe& Cu) and their usage in different fields (industry, software devices, electronic goods).
- Experiment with the physical parameter of inorganic compounds.

Specific Instructional Objective

1. To learn and understand different types of chemical interactions
2. To Applying of chemical reactions to the real-world environmental problem identification.
3. To Perform precise tests on environmental samples
4. For Understanding the chemistry behind these experiments.
5. For Interpret pathway of a pollutant by testing its chemical nature.

1. Oxidation – Reduction Titrations
• Estimation of Copper Sulphate using a standard solution of Sodium Thiosulphate.
• Estimation of Potassium dichromate using a standard solution of Mohr‘s salt
2. Argentometric titrations
• Determination of chloride by Mohr method
3. Iodometric titrations
• Determination of available chlorine
4. Complexometric titrations
• Determination of calcium and magnesium in the mixture
Text Books:
Mendham J, Denney RC, Barnes JD, Thomas M and Sivasankar B ,Vogel’s Quantitative Chemical Analysis, 6/e, Pearson publishers, 2000.
Additional Reading:
N.K Bhasinand SudhaRani Laboratory Manual on Engineering
Reference Book(s):
Chemistry, 3/e, Dhanpat Rai Publishing Company, 2007.

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

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

ENVS 2001: Air Pollution and Control

L	T	P	S	J	C
3	0	0	0	0	3

Introduction

Course Objective:

This paper explains the different types of air pollutants, sources, effects, classification of pollutants and control technologies for air pollution.

Course outcomes:

- Student will acquire knowledge on the classification of air pollutants, sources and factors effecting air pollution.
- Student will be able to understand the concept of locating an industrial plant, city planning, plume behavior and effect of air pollution on living beings.
- Student will be able to understand the procedures of air sampling, equipment used for sampling and control equipment for air pollution.

UNIT - I		
Introduction – Definition, Sources, classification of air pollutants, Natural contaminants, Gases, Primary and secondary air pollutants. Stationary and mobile sources. Meteorology: Meteorology and air pollution, primary parameters – Wind direction and speed, temperature, atmospheric stability, mixing height, secondary parameters – precipitation, Humidity, solar radiation, visibility. Methods of measurement of meteorological variables.		
Learning Outcomes:		
Upon completion of the unit the student will be able to:		
•	Know different types of air pollutants, its sources and factors affecting air pollution	
UNIT - II		
Industrial plant location and city planning: Introduction, Factors to be considered for industrial plant location, Existing levels of air contaminants, Potential effects on surrounding area, meteorological factors and climate, topographical features, planning and zoning, City planning.		
Learning Outcomes:		
Upon completion of the unit the student will be able to:		
•	Understand the concept of city planning and factors to be considered during the location of an industrial plant.	
UNIT - III		
Plume behaviour: Single stack and multiple source pollution, wind rose, Stack effluent dispersion theories, effect of dilution, plume rise. Dispersion model: wind tunnel method. Stack height. Effects of air pollution on human health, plants, animals, and properties. Major air pollution disasters: Meuse valley (Belgium), Donora (USA), London, Bhopal gas tragedy.		
Learning Outcomes:		
Upon completion of the unit the student will be able to:		
•	Understand Plume behavior, stack effluent dispersion and effects of air pollution on living beings with relevant case studies.	
UNIT - IV		
Sampling procedures: classification of sampling methods, instruments for sampling waste gases and for atmospheric sampling, duration and sampling sites, sampling methods, high volume sampler and respirable dust sampler.		
Learning Outcomes:		
Upon completion of the unit the student will be able to:		
•	Understand the procedures of air sampling, equipment used for sampling and air pollution control equipment.	
UNIT - V		

Air pollution due to automobiles: exhaust emissions; crank case emission, evaporative emissions, air-fuel ratio. Spark timing, control of exhaust emissions.
Air quality and emission standards, air pollution legislations and regulations.
Learning Outcomes:
Upon completion of the unit the student will be able to:
• Understand emission standards for air quality, legislations and regulations for the control of air pollution.
Reference Books:
1. Air pollution MN Rao & HVN Rao. Tata McGraw-Hill Publishing Company Limited. New Delhi
2. Text book of Air Pollution and control Technologies. Y. Anjaneyulu, Allied Publishers (P) Limited, New Delhi.
3. Air Pollution Control Technology Handbook Karl B. Schnelle, Jr., Charles A. Brown, CRC Press
4. Environmental Pollution Control Engineering, CS Rao, New Age International publishers
5. Air Pollution & Control KVSG Murali Krishna Published by Kaushal & Co.

ENVS2021: Geological Sciences and its resources

L	T	P	S	J	C
3	0	0	0	0	3

Description of Rocks & Minerals is an inclusive course covers integrated approach of Earth Science studies. The course begins with the structure and composition of earth, waste lands and its management, conservation of natural resources: - Land Resources, Mineral resources, Water Resources and Energy Resources and their proper management.

Course Objectives

1. To describe about the structure and composition of the Earth
2. To illustrate the types of rocks and their formation
3. Explain the concepts of conservation of resources
4. To describe the economic importance of the minerals and their extraction
5. Acquire knowledge on advanced electricity generating methods by using Renewable resources
6. To explain the structure of the atmosphere and its importance

Course outcomes:

The student will be able to

1. Recognise the importance of the Land conservation methods and land use pattern.
2. Apply advanced technological methods in generating electricity by using renewable and non renewable resources.
3. Gain knowledge on effective utilisation of the economic minerals and their role in improving our countries wealth.
4. Design and implements the water conservation strategies to strengthen the availability of the water reresources.
5. Identity and solve the issues related to the radioactive waste by implementing innovative disposal methods.
6. Identify the factors responsible for increasing of temperature in the atmosphere and can apply remedial methods to maintain normal temperature..

UNIT - I		
Energy Resources: Fossil fuels. Nuclear energy, Hydel power, Geothermal and Tidal Energy, Wind Energy and Solar Energy. Advantages and disadvantages of Energy Resources.		
Learning Outcomes:		
Upon completion of the unit the student will be able to:		
•	Illustrate the types of energy resources, both renewable and non renewable and their importance.	
•	Recognize the role of Renewable resources like Hydel Power, Geo thermal, Tidal Energy, Wind Energy and Solar Energy and their importance.	
•	Explain the role of Non Renewable resources like Fossil Fuels, Nuclear Energy and their advantages and disadvantages.	
•	Know the generation of thermal power by using coal.	
•	Acquire knowledge on how to generate the hydel power from the hydel power projects.	
•	Illustrate the disposal methods of the radioactive waste	
•	Acquire knowledge on how to generate nuclear power from the nuclear power plants.	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading.		
UNIT - II	**Land Resources**	
Land Topography and Resources: Types of Rocks, Igneous rocks, Sedimentary Rocks and Metamorphic Rocks. Description of rocks. Land Hazards Like Earthquakes and Volcanoes. Land Degradation: Land Degradation, Land use pattern, Land conservation, Types of Wastelands and their management.		
Learning Outcomes:		
Upon completion of the unit the student will be able to:		

•	Illustrate the types of rocks and their formation.
•	Comprehend the structures and classification of the igneous sedimentary and metamorphic rocks
•	Grasp the concept of Volcanoes and earthquakes
•	Comprehend the Land degradation and controlling methods.
•	Illustrate Types of Wastelands and their management
•	Understand the land conservation methods
•	Acquire knowledge on the effective utilization of the land
Pedagogy tools Blended learning, Video lectures for relevant topics	
UNIT - III	**Water Resource**
Water Resources: Types of Water sources, Ground Water, Hydrological properties, Hydrological cycle, Surface Water etc, Water Conservation, Watershed Management, Cloud seeding for artificial rains.	
Learning Outcomes:	
Upon completion of the unit the student will be able to:	
•	Illustrate the types of water resources:- Surface water and Ground water
•	Recognize the role of Ground water and its use
•	Comprehend about Hydrological properties of water and water conservation methods and strategies in India.
•	Recognize the role of watershed management and its importance.
•	Illustrate different types of Cloud seeding for generation of artificial rains.
•	Acquire knowledge on the multipurpose river vally projects and their role
Pedagogy tools: Blended learning, Video lectures for relevant topics.	
UNIT - IV	**Mineral Resources**
Mineral Resources: Silicate Minerals and Non Silicate Minerals, Description of Minerals like Pyroxenes, Amphiboles, Feldspar. **Economic mineral Resources**: Economic Minerals like Gold, Copper, Aluminum, Iron, Manganese, Chromium, Coal, Petroleum, Lead and Zinc.	
Learning Outcomes:	
Upon completion of the unit the student will be able to:	
•	Illustrate the role of minerals, different types of minerals and their formation.
•	Grasp the importance of Silicate mineral structures
•	Apprehend the physical properties of the minerals.
•	Recognize the importance of non-silicate minerals.
•	Grasp properties of the Pyroxenes minerals
•	Comprehend about physical and chemical properties of the Amphibole minerals.
•	Know about properties of Feldspars minerals
•	Illustrate the importance of the Economic mineral Resources like Gold, Copper, Aluminium, Iron, Manganese, Chromium, Lead, Zinc, Coal, Petroleum, and Natural gases.
Pedagogy tools: Blended learning, Video lectures for relevant topics.	
UNIT - V	**Climate Change and its Consequences**
Structure of Atmosphere, Green House Effect, Ozone depletion, Climate change and its Consequences.	
Learning Outcomes:	
Upon completion of the unit the student will be able to:	
•	Acquire knowledge on structure of atmosphere: Troposphere, Stratosphere, Mesosphere Thermosphere and Exosphere.
•	Grap the characteristics of troposphere
•	Recognise the role of ozone layer in the stratosphere.
•	Acquire knowledge on Ionosphere which includes the thermosphere, parts of the mesosphere and exosphere.
•	Recognise the role of Green House Effect and its consequences.
•	Illustrate the Ozone depletion and its related issues.
•	Comprehend about the Climate change and the factors responsible for increasing of temperatures in the Atmosphere.
Pedagogy tools: Blended learning, Video lectures for relevant topics.	

Reference Books:
1. A text book of Geology by PK Mukerjee. Publisher: CBS Publishers & Distributors. ISBN: 9788123900131.
2. An Introduction to the Rock forming minerals by WA Deen, RA Howie & J. Zusman Longman Group Limited, Longman House. Publisher: Mineralogical Society of Great Britain & Ireland. ISBN: 9780903056274.
3. Energy Resources G.D.Rai. Publisher: Khanna Publishers. ISBN: 9788174090737.
4. Perspectives in Environmental Studies by Anubha Kaushik and C P Kaushik. (Sixth Edition). New Age International Publishers. ISBN: 9789386418630.
5. Economic Geology Economic Mineral Deposits by Umeshwar Prasad.Second edition.CBS Publishers and Distributors PVT Ltd. ISBN: 9788123904603.
Additional Reading:
1. Principles of Petrology 2 Edition by G.W.Tyrrell. AITBS Publications,India, ISBN: 9789374735275, 937473527X. Edition: 2, 2019
2. Dana's Textbook of Mineralogy by William E.Ford. Publisher: CBS Publishers & Distributors. ISBN: 9788123908090.
Reference Book(s):
1. Rutlys Elements of Mineralogy . Publisher: CBS Publishers & Distributors. ISBN: 9788123909165. 27th Edition
2. Environmental Science, S.C. Santra- Publisher New Central Book Agency (P) Ltd. ISBN: 9788173814044.
3. Principles of Engineering Geology by K.M.Bangar. Publisher: Standard Publishers.
Journal(s):
1. Journal of Groundwater for Sustainable Development, ISSN: 2352-801X
2. Journal of Nature Environment and Pollution Technology, ISSN: 2395.3454
3. *Journal of Environmental Nanotechnology, Monitoring & Managemen, ISSN: 2215-1532*
Website(s): https://onlinecourses.nptel.ac.in/noc21_ce30/preview

ENVS 2011: Air Pollution Control Lab

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

Introduction
Course objective
Course outcome

1.	Introduction to Ambient air quality standards.
2.	Meteorology parameters – Wind direction and speed, temperature, precipitation, Humidity, solar radiation
3.	Demonstration of High volume sampler
4.	Demonstration of Respirable dust sampler
5.	Dust fall jar experiment
6.	Estimation of Particulate matter in ambient air by using respirable dust Sampler.
Learning Outcomes:	
After the completion of practical sessions the student will be able to:	
	Identify the factors affecting air pollutants and demonstration of different samplers used for sampling of air.
	Estimation of particulate matter with the collection of ambient air samples.

ENVS2031: Geological Sciences and its resources Lab

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

Introduction

Course objective

Corse outcome

i.	Igneous Rocks Granite Dunite Syenite Rhyolite Gabbro Basalt Dolarite Andesite Peridotite Diorite
	Sedimentary Rocks Sand Stone, Lime Stone, Shale, Conglomerate, Coal, Brescia, Arkose.
	Metamorphic Rocks Marble, Schist, Quartzite, Gneiss, Amphibolite.
ii.	Identification of Minerals (Mega Scopic) Pyroxenes, Amphiboles, Feldspars
iii.	Identification of Economic Minerals (Mega Scopic) Bauxite, Manganese, Chromium, Iron, Lead and Zinc.
iv.	Estimation of Heavy Metals content in Ores.
Reference Text Books:	
1.	A text book of Geology by PK Mukerjee. Publisher: CBS Publishers & Distributors. ISBN: 9788123900131.
2.	An Introduction to the Rock forming minerals by WA Deen, RA Howie & J. Zusman Longman Group Limited, Longman House. Publisher: Mineralogical Society of Great Britain & Ireland. ISBN: 9780903056274.
3.	Energy Resources G.D.Rai. Publisher: Khanna Publishers. ISBN: 9788174090737.
4.	Perspectives in Environmental Studies by Anubha Kaushik and C P Kaushik. (Sixth Edition). New Age International Publishers. ISBN: 9789386418630.
5.	Economic Geology Economic Mineral Deposits by Umeshwar Prasad.Second edition.CBS Publishers and Distributors PVT Ltd. ISBN: 9788123904603.
Additional Reading:	
1.	Principles of Petrology 2 Edition by G.W.Tyrrell. AITBS Publications,India, ISBN: 9789374735275, 937473527X. Edition: 2, 2019
2.	Dana's Textbook of Mineralogy by William E.Ford. Publisher: CBS Publishers & Distributors. ISBN: 9788123908090.
Reference Book(s):	
1.	Rutlys Elements of Mineralogy . Publisher: CBS Publishers & Distributors. ISBN: 9788123909165. 27th Edition
2.	Environmental Science, S.C. Santra- Publisher New Central Book Agency (P) Ltd. ISBN: 9788173814044.
3.	Principles of Engineering Geology by K.M.Bangar. Publisher: Standard Publishers.

	Programme Objectives (POs)												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1															
CO2															
CO3															
CO4															
CO5															

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

ENVS2041: Environment and Microbiome Interactions

L	T	P	S	J	C
3	0	0	0	0	3

This course aimed to focus on miniscule organisms which rule the world. Makes the student understand a group of microbes in a better way. This course gives information about fundamentals of microbiology, microbial ecology and microbial relationships. This course gives insights to students about how microbes are friends as well as foes to human beings.

Course Objectives

- To impart knowledge on the role of historians in the field of microbiology and classification of living organisms to learners.
- To familiarize learners with salient features of microbes and internal structure of cells.
- To introduce learners about air and water microbes.
- To acquaint learners with microbial relationships and their role in agriculture.
- To make learners understand about food and milk microbiology.

UNIT - I	**Introduction to Microbes and its Classification**	**No of Hours: 12**
Microorganisms: Definition and history. Contributions of Antony Van Leeuwenhoek, Louis Pasteur, Alexander Fleming and Robert Koch. Importance and application of Environmental Microbiology.		
Outline classification of living organisms: Binominal nomenclature, two kingdom, three kingdom, four kingdom and five kingdom. Differences between Prokaryotes and Eukaryotes.		
Learning Outcomes:		
After Completion of this Unit Student will be able to		
•	Define microbiology. (L1)	
•	List applications of environmental microbiology. (L1)	
•	Find the inventions of scientists in the field of microbiology. (L1)	
•	Recall different types of classification of living organisms. (L1)	
•	Classify between prokaryotes and eukaryotes. (L2)	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading.		
UNIT - II	**General Account of Microbes**	**No of Hours:10**
Microorganisms –General characteristics and economic importance of Bacteria, Algae and Fungi. Salient features of Viruses and Protozoa. **Ultra-structure of bacterial cell** -size, shape and arrangement. Structure, lytic and lysogenic cycles of Bacteriophage.		
Learning Outcomes:		
After completion of this unit, the student will be able to		
•	Explain general characteristics of and economic importance of bacteria. (L2)	
•	Summarize the economic importance of algae and fungi. (L2)	
•	Outline the salient features of viruses and protozoa. (L2)	
•	Interpret the size and shape of a bacterial cell. (L2)	
•	Identify structure of lytic and lysogenic cycles of bacteriophage. (L3)	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading.		
UNIT - III	**Microbes and Environment**	**No of Hours: 10**
Air Microbiology: Air-borne microbes, impact of Air-borne microorganisms on living beings, sampling of air -borne microorganisms and control of air-borne microorganisms.		
Aquatic microbiology: Water-micro flora, sampling of water-microorganisms.		
Soil microbiology: Soil components and microorganisms, sampling of soil-microorganisms. Humus and its significance.		
Epidemiology of Tuberculosis, AIDS and Malaria		
Learning Outcomes:		
After the completion of Unit, the student will be able to		
•	Apply the concepts of how to control air borne microbes. (L3)	

•	Develop sampling techniques for water microbes (L3)	
•	Experiment with soil components and microorganisms. (L3)	
•	Solve the problems associated with epidemiology of tuberculosis (L3)	
•	Analyse the epidemiology of AIDS and Malarial diseases. (L4)	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading.		
UNIT - IV	**Microbial Links**	**No of Hours: 10**
Microbial relationships: Mutualism (Rhizobium-legume association, Mycorrhizae and lichens), Commensalism, Amensalism, Parasitism and Predation		
Microorganisms in Agriculture: Biological Nitrogen fixation, Biofertilizers (Bacteria and Algae) and microbial insecticides (BT). Microbes in sewage treatment.		
Learning Outcomes:		
After the completion of Unit IV, the student will be able to		
•	Assume the mutualism association of rhizobium and legume. (L4)	
•	Discover Commensalism in microbial relationships. (L4)	
•	Distinguish between Amensalism, parasitism and predation. (L4)	
•	Examine microbe's role in biological nitrogen fixation. (L4)	
•	Agree the role of microbes in sewage treatment. (L5)	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading.		
UNIT - V	**Microbes Role in Food and Milk**	**No of Hours:08**
Food Microbiology: Role of Microorganisms in Food Spoilage (contamination of Plant Food Products, Animal Food Products and Processed Foods). Food Preservation processes.		
Milk Microbiology: Sources of Microorganisms in milk, Microbiological examination of milk. Pasteurization.		
Learning Outcomes:		
After the completion of Unit V, the student will be able to		
•	Determine food preservation processes. (L5)	
•	Conclude the role of microorganisms in food spoilage (L5)	
•	Measure the microflora of milk. (L5)	
•	Evaluate microbial examination of milk. (L5)	
•	Discuss the types of pasteurization techniques. (L6)	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading.		
Textbook(s):		
1. Willey J., Sandman K and Wood D. Prescott Microbiology, 11 edition, McGraw Hill, International edition. 2020.		
2. Ananthanarayan R and Paniker C.J. TextBook of Microbiology, 11 edition, University Press (India) Pvt.Ltd. 2020.		
Additional Reading		
Reference Book(s):		
1. Madigan M.T., Martinko J.M., Bender K.S., Buckley D.H and Stahl D.A. Brock Biology of Microorganisms, 14 edition, Pearson, 2014.		
2. Pelczar M.J., Chan E.C.S and Krieg N.R. Microbiology, 5th edition, McGraw Hill Education, 2001.		
3. Raju P.V.R and Krishna M.K.V.S.G. Environmental Sanitation - Social and Preventive Medicine, Environmental Protection Agency.		
Journal(s):		
1. Indian Journal of Microbiology		
Website(s):		
1. www.coursera.org/learn/algae		
2. www.coursera.org/learn/protists-evolution-ecology-microbial-eukaryotes		

	Programme Objectives (POs)												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1			1									1		
CO2			1			2			3						
CO3		2		2						1		3		2	
CO4	1	2								1				1	
CO5							2								2

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

ENVS2051: Environment and Microbiome Interaction Lab

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

This course enables the students to acquire knowledge on various aspects of environmental microbiology. The course focuses on using different instruments, sterilization techniques. The knowledge gained in this course can be applied to enumerate different microbes by simple techniques.

Course Objectives

- To recall principles and working procedures of various instruments.
- To illustrate sterilization techniques and sterilising materials.
- To demonstrate culture media.
- To introduce liquid media.
- To train staining procedures.

Specific Instructional Objective

1. To learn how autoclave works.
2. To learn how laminar air flow works.
3. To demonstrate the function of inoculating loop and petri dishes.
4. To learn sterilization and wrapping of glassware.
5. To understand the use of cotton plugging, gloves, lab coats in environmental microbiology lab.
6. To understand nutrient agar as a source to isolate microbes.
7. To experiment with Eosin methylene blue agar to isolate specific bacteria.
8. To learn how to use nutrient broth.
9. To understand how to use lactose broth.
10. To take part in the identification of spots.
11. To estimate simple staining.
12. To learn staining to differentiate between Gram positive and Gram negative bacteria.

Environmental microbiology laboratory protocol.
Principle and working autoclave.
Principle and working of laminar air flow.
Working of inoculating loop and petri dishes.
To demonstrate Sterilization and wrapping of glassware
The function and the importance of cotton plugging, lab coats, gloves.
Estimation of microbes with nutrient agar.
Determination of specific microbe with eosin methylene blue agar.
Estimation of microbes with nutrient broth.
Determination of microbes with lactose broth.
Estimation of bacteria with simple staining.
Determination of Gram's staining.
Identification of spots
Text Books:
Johnson T, Case C.L. Laboratory Experiments in Microbiology. Pearson Publishers. Edition 10. 2012.
Reference Book(s):
Johnson T, Case C.L. Laboratory Experiments in Microbiology. Pearson Publishers. Edition 10. 2012.

	Programme Objectives (POs)												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1														1
CO2												1		2	
CO3							2						1		
CO4				2											1
CO5										2				2	

ENVS 3001: Solid Waste Management and Soil Pollution

L	T	P	S	J	C
3	0	0	0	0	3

Introduction

Course objectives:
This paper explains waste generation in society, types of solid wastes, segregation of materials, hazardous waste management and waste landfills and also soil pollution.

Course Outcomes:
After the completion of this course, student will be able to:

- Types and composition of solid wastes, factors influencing generation of solid wastes and methods for disposal of solid wastes.
- Methods of composting, recycling and reuse of materials, classification of hazardous wastes properties of soil, sources, types of soil pollution and its control methods.

UNIT - I		
Municipal solid waste Definition - Sources and types of solid waste- composition and its determinants of Solid waste-factors influencing generation-quantity assessment of solid wastes-methods of sampling and characterization. Collection and transfer of Municipal Solid Waste.		
Learning Outcomes:		
Upon completion of the unit a student will be able to understand the types and composition of solid wastes and factors influencing the generation of municipal solid waste		
UNIT - II		
Disposal of Solid Wastes: Refuse disposal – various methods – incineration – principle features of an incinerator – site selection and plant layout of an incinerator - sanitary landfill- methods of operation – advantages and disadvantages of sanitary land fill - site selection – reactions accruing in completed landfills – gas and leachate movement and control – equipments necessary		
Learning Outcomes:		
Upon completion of the unit a student will be able to understand the methods and equipment needed disposal of solid wastes.		
UNIT - III		
Composting: Principle – types- factors affecting compost process- mechanical composting methods. Reuse and recycling of paper, glass, rubber. Plastic waste status in India. Effect of plastic wastes on environment, management of plastic waste.		
Learning Outcomes:		
Upon completion of the unit a student will be able to understand the process and methods of composting, recycling and reuse of materials and plastic waste status in India.		
UNIT - IV		
Hazardous waste Management: Sources and classification of hazardous wastes – Storage and collection of hazardous wastes – Treatment and disposal techniques: Physical, chemical and biological - Protection of public health and the environment. Biomedical wastes – Types – Management and handling and control. Radioactive wastes- sources and types - control and management.		
Learning Outcomes:		
Upon completion of the unit a student will be able to understand the sources and classification of hazardous wastes and their management practices.		
UNIT - V		
Soil Pollution – Physical, Chemical, Mineralogical and Biological properties of soil, sources of soil pollution, Pollution and residual toxicity from the application of insecticides, pesticides and fertilizers; Soil erosion and land degradation. Control of Soil pollution.		
Learning Outcomes:		
Upon completion of the unit a student will be able to understand the properties of soil, sources and types of soil		

pollution and its control methods.
Reference Book(s):
1. George Techobanoglous and Frank, K**.** Handbook of Solid Waste Management, Second Edition, Mc GRAW-HILL.
2. George Techobanoglous et al, ―Integrated Solid Waste Management‖ Mc Graw - Hill.
3. Techobanoglous Thiesen Ellasen; Solid Waste Engineering Principles and Management, Mc Graw – Hill.
4. Manual on Municipal Solid waste Management, CPHEEO, Ministry of Urban Development, Govt. of. India, New Delhi.
5. Blide A. D. & Sundaresan, B. B, ―Solid Waste Management in Developing Countries, INSDOC.

ENVS 3021: Environmental Impact Assessment

L	T	P	S	J	C
3	0	0	0	0	3

Introduction

Course Outline:
To make the students understand the concept of Environmental Impact Assessment. They become familiar with the Environmental Impact Assessment Methodology and its application. The students also understand the Disaster management plan (on site & offsite). The course is designed to enable the student to learn about Environmental management system (EMS) along with its standards including ISO 14000 series and ISO 14001.

Course outcomes:

- Student will gain knowledge on the concepts and principles of EIA and EIA notification, 2006.
- Student will be able to know the types of impacts, components and procedures of EIA and Environmental Management Plan.
- Student will be able to know about pollution control norms and coastal regulation zone.

UNIT - I		
EIA – Introduction -Definition – Basic concepts and principles of EIA – Origin and development of EIA - Short-term and Long-term objectives – EIA guidelines 2006 (Notification of Government of India) — Merits and Demerits of EIA.		
Learning Outcomes:		
Upon completion of the unit a student will gain knowledge on concepts and principles of EIA and EIA notification, 2006.		
UNIT - II		
Basis for Environment Impact Assessment – Types of impacts (Negative & Positive, Primary & Secondary, Reversible and Irreversible Tangible and Intangible) Components of EIA: Screening of Projects - Public Participation - Preparing environmental impact statements.		
Learning Outcomes:		
Upon completion of the unit a student will be able to understand the types of impacts and components of EIA.		
UNIT - III		
EIA Methodologies: Adhoc Method – Checklist Approach – Matrix Methods – Network Methods - Environmental Management Plan.		
Learning Outcomes:		
Upon completion of the unit a student will gain knowledge on the procedures of EIA and Environmental Management Plan.		
UNIT - IV		
Disaster Management plan on site & off site, Environmental Auditing: Scope, Objectives and Procedures for environmental auditing. Environmental Management System (EMS): EMS standards, The ISO 14000 series, The ISO 14001.		
Learning Outcomes:		
Upon completion of the unit a student will be able to understand the process of disaster management and the procedure of environmental auditing an Environmental Management System.		
UNIT - V		
Pollution control norms at source – Coastal Zone Regulation restrictions – Zoning atlas – Medium related standards (Ambient standards)		
Learning Outcomes:		
Upon completion of the unit a student will be able to understand pollution control norms at source and Coastal zone regulation and its management.		

Reference Book(s):
1. Fundamentals of Ecology, E.P. Odum, W.B. Saunders & Co.
2. Das, R.C. and Behera, D.K. Environmental Science – Principles and practice, PHI, New Delhi.
3. Y. Anjaneyulu Environnemental Impact Assessment Methodologies , B. S. Publications
4. Sherman, J. Rosen, Manual for Environmental Impact Evaluation. Prentice Hall, New Jersey.
5. Erickson, P.A. Environmental Impact Assessment Principles and Applications.
6. Canter LW. Environmental Impact Assessment. Mc Graw Hill, New York.

ENVS 3011: Solid Waste Management and Soil Pollution Lab

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

Introduction
Course objective
Course outcomes
Upon the completion of laboratory sessions the student will be able to:

- Analysis of physico-chemical characteristics of solid waste.
- Estimation of organic and inorganic fractions of solid waste.
- Biological analysis of solid waste.

1.	Determination of Physical characteristics of solid waste :
	a) Particle size; Temperature; pH; Conductivity and bulk density
2.	Determination of Chemical characteristics of solid waste – Nitrogen, Phosphorus, Potassium and Heavy metals (selected).
3.	Estimation of organic and Inorganic fraction of solid waste.
4.	Determination of moisture in solid wastes.
5.	Determination of biological analysis of solid waste.

ENVS 3031: Environmental Impact Assessment Lab

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

Introduction
Course objective
Course Outcome:
Upon completing the laboratory sessions the student will be able to:

- Comparative case studies of different areas using different procedures of EIA.
- Measurement of noise levels and air sampling in different areas.
- Analysis of various effluents from industries.

1.	Comparative analysis of air sampling from clean and polluted area using key Parameters.
2.	Collection and Interpretation of weather data and development of wind roses.
3.	Measurement of noise in silent, industrial, residential and commercial areas.
4.	Effluent analysis (available effluent)
5.	Case Study – At least One Situation – a) Questionnaires; b) Data Collection and Generation; c) Integration of Data and Analysis

ENVS 3041: Industrial Safety

L	T	P	S	J	C
3	0	0	0	0	3

Introduction

Course outline

Through the course content, you will learn more about safety, incident management, risk reduction and crowd management along with other principles that relate to law enforcement and public protection. In the event of any emergency conditions the role of Industrial safety cannot be overemphasized. When major accidents, state of emergency is declared, the public looks to trained individuals for guidance, comfort and a course of action. The priority is always to save lives and ensure public stability at all times.

Course outcome

Upon completion of the course a student will be able to understand the concept and need of safety management. The gained knowledge will help to deal with major accidents, state of emergency. The public also looks to trained individuals for guidance, comfort and a course of action.

UNIT - I		
Safety: Introduction, importance of the safety, Principles of industrial safety, definition – Accident, Incident, Hazard, explosion, Contamination, Fire, protection, housekeeping, safe measures. Safety training and education.		
Learning Outcomes:		
Upon completion of the unit a student will be able to gain knowledge on importance of safety, principles of industrial safety and safety education.		
UNIT - II		
Occupational Health: Concept of health and occupational health, Spectrum of health, Occupational and work related diseases, Levels of prevention, History of occupational health, Characteristics of occupational diseases, Essentials of occupational health service, personal protective equipments (respiratory and non-respiratory).		
Learning Outcomes:		
Upon completion of the unit a student will be able to know occupational health disorders and protective equipment needed during occupation.		
UNIT - III		
Hazards in work places – Safety in Process plants: Nature and types of work places, type of Hazards, hazards due to improper housekeeping, workers exposure to hazardous chemicals, Physical and chemical properties of chemical leading to accidents like fire, explosion, ingestion and inhalation – atmospheric pollution, dangers of dusts, fumes, vapors in work spots., Noise and Vibration hazards.		
Case studies - Hazards peculiar to the following industries: Thermal Power plants, Steel industry, Mining Industry, Fertilizers.		
Learning Outcomes:		
Upon completion of the unit a student will be able to gain knowledge hazards in work place and hazards of improper housekeeping and their related case studies.		
UNIT - IV		
Control of Fire Hazards Factors contributing towards fire. Chemistry of fire. Classification of fires. Common causes of industrial fires. Determination of fire load. Fire resistance of building materials. Design of building plant, exits, etc. for fire safety. Prevention of fire. Portable extinguishers. Water systems, carbon-di-oxide systems. Foam extinguisher system. Dry chemical extinguishing system. Industrial fire detection and alarms. Sprinkle systems.		
Learning Outcomes:		
Upon completion of the unit a student will be able to gain knowledge on factors contributing fire hazards and equipment used to control fire hazards.		

UNIT - V		
Safety Management: Management: Concept, definition, nature and importance, Role and functions of a manager, Elements and functions of Management. Management Principles: Authority, responsibility & power of Management, Span of Control. Delegation and decentralization of authority. General principles of Management.		
Learning Outcomes:		
Upon completion of the unit a student will be able to gain concept of safety management and the gained knowledge will help and general principles of management.		
Reference Book(s):		
1. R.K.Jain and Sunil S.Rao, Industrial Safety, Health and Environment Management Systems, Khanna publishers, New Delhi.		
2. Slote.L.Handbook of Occupational Safety and Health, John Willey and Sons, New York.		
3. Frank P. Lees, Loss of prevention in Process Industries, Vol. 1 and 2, Butterworth-Heinemann Ltd., London.		
4. Industrial Safety -National Safety Council of India.		
5. The Factories Act with amendments 1987, Govt. of India Publications DGFASLI, Mumbai		
6. Grimaldi and Simonds, Safety Management, AITBS Publishers, New Delhi.		
7. Industrial Safety and pollution control handbook: National Safety Council and Associate publishers Pvt. Ltd, Hyderabad.		
8. Handbook of Environmental Health and Safety: Herman Koren and Michel Bisesi, Jaico Publishing House, Delhi.		

ENVS 3051: Industrial Safety Lab

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

Introduction

Course objective

- To provide opportunity to operate the equipment to acquire practical knowledge.
- To know the various PPEs.
- To carry out experiments to find out the environmental parameters.
- Case Studies of National and International Industrial Accidents
- Field Visits / Industrial Visits.

Course outcomes

- This course would make students to know and run the various equipment's to bring out the safety environment in the industry.
- Course would be helpful for the students to measure the particulate matter and assess the impact of air pollution.
- Students would be trained to conduct experiments to find out various environmental parameters. Students would be able to use personal protective equipment in-dependently.

NOISE LEVEL MEASUREMENT AND ANALYSIS Measurement of sound pressure level in dB for Impact, continuous and intermittent sources.
ENVIRONMENTAL PARAMETER MEASUREMENT Dry Bulb Temperature, Wet Bulb Temperature, Determination of relative humidity, wind flow. Particle size Measurement Air sampling analysis.
TRAINING IN USAGE AND SKILL DEVELOPMENT Personal protective equipment: Respiratory and non-respiratory-demonstration-self-contained breathing apparatus. Safety helmet, belt, hand gloves, goggles, safety shoe, gum boots, ankle shoes, face shield, nose mask, ear plug, earmuff, anti-static and conducting plastics/rubber materials, apron and leg guard.
Field Visits / Industrial Visits Fire extinguishers and its operations Water, Co_2, Foam, Carbon dioxide (Co_2) Dry chemical powder and currently amendment fire safety systems
TECHNICAL SEMINAR: (Case Studies of National and International Industrial Accidents) **OBJECTIVE**: To enrich the communication skills of the student through presentation of topics in recent advances in Industrial safety engineering/technology
Learning outcomes: Students will develop skills to read, write, comprehend, and present research papers. Students shall give presentations on recent areas of research in industrial safety engineering. Depth of understanding, coverage, quality of presentation material and communication skill of the student will be taken as measures for evaluation. Note: Any other experiment as per the syllabus of theory courses and approval of the faculty.

ENVS2061: Biodiversity Conservation

L	T	P	S	J	C
3	0	0	0	0	3

Biodiversity conservation gives a scope to understand the importance of Biodiversity, focuses on levels of biodiversity, value of Biodiversity, Biogeographical Classification of India, major threat to biodiversity and conservation strategies.

Course Objectives

- To enable the student to better understand the definition of Biodiversity, components and levels of biodiversity.
- To create awareness about the Biogeographical Classification of India including major biomes, hotspots.
- It helps in attaining the knowledge on threat to biodiversity, endangered and endemic species of India, finally concluding with biodiversity conservation.

Course Outcomes

After reading this paper the student –

- Adds theoretical knowledge on biodiversity conservation including general importance, type's levels and value of biodiversity.
- Knowledge enhances on Values and ethics in biodiversity conservation, protected area networks.
- The thinking ability increases on the conservation of biodiversity, wildlife, Biosphere reserves and finally mangrove conservation.

UNIT - I		
Biodiversity: Definition; Concepts and components of biodiversity, Levels of Biodiversity: Genetic, Species, Ecological. Types of Biodiversity: (Diversity Indices)- Alpha (α), Beta (β), Gamma (γ) Diversity; Biodiversity as an important resource, value of biodiversity: Consumptive value, Productive Value, Social value, Ethical value, Aesthetic value, optional value.		
Learning Outcomes:		
The student achieves basic knowledge on the concept and components of biodiversity including its Consumptive value, Productive Value etc		
UNIT - II		
Biogeographical Classification of India: Geography and major biomes, climate, wetlands, forests. Biodiversity at Global, National Levels, India as a mega diversity nation, Hot spots of biodiversity in the world.		
Learning Outcomes:		
The student gains information on Biogeographical Classification of India, India as a mega diversity nation, major biomes and hotspots		
UNIT - III		
Threat to Biodiversity – Habitat loss, Wild life conservation and Poaching of wild life, Man – wild life Conflicts, Threat to Indian Biodiversity Endangered Flora and Fauna of India – Reasons for Loss of Biodiversity, Endangered and Endemic species of India.		
Learning Outcomes:		
The student gets familiar with important concepts like threat to biodiversity, poaching of wildlife etc.		
UNIT - IV		
Conservation of biodiversity: Biodiversity Conservation Strategies, In-situ and Ex-situ conservation. Wildlife reserves in India, Protected Areas Network of India, National Parks and Sanctuaries, Management of Germplasm collection, Biopiracy of Indian flora, Eco planning Responsibilities.		
Learning Outcomes:		
The attention of the student increases on the conservation of biodiversity, types of conservation namely In-situ and Ex-situ conservation and protected area network		

UNIT - V		
Endangered Wildlife – Special Projects for Endangered Wildlife, Biosphere Reserves, Mangroove Conservation. Biological Diversity Act (2002 in force), National Biodiversity Authority, Biopiracy, Convention on Biological Diversity (CBD) and its milestones.		
Learning Outcomes:		
The thinking ability increases on the conservation of biodiversity, wildlife, Biosphere reserves and finally mangrove conservation.		
Reference Books:		
1. Environmental Science by S. C. Santra. New Central Book Agency (P) Ltd.,		
2. Ecology & Environment by P.D. Sharma. 10th edition – Rastogi Publications; Meerut		
3. Environment Problems & Solutions by D.K.Asthana and Meera Asthana; S.Chand & Company Ltd.		
4. Introduction to Environmental Science by Y.Anjaneyulu. BS Publications.3rd Edition reprint		

ENVS2071: Biodiversity Conservation Lab

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

This course enables the students to acquire knowledge on various aspects of Biodiversity and Conservation. The course focuses on using different methods for biodiversity assessment. The knowledge gained in this course can be applied to understand the biodiversity of the studied area.

COURSE OBJECTIVES

- To assess the biodiversity of the area.
- To illustrate Abundance of flora and fauna.
- To demonstrate richness of flora and flora.
- To introduce floral diversity of the area
- To estimate alpha diversity of the area
- To estimate Beta diversity of the area.
- To survey birds diversity in an area

Specific Instructional Objective

- To learn survey for biodiversity.
- To learn abundance of flora and fauna.
- To demonstrate the richness.
- To learn floral diversity.
- To understand species diversity in an area.
- To understand pond ecosystem diversity.
- To experiment with aquatic alpha biodiversity.
- To learn alpha and beta diversity.

1. Understanding biodiversity survey
2. Determination of abundance of flora
3. Determination of abundance of fauna
4. Estimation of richness of biodiversity.
5. Determination of floral diversity
6. Determination of species diversity
7. Determination of aquatic alpha diversity
8. Estimation of alpha diversity
9. Determination of beta diversity
10. A study of pond ecosystem biodiversity
11. Determination of the biodiversity register
12. Survey of zoological park
Text Books:
An Advanced Textbook On Biodiversity: Principles And Practice K.V. Krishnamurthy
Additional Reading
Reference Book(s):
Biological Diversity: Exploiters And Exploited by Paul E. Hatcher , Nick Battey, John Wiley & Sons Inc

ENVS2081: Environmental Problems in Indian Context

L	T	P	S	J	C
3	0	0	0	0	3

The course focusses on various contemporary environmental problems in India, means, methods and technologies to manage and combat these problems. It also emphasizes on the environmental laws in India that help in dealing with various environmental issues. It also provides an insight to the previous environmental issues and how they were addressed through case studies so as to gain knowledge and apply some concepts for addressing the current issues.

Course objective

- To familiarize various contemporary environmental concerns, their causes and consequences.
- To learn lessons from previous environmental movements taken place in India
- To appreciate the environmental movements and the way they were addressed.
- To grasp legislative measures available in India towards addressing environmental issues
- To appreciate green benches and their efforts towards resolving environmental issues at possible earliest.
- To review, extract and learn case studies judged by green benches.

Course outcomes

- Gain acquaintance with contemporary environmental concerns, their causes and consequences.
- Summarize key points from previous environmental movements taken place in India
- Gain insights to the environmental movements and the way they were addressed.
- Understand legislative measures available in India towards addressing environmental issues
- Learn and understand importance of green benches and their efforts towards resolving environmental issues at possible earliest.
- Appreciate and note case studies judged by green benches.

UNIT – I	**Land Degradation**	No of Hours:12
Land degradation: Land use pattern in India, causes of land degradation, environmental consequences of land degradation: soil erosion, desertification, Salination and water logging. Control of land degradation.		
Waste Lands: Causes of waste land formation and reclamation of waste lands. Wetlands: Importance and types of wetlands and their management		
Learning Outcomes:		
After completion of this unit, the student will be able to		
•	Understand the process and causes of land degradation.	
•	Comprehend in detail various environmental consequences of land degradation.	
•	Recognize and analyse the control methods available for land degradation.	
•	Cognize the process of formation of waste lands.	
•	Appreciate the importance of wetlands.	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading		
UNIT – II	**Forests and Dams**	No of Hours:12
Forest – Significance of forest. Deforestation: Causes and consequences of deforestation. Dimensions of deforestation in India. Forest Management: Social forestry and joint forest management.		
Environmental consequences of Dams. Mining: Types of mining (brief). Environmental consequences of Mining and control methods		
Learning Outcomes:		
After completion of this unit, the student will be able to		
•	Understand significance of forests and causes leading to deforestation	
•	Recognize the consequences of deforestation and grasp the deforestation status in India.	

•	Appreciate the concepts and working of social forestry and joint forest management.	
•	Empathise the consequences of large dams.	
•	Apprehend consequences of mining and realize control methods.	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading		
UNIT – III	**Global Warming**	No of Hours:12
Global Warming and Green House Effect: Greenhouse gases and global climate changes, impact of Global warming. Control measures for Global Warming.		
Ozone depletion: importance of Ozone, causes for Ozone depletion and ozone depleting substances, consequences of Ozone depletion, Ozone hole, alternate measures to mitigate Ozone depletion. Acid rain: causes of acid rain, impact of acid rain and mitigation of acid rain problems.		
Learning Outcomes:		
After completion of this unit, the student will be able to		
•	Comprehend the process and causes leading to global warming.	
•	Recognize the consequences of global warming and evaluate the available control methods.	
•	Cognize process and causes leading to depletion of ozone layer and acid rain.	
•	Identify and grasp the nature of ozone depletion substances.	
•	Identify and evaluate the mitigation measure available for ozone layer depletion and acid rain.	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading		
UNIT – IV	**Environmental Movements**	No of Hours:12
Environmental movements: Major environmental movements in India. Chipko movement, Silent Valley movement, Appiko movement, Narmada Bachavo Andolan and Tehri Dam conflict.		
International agreements: Earth Summit, Convention of biodiversity and United convention on climate change.		
Learning Outcomes:		
After completion of this unit, the student will be able to		
•	Gain knowledge on environmental movements in India.	
•	Learn lessons from previous environmental movements in India.	
•	Comprehend the contemporary environmental issues in India.	
•	Appreciate the international agreements put forth for protection of environment.	
•	Absorb details of United convention on climate change.	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading		
UNIT – V	**Environmental Legislation**	No of Hours:12
Environmental Legislation: Environmental Laws in India. Objective of the Act, Definition of pollution under the Act and Power and functions of boards of the following Acts: The Wildlife (protection) Act, 1972, amended in 1983, 1986, 1991 and 2010. The Water (Prevention and Control of Pollution) Act, 1974, amended in 1988, The Forest (Conservation) Act, 1980, amended in 1988, The Air (Prevention and Control of Pollution) Act, 1981, amended in 1988, The Environment (Protection)Act, 1986, The Motor Vehicles Act, 1938, amended in 1988.		
A Notification on Coastal Regulation Zone, 1991. Green benches: Structure and functions of green bench.		
Learning Outcomes:		
After completion of this unit, the student will be able to		
•	Appreciate environmental laws in India.	
•	Recognize the Power and functions of boards of Acts towards protection of environment.	
•	Cognise the importance and amendments of the acts.	
•	Appreciate the notification of coastal regulation zone.	
•	Comprehend structure and functions of green benches.	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading		
Text Book(s)		
1. ***Environmental Law in India by P. Leela Krishnan, 2016. 1st Edition. LexisNexis, India. ISBN 13: 978-9350357200***		
2. Exploring Environmental Issues an Integrated Approach by David D. Kemp. 2004. 1st Edition. Routledge, London. 9780415268639		

Additional Reading

1. Environmental Management Problems and Solutions by Louis Theodore, R. Ryan Dupont, Terry E. Baxter. 2020. 3rd Edition, CRC Press, 9780367579296

Reference Book(s):

1. Environmental Movements of India - Chipko, Narmada Bachao Andolan, Navdanya by Krishna Mallick. 2021. 1st Edition. Amsterdam University Press. Amsterdam. ISBN: 9789462984431

Journal(s):

1. Brown, D., Boyd, D. S., Brickell, K., Ives, C. D., Natarajan, N., & Parsons, L. (2021). Modern slavery, environmental degradation and climate change: fisheries, field, forests and factories. Environment and Planning E: Nature and Space, 4(2), 191-207.
2. Verma, A. (2021). Law Of Environment in India: Problems and Challenges in Its Enforcement. Research Ambition: An International Multidisciplinary e-Journal, 6(II), 17-26.

Website(s):

1. https://wri-india.org
2. http://www.indiaenvironmentportal.org.in/

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

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

ENVS2091 Environmental Problems Indian context Lab

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

This course enables the students to acquire knowledge on various aspects of environmental problems in Indian context. The course focuses on using different instruments, techniques. The knowledge gained in this course can be applied to enumerate different current issues related environmental problems.

Course Objectives

7. To recall principles and working procedures of various instruments.
8. To illustrate different techniques and procedure.
9. To demonstrate longitudinal studies.
10. To introduce EC of different samples.
11. To train analysis for soil and forest samples.

Estimation of bulk density of degraded land.
Estimation of soil pH, Soil Temperature of degraded land.
Determination of tree growth by visual observation.
Determination of Longitudinal studies of a biodiversity region.
Case study on status of forest resources in India
Determination of different rays absorb and emit at varying strengths.
Determination of Carbon dioxide content in collected sea water.
Determination of EC of collected sea water
Estimation of plant species in university campus
Case study on recent environmental movements
Text Books
Clesceri.L.S., Greenberg A.E., Eaton A.D. 2020. Standard methods for the estimation of water 20th edn.
Additional Reading
Reference Book(s):
Clesceri.L.S., Greenberg A.E., Eaton A.D. 2020. Standard methods for the estimation of water 20th edn.

	Programme Objectives (POs)												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1														1
CO2												1		2	
CO3							2						1		
CO4				2											1
CO5										2				2	

ENVS2101: Industrial Waste Management

L	T	P	S	J	C
3	0	0	0	0	3

This course aimed to focus on industrial waste to reduce the entry of toxic pollutants and hazardous substances into air, water and soil. Makes the student understand various sources of industrial waste and their effects on environment. This paper highlights various characteristics of industrial waste discharges. This course also focuses on the management of Industrial waste with latest technology.

Course Objectives

- To impart knowledge on the role of historians in the field of microbiology, classification of living organisms and make learners understand the role of nutrients and their uptake.
- To familiarize learners the use of tools and different techniques to understand environmental microbiology.
- To introduce learners about control of microorganisms.
- To acquaint learners with milk microbiology and different milk handling techniques.
- To make learners understand about food microbiology.

UNIT - I	**Introduction to Industrial Waste**	**No of Hours: 08**
Sources of industrial waste [manufacturing unit, processing unit, fabrication unit], types of industrial waste [solid, liquid, gaseous], principles of industrial waste management, effects of industrial waste on environment and human health.		
Learning Outcomes:		
After Completion of this Unit Student will be able to		
•	Find the sources of industrial waste.	
•	Tell the types of waste.	
•	Relate the principles of industrial waste management.	
•	Explain effects of industrial waste on environment and human health.	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading		
UNIT - II	**Treatment of Industrial Waste**	**No of Hours:10**
Characteristics industrial waste, collection and segregation of industrial waste [solid, liquid], primary treatment of industrial waste [screens, grit chamber, Coagulants, Flocculants], theories of neutralization, equalization and proportioning, Housekeeping.		
Learning Outcomes:		
After completion of this unit, the student will be able to		
•	Classify the characteristics of industrial waste.	
•	Summarize the collection and segregation of industrial waste.	
•	Demonstrate the treatment of industrial waste.	
•	Interpret the theories of neutralization.	
•	Identify housekeeping in industry.	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading		
UNIT - III	**Cleaner Production**	**No of Hours: 10**
Threat to Biodiversity – Habitat loss, Wild life conservation and Poaching of wild life, Man – wild life Conflicts, Threat to Indian Biodiversity Endangered Flora and Fauna of India – Reasons for Loss of		

Biodiversity, Endangered and Endemic species of India.		
Learning Outcomes:		
After completion of this unit, the student will be able to		
•	Choose different terms used in waste audit.	
•	Develop removal of suspended colloids.	
•	Identify dissolved organic solids and in organic dissolved solids.	
•	Analyse recovery and disposal of sludge.	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading		
UNIT - IV	**Advanced Technology**	**No of Hours: 12**
Membrane Techniques [Ultra filtration, Nanofiltration], phytocatalytic degradation, microbial degradation, ceramic membrane], Selective Catalytic Reduction system, air-Biofilter (mechanism and working), industrial waste incinerator.		
Learning Outcomes:		
After completion of this unit, the student will be able to		
•	Assume the membrane techniques	
•	Discover photocatalytic degradation.	
•	List selective catalytic reduction system.	
•	Agree the role of industrial waste incinerator.	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading		
UNIT - V	**Major industries**	**No of Hours:10**
Manufacturing processes, flow sheets, characteristics and composition of wastes including waste reduction, treatment and disposal methods of major Industries: Sugar, Steel mills, Textile, Dairy, Paper and Pulp and Oil refinery.		
Learning Outcomes:		
After completion of this unit, the student will be able to		
• Determine the manufacturing process of sugar industry.		
• Estimate the flow sheets of steel mills.		
• Agree with textile industry.		
• Discuss paper and pulp and oil refinery industry.		
Pedagogy tools: Blended learning, Case let, video lectures, self-reading		
Reference Books:		
1. Waste and wastewater technology, Mark, JH. John Wiley and Sons, New York.		
2. Water and wastewater analysis, B.B. Sundaresan, NEERI, Nagpur.		
3. Standard methods for examination of Water and wastewater, APHA, American Water work Association, Water pollution control federation, New York.		
4. Industrial Waste Management, M.N. Rao and A.K. Datta.		
Textbook(s):		
1. Willey J., Sandman K and Wood D. Prescott Microbiology, 11 edition, McGraw Hill, International edition. 2020.		

	Programme Objectives (POs)												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1											1	1		
CO2		2												1	
CO3			1								1				1
CO4					2									2	
CO5							3			1			2		

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

ENVS2121: Environmental Toxicology

L	T	P	S	J	C
3	0	0	0	0	3

Course Objectives:

The main objectives of this paper is to make student aware of the concept of toxicology, history, toxicology tests, exposure to toxicants, bioaccumulation and biomagnification, heavy metals in the environment, radiation and its health effects.

Course Outcomes:

- Student will be able to understand the concepts of ecotoxicology and toxic substances, their entry and environmental impacts.
- Student will be able to understand dose response relationship, heavy metals, pesticides and fertilizers and their biomagnification.
- Student will be able to understand the methods to assess toxicity and classification of toxic materials.

UNIT - I	**Basic concepts of Eco-toxicology**	
Introduction to Ecotoxicology, Principles of toxicology, scope of toxicology. Types of toxic substances - degradable and non-degradable. Factors influencing toxicity, drug toxicity. Acute and chronic toxicity. Influence of ecological factors on the effects of toxicity.		
Learning Outcomes:		
Upon the completion of the unit a student will be able to understand the basic concepts of Eco-toxicology and influence of ecological factors on the effect of toxicity.		
UNIT - II	**Toxicants in the Environment**	
Toxic substances in the environment, their sources and entry routes. Transport of toxicants by air and water: Transport through food chain - bioaccumulation and biomagnification of toxic materials in food chain. Toxicology of major pesticides. Environmental impacts of pesticides, Physiological and metabolic effects on flora and fauna.		
Learning Outcomes:		
Upon the completion of the unit a student will be able to understand the toxic substances, sources, entry and transport of toxic substances through air and water. Environmental impacts of pesticides.		
UNIT - III	**Environmental Toxicology**	
Principles in toxicology dose response relationship; Statistical concept concerning toxicology, principles in toxicology dose response relationship statistical concept of LC_{50} and EC_{50} values. Potency vs. toxicology short and long term effect at organisms' synergetic effects eco toxicology of heavy metals to algae and higher plants.		
Learning Outcomes:		
Upon the completion of the unit a student will be able to gain knowledge on dose response relationship and principles of toxicology.		
UNIT - IV	**Bio magnification and Bio monitoring**	
Heavy metals pesticides and fertilizers pollution in air water soil – extent accumulation of pollution in organization- biomagnification – Bioindicators – Bioremediation with special reference to microbes and plants.		
Learning Outcomes:		
Upon the completion of the unit a student will be able to gain knowledge on heavy metals, pesticides and fertilizers, their accumulation and biomagnification.		
UNIT - V	**Evaluation of toxicity**	
Methods used to assess toxicity, classification of toxic materials. Concepts of Bioassay- types, characteristics. Importance and significance of bioassay, Microbial bioassay for toxicity testing, Bioassay test models and classification.		
Learning Outcomes:		
Upon the completion of the unit a student will be able to understand the methods to assess toxicity, classification of toxic materials and their characteristics.		
Reference Books:		
1. Principles of Environmental Toxicology: I. C. Shaw and J. Chadwick; Taylor & Francis, ltd		

2.	Environmental biology and Toxicology, by Sharma P.D. Rastogi and Lamporary.
3.	Environmental Toxicology by M.Satake, H.Yasuhisa, M.S. Sethi, Y.Mido, S. Taguchi, S.A. Iqbal; Discovery Publishing House.
4.	Introduction to Environmental Science by Y.Anjaneyulu; B.S. Publications
5.	Science and Engineering – Meenakshi, Prentice Hall India.

ENVS2111: Water and Wastewater Treatment

L	T	P	S	J	C
3	0	0	0	0	3

This course is developed to provide precise understanding of providing safe water and also treating wastewater. Providing safe, reliable source of potable water is an ever-growing challenge for governmental and professional agencies, where daily demand is growing and yet more complex issues are evolving with the daily use of more chemicals and materials. In order to ensure that the public at large are receiving healthy water for daily use a fundamental understanding of processes and technology used in water and wastewater treatment becomes very important.

Course objective

- Will characterize water from various sources and also understand the quantitative aspects.
- Will gain understanding on the purpose and operational steps of drinking water treatment processes.
- Will be able to quantify and characterize domestic sewage.
- Get acquainted to the purpose and operational steps for treatment of wastewater.
- Will learn and appreciate the efficacy of low-cost waste treatment methods
- Grasp the advantages and disadvantages of low-cost waste treatment methods.

Course outcomes

- To characterize water from various sources and also understand the quantitative aspects.
- To understand the purpose and operational steps of drinking water treatment processes.
- To quantify and characterize domestic sewage.
- To describe the purpose and operational steps for treatment of wastewater.
- To appreciate the efficacy of low-cost waste treatment methods
- To comprehend the advantages and disadvantages of low-cost waste treatment methods.

UNIT – I	**Sources of Water**	**No of Hours: 12**
Hydrological cycle - Sources of Water – Surface sources & Ground Water Sources - suitability of surface and ground water with regard to quantity & quality.		
Quantity of Water – Types of demands - Fluctuation in demand of water – Factors affecting the water demand		
Learning Outcomes:		
After completion of this unit, the student will be able to		
•	Familiarize with hydrological cycle	
•	Understand sources of water for consumption.	
•	Examine the qualitative and quantitative aspects of water for consumption.	
•	Familiarize with the aspects of water demand in a community and its trends	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading		
UNIT – II	**Quality of Water**	**No of Hours: 12**
Quality of Water – Classification of impurities – Examination of water – Collection of water samples – Water analysis – Physical tests- Chemical tests- Living organisms in water- Biological tests- Standard of water quality.		
Intakes - Classification of intakes. Objectives of treatment of water – Plain sedimentation – types of sedimentation tanks - Sedimentation with coagulation		
Learning Outcomes:		
After completion of this unit, the student will be able to		
•	To understand the need for examination of water	
•	Gain vital understanding of aquatic chemistry.	
•	Gain insights to collection and analysis of water	
•	Understand various intakes for collection of water from source	

•	Absorb the process of plain sedimentation.	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading		
UNIT – III	**Treatment of Drinking Water and Analysis of Sewage**	**No of Hours: 12**
Filtration – Classification of filters- Slow Sand Filter- Rapid Sand Filter - Disinfection of water - Methods of disinfection – Chlorination.		
Sewage- Physical, Chemical & biological characteristics, analysis of sewage. Need for treatment, criteria for selection of site for sewage treatment plant		
Learning Outcomes:		
After completion of this unit, the student will be able to		
•	Appreciate the mechanism of filtration in water treatment	
•	Elucidate different methods for disinfecting water and gain insight to the process of chlorination.	
•	Methods to characterize sewage.	
•	Recognise the need for sewage treatment	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading		
UNIT – IV	**Sewage Treatment**	**No of Hours: 12**
Sewage Treatment - Objectives of treatment- Classification of treatment- Flow diagram of conventional treatment plant.		
Preliminary Treatment- Screenings, Grit chamber, Skimming tanks - Only description (design not required). Primary Treatment- Primary sedimentation – Description & working (Design not required).		
Learning Outcomes:		
After completion of this unit, the student will be able to		
•	Comprehend wastewater treatment in a sequential and systematic way.	
•	Absorb the objectives and classification of sewage treatment.	
•	Comprehend the preliminary treatment of sewage.	
•	Appreciate the process of treatment in primary sedimentation.	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading		
UNIT – V	**Secondary and Low-cost waste treatment**	**No of Hours: 12**
Secondary Treatment – Trickling filters, Contact beds, intermittent sand filters, Activated Sludge process (Only description, design not required). Sludge Treatment & disposal-Sludge digestion, Sludge drying, Sludge Disposal.		
Low-cost waste treatment: Oxidation ponds, Oxidation ditches, Activated Lagoon, Anaerobic lagoons. Miscellaneous: Septic tank, Imhoff tank		
Learning Outcomes:		
After completion of this unit, the student will be able to		
•	Apprehend sewage treatment using trickling filters.	
•	Cognize the process of activated sludge process	
•	Recognize the importance of sludge treatment.	
•	Appreciate low-cost waste treatment methods	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading		
Text Book(s)		
6. Water Supply & Sanitary Engineering - Including Environmental Engineering & Pollution Control Act's by J. S. Birdie, G. S. Birdie. 2014, 9th Edition, Dhanpath Rai Publishing Company, New Delhi. ISBN: 9789384378387, 9384378380 – Units 1 to 5		
7. Wastewater Engineering: Treatment and Reuse by Metcalf & Eddy, Inc, George Tchobanoglous, Franklin Burton, H. David Stensel, 2017, 4th Edition, McGraw Hill Education India, Uttar Pradesh, ISBN: 9780070495395, 978007049539 – Units 1 to 5		
8. Water and Wastewater Engineering by Sudha Goel, 2019, 1st Edition, Cambridge University Press India Private Limited, New Delhi, ISBN – 1108155324, 9781108155328 – Units 1 to 5		
Additional Reading		
2. **Water Resources Engineering by Larry W. Mays, 2019, 3rd Edition, Wiley, USA, ISBN: 978-1-119-49316-7. Units 1 to 3**		

3. Introduction to Water Resources by John C. Clausen, 2019, 1st Edition, Waveland Pr Inc, Illinois, ISBN – 1478628006. Units 1 to 3

Reference Book(s):

5. Water & Wastewater Engineering by Davis, 2020, 2nd Edition, McGraw Hill, New York, ISBN: 9781260132274. Units 2 to 5

Journal(s):

1. **Hasan, H. A., & Muhammad, M. H. (2020). A review of biological drinking water treatment technologies for contaminants removal from polluted water resources. Journal of Water Process Engineering, 33, 101035.**
2. **Gilca, A. F., Teodosiu, C., Fiore, S., & Musteret, C. P. (2020). Emerging disinfection by-products: A review on their occurrence and control in drinking water treatment processes. Chemosphere, 127476.**

Website(s):

https://onlinecourses.nptel.ac.in/noc21_ce30/preview

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

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

ENVS2131: Environmental Biotechnology

L	T	P	S	J	C
3	0	0	0	0	3

Course outline:

The course is designed to teach students the scientific and engineering principles of microbiological treatment technologies to clean up contaminated environments and to generate valuable resources for the human society.

Course Outcomes:

- Student will gain knowledge on the scope, role and current status of biotechnology.
- Student will be able to know the types of biological processes for industrial treatment and the role of microbes as biofertilizers and biopesticides.
- Student will be able to know about the processes and types of bioremediation, phytoremediation and role of biotechnology in production of energy.

UNIT - I		
Environmental Biotechnology: Definition, Scope and role of Biotechnology in Environment Protection, Current Status of Biotechnology in Environment Protection, Future. Biotechnology for air pollution abatement and odor control: Deodorization process - bioscrubbers, biobeds, Biotrickling filters.		
Learning Outcomes:		
Upon completion of the unit a student will be able to understand the scope, role and current status of biotechnology and control processes for air pollution.		
UNIT - II		
Bioreactors for Waste –Water Treatment: Biological processes for Industrial treatment - Aerobic biological Treatments (Activated sludge process, biological filters, Rotating Biological Contactors (RBC), Anaerobic Biological treatment: Contact Digesters, Packed column reactors, Upflow Anaerobic Sludge Reactor (UASB).		
Learning Outcomes:		
Upon completion of the unit a student will gain knowledge on the types of biological processes for industrial treatment.		
UNIT - III		
Biofertilizers: Use of microbes as biofertilizers and bioinsecticides to improve productivity and crop protection. Biopesticides: Bacterial (Bt pesticides), fungal (Trichoderma). Role of symbiotic and asymbiotic nitrogen fixing bacteria in the enrichment of soil, Algal and fungal biofertilizers (VAM). Eutrophication.		
Learning Outcomes:		
Upon completion of the unit a student will be able to understand the use of microbes as biofertilizers and biopesticides.		
UNIT - IV		
Bioremediation: Definition, need and scope of bioremediation: types of bioremediation. Environmental applications of bioremediation, Bioremediation of soil and water contaminated with oil spills, heavy metals and pesticides by soil microorganisms. Phytoremediation.-Biotechnology in cleaning up the environment by plants. Phytoremediation of heavy metal contaminated soils.		
Learning Outcomes:		
Upon completion of the unit a student will be able to understand processes and types of bioremediation and phytoremediation.		
UNIT - V		
Biomass based energy: Role of microbes in energy production, biogas production (Methanogenic bacteria), microbial hydrogen production, ethyl alcohol production from sugarcane and single cell protein (SCP).		
Learning Outcomes:		
Upon completion of the unit a student will be able to understand the biotechnological methods involved in biotransformation of pollutants and generation of energy		

Reference Books:
1. Introduction to Environmental Biotechnology by A.K.Chattarji, 2nd Edition, Prentice Hall Publishers.
2. Environmental Biotechnology – Principles and Applications by Bruce E Rittman, Perry. L. Mc.Carty, Mc Graw Hill Publishers.
3. Microbial Ecology by Ronald. A.Atlas
4. Environmental Biotechnology, SVS Rama, Rastogi Publications.

ENVS3061: Global Warming and Climate Change

L	T	P	S	J	C
3	0	0	0	0	3

Course Outline:
To strengthen the understanding of student on the causes and consequences of global warming, climate and climate change, policies initiated for mitigation and adaptation strategies.

Course outcomes:

- Student will gain knowledge on energy and carbon emissions, global climate change and its related effects.
- Student will be able to understand the impacts of global warming and its effect on human health.
- Student will be able to understand the concept of CDM, IPCC and UNFCC and mitigation strategies for global warming and carbon capturing.

UNIT - I		
Global climate Change – Evidence, causes and consequences, climate of past, present and future scenarios, concept of climate modeling. Impact on climate change on tropical and temperate regions. Impact of climate change on natural resources and health, causes for climate change, climate change mitigation measures, Adaptation to climate change.		
Learning Outcomes:		
Upon completion of the unit a student will be able to understand the causes and consequences of global warming and climate change and the concept of climate modeling.		
UNIT - II		
Causes for climate change: Greenhouse effect, sources and trends of greenhouse gases, warming potential of gases. Impacts of global warming, Photosynthetic mechanism and global climate change – case studies. Impact of climate change on India.		
Learning Outcomes:		
Upon completion of the unit a student will be able to understand greenhouse effect, impacts of global warming and climate change on India.		
UNIT - III		
Carbon Sequestration- concept, global carbon cycle, carbon sequestration potential in terrestrial and marine ecosystems, anthropogenic impact on carbon sequestration. Forest-Sink of Carbon, Measuring of Carbon Dioxide. Role of forests in climate mitigation potential and its evaluation, land use, land use change and forestry, Policy Perspective: UNFCC, Role and Function of IPCC, Kyoto Protocol and its implication on Developed and developing countries.		
Learning Outcomes:		
Upon completion of the unit a student will be able to understand the concept of carbon sequestration and the role of forests in climate mitigation potential.		
UNIT - IV		
• Upon completion of the unit a student will be able to gain knowledge on the concept of Clean Development Mechanism (CDM), IPCC and UNFCC.		
Learning Outcomes:		
Upon completion of the unit a student will be able to gain knowledge on the concept of Clean Development Mechanism (CDM), IPCC and UNFCC.		
UNIT - V		
Tools to study climate change: Mitigation and adaptation strategies for global warming, carbon capture and storage technologies. National action plan on climate change in India. Indian approach towards climate change in agriculture and food, energy consumption, water availability, environmental pollution and protection of biodiversity.		

Learning Outcomes:
Upon completion of the unit a student will be able to understand the mitigation strategies for global warming, carbon capture and storage technologies, National plan on climate change in India.
Reference Books:
1. Aguado, E. and James, E.B. Understanding weather and climate, Prentice Hall, New Delhi.
2. Gupta, K.R. Encyclopedia of environment global warming: problems and policies, Atlantic Publication, New Delhi.
3. Lovejoy, T.E. and Hannah L. Climate change and biodiversity, TERI press.
4. Owen, O.S., Chiras, D. D. and Reganold, J.P. Natural Resource Conservation: Management for Sustainable Future, Prentice Hall.
5. Jamil Ahmad. Climate Change and Sustainable Development in India. New century publications.
6. Stephen Peake. Climate Change: From science to sustainability. OUP Oxford; 2nd Edition.
7. Sushil Kumar Dash, S K Dash. Climate Change: An Indian Perspective (Environment and Development). Foundation books.

ENVS3071: Remote Sensing and GIS

L	T	P	S	J	C
3	0	0	0	0	3

Remote Sensing is science of acquiring information about an object or a phenomenon kept at a distance. This course provides basic understanding about Remote Sensing and GIS. Remote sensing is a powerful tool to study landscapes, which involves extracting information from spectral images and then analyse them to interpret earth surface processes. On the other hand, Geographic Information system (GIS) is a software tool used for creating, managing, analysing and mapping various types of data.

Course objective

- To describe the fundamental principles of remote sensing.
- To familiarize students with different types of aerial photographs
- To describe basics and components of Geographical Information Systems.
- To provide exposure on applications of remote sensing for environment.
- To comprehend applications of remote sensing and GIS for pollution monitoring.
- To review case studies where RS and GIS has successfully addressed an environmental issue.

Course outcomes

- Learn fundamental principles of remote sensing.
- Grasp various types of aerial photographs
- Understand basics and components of Geographical Information Systems.
- Gain knowledge on applications of remote sensing for environment.
- Will realize applications of remote sensing and GIS for pollution monitoring.
- Understand case studies where RS and GIS has successfully addressed an environmental issue.

UNIT – I	**Fundamental principles of Remote Sensing**	**No of Hours:12**
Definition and Overview of Remote Sensing; History and Evolution of Remote Sensing and Remote Sensing Systems.		
Electromagnetic energy and its atmospheric interactions; Remote Sensing Data Acquisition		
Learning Outcomes:		
After completion of this unit, the student will be able to		
•	Appreciate the history and evolution of remote sensing.	
•	Elucidate the process of remote sensing.	
•	Explain the phenomenon of electromagnetic radiation interaction with atmosphere and earth surface features.	
•	Describe different types of platforms and sensors used to detect and record earth surface features.	
•	Gain an overview of applications of remote sensing.	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading		
UNIT – II	**Elements of Image interpretation**	**No of Hours:12**
Elements of Image interpretation. Aerial photo-classification, distortions caused due to flight irregularities, overlaps, scale, relief displacement and its effects.		
Different types of photographs – their advantages and disadvantages.		
Learning Outcomes:		
After completion of this unit, the student will be able to		
•	Comprehend various elements of image interpretation.	
•	Classify aerial photographs and understand their advantages and disadvantages.	
•	Elucidate Distortions and displacement.	

•	Understand the concepts of scale, overlap.	
•	Evaluate the advantages and disadvantages of aerial photographs.	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading		
UNIT – III	**Fundamentals of GIS**	**No of Hours:12**
Fundamentals of GIS - Role of information technology in human health.		
Weather forecasting, Agro meteorology		
Learning Outcomes:		
After completion of this unit, the student will be able to		
•	Understand the fundamentals of geographic information systems.	
•	Absorb concepts, components and workflow of GIS.	
•	Appreciate the application of remote sensing and GIS for human health.	
•	Recognize application of RS and GIS for Weather forecasting.	
•	Realize application of RS and GIS for agrometerology.	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading		
UNIT – IV	**Applications of Remote Sensing and GIS**	**No of Hours:12**
Applications of Remote Sensing and GIS in Water Resources management.		
Mining - Urbanization		
Learning Outcomes:		
After completion of this unit, the student will be able to		
•	Monitoring water resources using RS and GIS for	
•	Comprehend applications of RS and GIS for water resource management.	
•	Recognize applications of RS and GIS for mapping minerals.	
•	Identify applications of RS and GIS in the life cycle of mining process.	
•	Recognize applications of RS and GIS for solving problems of urbanization.	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading		
UNIT – V	**Environmental Applications of GIS**	**No of Hours:12**
Environmental Applications of GIS – Pollution Monitoring – Water – Air		
Oil Pollution – Desertification		
Learning Outcomes:		
After completion of this unit, the student will be able to		
•	Monitoring environmental pollution using RS and GIS	
•	Water pollution monitoring using RS and GIS	
•	Air pollution monitoring and mapping using RS and GIS	
•	Oil pollution monitoring and mapping using RS and GIS	
•	Monitoring and mapping of desertification using RS and GIS	
Pedagogy tools: Blended learning, Case let, video lectures, self-reading		
Text Book(s)		
9. Remote Sensing and Image Interpretation by Thomas Lillesand, Ralph W. Kiefer, Jonathan Chipman. 2015, 7th Edition, John Wiley & Sons, USA, Inc. ISBN: 978-1-118-34328-9 (Units 1 to 5)		
10. Basic Concept of Remote Sensing, GPS and GIS by Shivam Pandey. 2020, 1st Edition, Sankalp Publication, India, ISBN: 9788194778011 (Units 1 to 5)		
Additional Reading		
1. Introductory Digital Image Processing. Jensen J. R. 2004, 3rd Edition, Pentice Hall, USA, ISBN-13: 978-0131453616 (Units 2 and 3) 2. Textbook of Remote Sensing and Geographical Information Systems by Kali Charan Sahu, 2021. 1st Edition, Atlantic Publishers, India, ISBN 13: 978-8126909100 (Units 3 and 4)		
Reference Book(s):		
6. Concepts of Cartography, Remote Sensing and GIS Paperback by K.K. Maltiar & S.R. Maltiar, 2019, 1st Edition, Rajesh Publications, India. ISBN: 9789383684847 (Unit 1)		
7. Application of GIS and Remote Sensing in Environmental Management by Shahid A. Abbasi, K. B. Chari. 2005, 1st Edition. Discovery Publishing House, India. ISBN 9788171419630 (Units 3 to 5)		

8. Remote Sensing and GIS by Basudeb Bhatta, 2021. 3rd Revised edition, Oxford University Press India, India, ISBN 13: 978-0199496648 (Units 1 to 3)
Journal(s):
1. Duan, W., Maskey, S., Chaffe, P. L., Luo, P., He, B., Wu, Y., & Hou, J. (2021). Recent Advancement in Remote Sensing Technology for Hydrology Analysis and Water Resources Management.
2. Chen, M. (2021). Development and evaluation of a hydrological and hydraulic coupled flood prediction system enabled by remote sensing, numerical weather prediction, and deep learning technologies.
3. Naqvi, H. R., Mutreja, G., Shakeel, A., & Siddiqui, M. A. Remote Sensing Applications: Society and Environment.
Website(s):
1. https://www.usgs.gov
2. https://nptel.ac.in/courses/105/103/105103193/

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

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

ENVS3071: Green Technologies

L	T	P	S	J	C
3	0	0	0	0	3

Course outline:
The course content includes concepts of green technologies, green chemistry, applications of green technology which help student in understanding the modern and green technologies available.

Course Outcomes:
Upon completion of this Course, the student will be able to:

- Gain knowledge on principles, tools and applications of green technology and green building.
- Techniques of bioremediation and its types, waste minimization techniques and use of nano materials.

UNIT - I		
Overview, Principle, concepts and tools of Green technology: Overview of green chemistry, chemistry of the atmosphere, principles of sustainable and green chemistry. Basic principles of green technology, concepts of atom economy and carbon trading, tools of green technology.		
Learning Outcomes:		
Upon the completion of unit a student will be able to gain knowledge on concept, principle and tools of green technology.		
UNIT - II		
Waste minimization techniques, waste minimization and climate change, zero emission technology, industrial ecology, greenhouse effect, climate change, photochemical smog.		
Learning Outcomes:		
Upon the completion of unit a student will be able to gain knowledge on techniques of waste minimization, climate change, zero emission technology, etc.		
UNIT - III		
Biological remediation: In situ and Ex situ bioremediation; evaluating Bioremediation; Bioremediation of VOCs. Phytoremediation – concept, types and mechanism involved in phytoremediation.		
Learning Outcomes:		
Upon the completion of unit a student will be able to gain knowledge on technique of Bioremediation and types of bioremediation studies.		
UNIT - IV		
Green Nanotechnology: Introduction to Nano materials and green nanotechnology, fullerene, carbon nanotubes, nanoparticles; green nanoparticle production and characterization, use of nanotechnologies and materials impact on biodiversity, resource conservation, ecosystems and human.		
Learning Outcomes:		
Upon the completion of unit a student will be able to understand what nano-materials are, its uses and their impact on biodiversity, ecosystems and humans.		
UNIT - V		
Green technology applications: energy from alternate sources, solar energy and solar photovoltaic technology, Biofuel production (bio-ethanol and biodiesel), prevention/minimization of hazardous/toxic products. Concept of green building.		
Learning Outcomes:		
Upon the completion of unit a student will be able to gain knowledge on applications of green technology and the concept of green building.		
Reference Books:		
1. M. H. Fulekar. Nanotechnology Importance and applications, I K international publishing house Pvt.Ltd.		
2. Lynn Goldman, Christine Coussens, Implications of nanotechnology for environmental health research, National Academic Press, Washington.		
3. Matlack, A. S. Introduction to Green Chemistry. Marcel Dekker: New York.		

4.	Anastas, P. T.; Warner, J. C. Green Chemistry: Theory and Practice. Oxford Univ. Press: Oxford.
5.	Lynn E. Foster: Nanotechnology: Science, Innovation, and Opportunity. Prentice Hall
6.	Fei Wang & Akhlesh Lakhtakia (eds). Selected Papers on Nanotechnology—Theory & Modeling (Milestone Volume 182). SPIE Press
7.	Caye Drapcho, Nhuan Phú Nghiêm, Terry Walker. Biofuels Engineering Process Technology. [McGraw-Hill].
8.	Akhlesh Lakhtakia (ed). The Handbook of Nanotechnology. Nanometer Structures: Theory, Modeling, and Simulation. SPIE Press, Bellingham, WA, USA

ENVS3081: Environment and Sanitation

L	T	P	S	J	C
3	0	0	0	0	3

Course Outline:

The course objective is to make the student understand

- Importance of health and role of environmental sanitation.
- Types of diseases, water borne diseases and low cost sanitation methods.
- Importance of indoor sanitation and institutional sanitation.

Course Outcomes:

Upon completion of the course the student will

- Gain knowledge on the types of diseases, importance of sanitation.
- Be able to know the importance of water sanitation and low cost sanitation methods.

  Be able to know about the importance of indoor sanitation and institutional sanitation.

UNIT - I		
Public Health: Definition, Health and disease. Components of Epidemiology and health, types of diseases. Determinants of health. Concept of disease: Causative agent, host factor and modes of transmission of disease. Disease Prevention and Control. Environmental Sanitation: History of sanitation. Definition, Concept and importance of Environmental Sanitation. Rural and urban sanitation. Rural sanitation in India. Urban sanitation in India.		
Learning Outcomes:		
Upon the completion of unit a student will be able to gain knowledge on types of diseases, importance of rural and urban sanitation and urban sanitation in India.		
UNIT - II		
Water sanitation: Sources of water. Impurities of water and water quality. Water-borne diseases (intestinal diseases). Protection of water storage in reservoirs, wells and overhead tanks. Purification of water on a small scale (household level and small communities).		
Learning Outcomes:		
Upon the completion of unit a student will be able to understand the importance of water sanitation and protection of water resources.		
UNIT - III		
Low Cost Sanitation: Existing scenario of waste disposal systems. Health and socio-economic criteria for low cost sanitary Privies. Night soil and excreta disposal. Insect vector and rodent control: Mosquitoes, rodent and house fly: habits, life cycle, diseases and their control measures.		
Learning Outcomes:		
Upon the completion of unit a student will be able to gain knowledge on low cost sanitation method and disease control measures.		
UNIT - IV		
Indoor sanitation: Principles of indoor sanitation. Ventilation: type of ventilation and standards for ventilation. Lighting and illumination: Requirement of good lighting, measurement of light, sources of lighting, types of illumination, standards for illumination. Air disinfection, thermal comfort and Noise control in indoor environments.		
Learning Outcomes:		
Upon the completion of unit a student will be able to gain knowledge on importance and principles of indoor sanitation.		
UNIT - V		
Institutional Sanitation: Sanitation in Schools. Sanitation of hospitals and nursing homes. Sanitation in restaurants and fairs. Sanitation at public bathing places and swimming pool sanitation.		
Learning Outcomes:		
Upon the completion of unit a student will be able to gain knowledge on importance of institutional sanitation (schools, hospitals and nursing homes, etc.)		

Reference Books:
1. Environmental Sanitation (Social and Preventive Medicine) I edition by K.V.S.G. Murali Krishna and P.V. Rama Raju, Environmental Protection Society, Kakinada
2. Municipal and Rural Sanitation Sixth Edition by Victor M. Ehler and Ernest W. Steel. Tata Mc Graw-Hill Publishing Company.
3. Environmental Sanitation by Baljeet S. Kapoor, S. Chand & Company Limited, 1st Edition
4. Text Book of Environmental Engineering by P. Venugopala Rao, PHI Learning Private Ltd., 7th Edition.