

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. Food Science and Technology (FST)

(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

PEO 1. To mould the students for successful careers in the industry and institutions of food technology.

PEO 2. To make students competent in Food Science and allied areas.

PEO 3. To motivate the young food technologists through professional, ethical development and research

PEO 4. Enable the graduates for becoming entrepreneurs

PEO 5. To introduce the students to societal needs and global food security challenges.

Program Outcomes

- Gain knowledge of food science and nutrition fundamentals, know the properties and reactions of various food components, and select appropriate analytical methods when asked to quantitate.
- Categorize the key pathogens and spoilage microorganisms in foods, and define the unit operations in food engineering applications to yield a healthier food product
- Describe the basic principles and practices of food hygiene in food processing operations by following the food laws in food science and with the exploitation of food packaging materials.
- Relate the principles of food science technology in practical, real-world situations and problems.

Program Specific Outcomes

- Understand the composition of food, the role of each component and their interactions, their roles in food processing.
- Will apply the knowledge of various spectrophotometric methods to quantify the desired compound in the given solutions.
- Will be able to describe the importance of microbiology to food production and food safety.
- Will be able to design food plant, identify the instruments required for processing by understanding principles followed by preservation techniques, and successful packaging method employment with good marketing skills.

CURRICULUM STRUCTURE OF B.Sc. FOOD SCIENCE AND TECHNOLOGY

(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 to 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
PHYS1041	1	Biophysics	3	0	0	0	0	3
CHEM1041	1	Chemistry - II Lab	0	0	2	0	0	1
PHYS1101	1	Biophysics Lab	0	0	2	0	0	1

Programme Core/ Major Core (PC/MaC)

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
MFST1031	1	Fundamentals of Food Technology Practical	0	0	2	0	0	1
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
MFST2021	2	Technology of Plantation Crops Practical	0	0	2	0	0	1
MFST2031	2	Food Processing and Preservation Technology Practical	0	0	2	0	0	1
MFST2041	2	Food Microbiology	3	0	0	0	0	3
MFST2051	2	Food Microbiology Practical	0	0	2	0	0	1
MFST3001	3	Technology of Animal Foods	3	0	0	0	0	3
MFST3011	3	Food Biochemistry	3	0	0	0	0	3
MFST3021	3	Technology of Animal Foods Practical	0	0	2	0	0	1
MFST3031	3	Food Biochemistry Practical	0	0	2	0	0	1
MFST3041	3	Food Chemistry	3	0	0	0	0	3
MFST3051	3	Food Chemistry Practical	0	0	2	0	0	1

Programme Elective (PE)#

Course code	Level	Course title	L	T	P	S	J	C
MFST2201	2	Bakery and Confectionary	3	0	0	0	0	3
MFST2231	2	Bakery and Confectionary Practical	0	0	2	0	0	1
MFST2211	2	Technology of Spices	3	0	0	0	0	3
MFST2241	2	Technology of Spices Practical	0	0	2	0	0	1
MFST2221	2	Food & Nutrition	3	0	0	0	0	3
MFST2251	2	Food & Nutrition Practical	0	0	2	0	0	1
MFST2261	2	Applied Physiology	3	0	0	0	0	3
MFST2271	2	Instrumentation for Food Analysis	3	0	0	0	0	3
MFST2281	2	Food Quality and Sensory Evaluation	3	0	0	0	0	3
MFST2291	2	Fermentation Technology	3	0	0	0	0	3
MFST3181	3	Food Engineering	3	0	0	0	0	3
MFST3191	3	Food Packaging	3	0	0	0	0	3
MFST3201	3	Functional Foods and Nutraceuticals	3	0	0	0	0	3
MFST3211	3	Clinical Nutrition	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 MFST2201 then he/she has to study MFST2231 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 Food Science& Technology 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, bibliography, index, etc.
3. Compose and send customized mail / e-mail using mail-merge.
4. Create / modify a power point presentation with text, multimedia using templates with animation.
5. Create spreadsheet with basic calculations with relative reference, absolute reference and mixed reference methods.
6. Simple report preparation using filtering tool / advanced filtering commands / pivot tables in spreadsheet application.
7. Analyse the results of an 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 / create pivot 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 Cunninham, S. & Moor, P. (nd). New Cutting Hedge (Intermediate). Longman
2. Cambridge Academic English: An Integrated Skills Course for EAP (Intermediate) By Craig Thaine, CUP (2012)
3. Rutherford, Andrea J. (2007). Basic Communication Skills for Technology: Second Edition. Delhi: Pearson Education.
4. McCarthy, M., O'Dell, F., Mark, G. (2005). English Vocabulary in Use. Spain: Cambridge University Press.
5. New Headway Academic Skills: Reading, Writing, and Study Skills Student's Book, Level-1 by Sarah Philpot. OUP
6. Philpot, S. & Curnick, L. (2017). Headway: Academic Skills: Reading, 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 make individual and group presentations aided with images, audio, video, tabular data, etc.	Making power point presentation aided with images, audio, video, etc. with a small group by listening to academic lectures/talks/ discussions, etc.
10	Self-reflection: Re-reading one's own drafts, identifying errors, correcting the errors, and giving rationalize the changes	Pre-task discussion/modelling, Editing the texts by careful reading and identifying the errors, peer-exchange (Pair work), feedback/consolidation
11	Collaborative work (speaking and writing) in small groups of 3 or 4 learners: discussing a general/discipline-specific topic: creating outline, assigning specific roles to members of the group; and group presentation followed by peer and instructor feedback	Pre-task modelling (peer/teacher), general discussion on structure, group work (collaboration), feedback
12	Independent reading of different text types using appropriate reference sources by adapting suitable reading styles and speed. Focus on active reading for vocabulary: low-frequency collocations and idiomatic expressions.	Brain-storming, mapping of key terms (content specific), reading and note-making (individual), oral questioning, discussion
13	Role-play (specific social and academic situations): planning (making notes), understanding nuances of speaking in context, coordinating with situational clues and fellow speakers/participants	Peer discussion for outline, A-V support, observing (teacher modelling), role play (guided), role-play (free), feedback
14	Writing instructions: Guidelines - Flowcharts - Procedures to be followed	Pre-task reading, pair work, teacher/peer-discussion, feedback
15	Speaking spontaneously on topics of interest and writing short structured essays on the same topics adopting appropriate academic conventions and grammatical accuracy.	Reading for task preparation, note-making, speaking, reflection and corrective peer and teacher feedback

Reference Books

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

Online Resources

1. <https://www.grammarly.com/blog/>
2. <https://www.nationalgeographic.org/education/>
3. <https://www.bbc.co.uk/teach/skillswise/english/zjg4scw>
4. <https://www.englishclub.com/>
5. <https://www.oxfordlearnersdictionaries.com/>
6. <https://dictionary.cambridge.org/>
7. learnenglishteen.com/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. analytical, evaluative and extra-polative processing (listening and reading) and involves problem-solving, logical reasoning and decision-making skills in terms of application of the learning (speaking/writing) with an awareness for social and personality based variations in communication. This course provides opportunities with activity-based practice of advanced oral and written communicative skills besides building awareness on the finer nuances of language use for various purposes. This course emphasizes free writing through meaningfully engaging tasks with a pre and post context building. There is ample scope for application of critical thinking through simulated activities for effective communication in real life situations.

Course Objectives

1. Enable learners to listen actively become aware of tone and attitude in speech, and demonstrate their comprehension of fairly complex lines of argument presented by a variety of speakers in talks/presentations/discussions. (Bloom's Taxonomy Level/s: 2 & 4)
2. Enable learners to become aware of tone and attitude in written texts, and demonstrate their comprehension of fairly complex lines of argument and points of view presented in a variety of texts by equipping them with upper intermediate to advanced level reading skills and strategies. (Bloom's Taxonomy Level/s:2 & 3)
3. Make effective presentations, engage in formal group discussions, and write structured essays/ short reports to highlight the significance of actions/decisions/experiences, and sustain views by providing relevant evidence and argument. (Bloom's Taxonomy Level/s: 3 & 4)
4. Equip learners with the skills and strategies to communicate effectively in speech and writing using the language with a degree of fluency, accuracy and spontaneity, and fairly good grammatical control adopting a level of formality appropriate to the context. Encourage learners to apply their knowledge of language and their communication skills in real life situations. (Bloom's Taxonomy Level/s:3 & 5)

List of Activities & Tasks for Assessment

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

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

Reference Books

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

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

Online Resources

1. <https://www.grammarly.com/blog/>
2. <https://www.nationalgeographic.org/education/>
3. <https://www.bbc.co.uk/teach/skillswise/english/zjg4scw>
4. <https://www.englishclub.com/>
5. <https://www.oxfordlearnersdictionaries.com/>
6. <https://dictionary.cambridge.org/>
7. learnenglishteens.britishcouncil.org
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, <i>Self Awareness</i> : Self Motivation, Accurate Self Assessment (SWOT Analysis), Self Regulation: <i>Self Control, Trustworthiness & Adaptability</i>	3
2	Importance, Practising Social Awareness, Building Relationships, Healthy and Unhealthy Relationships, Relationship Management Competencies- Influence, Empathy, Communication, Types of Conflicts, Causes, Conflict Management	3
3	Social Media: Creating a blog, use of messaging applications, creating a website to showcase individual talent, creation of a LinkedIn Profile	2
4	Goal Setting & Time Management: Setting SMART Goals, Time Wasters, Prioritization, Urgent Vs Important, Q2 Organization	3
5	Teamwork: Team Spirit, Difference Between Effective and Ineffective Teams, Characteristics of High Performance Teams, Team Bonding, Persuasion, Team Culture, Building Trust, Emotional Bank Account	4
6	Verbal Reasoning: Introduction, Coding-decoding, Blood relations, Ranking, Directions, Group Reasoning	6
7	Analytical Reasoning: Cubes and Dices, Counting of Geometrical figures	3
8	Logical Deduction: Venn diagrams, Syllogisms, Data Sufficiency, Binary logic	4
9	Spatial Reasoning: Shapes, Paper Cutting/Folding, Mirror images, Water images and Rotation of figures	2
	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: <i>The Communication Process</i> , Elements of Interpersonal Communication, <i>Non-Verbal Communication</i> : Body Language, Posture, Eye Contact, Smile, Tone of Voice, <i>Barriers to Communication</i> . Effective Listening Skills: Active Listening, Passive Listening, Asking Questions, Empathizing, Being Non Judgemental, Being Open Minded, Mass Communication: Design of Posters, Advertisements, notices, writing formal and informal invitations	5
2	Focus on Audience Needs, Focus on the Core Message, Use Body Language and Voice, Start Strongly, Organizing Ideas & Using Visual Aids: SPAM Model, Effective Opening and Closing Techniques, Guy Kawasaki's Rule (10-20-30 Rule), Overcoming Stage Fear, Story Telling	3
3	Problem Solving & Decision Making: Difference Between the Two, Steps in Rational Approach to Problem Solving: Defining the Problem, Identifying the Root Causes, Generating Alternative Solutions, Evaluating and Selecting Solutions, Implementing and Following-Up, Case Studies	3

4	Group Discussion: Understanding GD, Evaluation Criteria, Nine Essential Qualities for Success, Positive and Negative Roles, Mind Mapping, Structuring a Response, Methods of Generating Fresh Ideas	4
5	Number Theory: Number System, Divisibility rules, Remainders and LCM & HCF	3
6	Numerical Computation and Estimation - I : Chain Rule, Ratio Proportions, Partnerships & Averages, Percentages, Profit-Loss & Discounts, Mixtures, Problems on Numbers & ages	6
7	Data Interpretation: Interpretation and analysis of data in Tables, Caselets, Line-graphs, Pie-graphs, Box-plots, Scatter-plots and Data Sufficiency	3
8	Mental Ability: Series(Number, Letter and Alphanumeric), Analogy(Number, Letter and Alphanumeric) and Classifications	3
	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], Cryptarithmic & Modular Arithmetic (Cryptarithmic, Application of base system (7, 24), Clocks (Base 24), Calendars (Base 7), and Mental Ability (Number series, Letter series & Alpha numeric series, Analogies (Numbers, letters), Classifications, Algebra (Exponents, Logarithms, Problems related to Equations, Special Equations, and Statistics) . This module focuses on all these areas by building on what the students already learnt in their earlier studies.

Course Objectives:

1. Apply the rules of grammar to solve questions in Error Detection, Sentence Correction and Sentence Improvement.
 2. Apply the rules of structure to solve questions in Error Detection, Sentence Correction and Sentence Improvement, Fill-in-blanks and Cloze Passages.
 3. Explain methods of solving problems in Combinatorics (Permutations & Combinations, Probability], Cryptarithmic & Modular Arithmetic (Cryptarithmic, Application of base system (7, 24), Clocks (Base 24), Calendars (Base 7))
 4. Explain how to solve questions in Mental Ability (Number series, Letter series & Alpha numeric series, Analogies, Numbers, letters, Classifications] and Algebra (Exponents, Logarithms, Problems related to Equations, Special Equations, Statistics)
-
1. Error Detection: Pronouns, Conjunctions, Prepositions and Articles
 2. Error Detection: Tenses and their Uses
 3. Sentence Correction: Subject-Verb Agreement, Antecedent-Pronoun Agreement, Conditional Clauses
 4. Sentence Correction: Modifiers (Misplaced and Dangling) & Determiners, Parallelism & Word Order, and Degrees of Comparison
 5. Combinatorics: Permutations & Combinations, Probability

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

Course Outcomes:

1. Identify and correct errors in English grammar and sentence construction
2. Identify and correct errors in Structure, Style and Composition
3. Solve problems in Combinatorics, Cryptarithmic, and Modular Arithmetic
4. Solve problems in Mental Ability and Algebra

References:

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

VEDC1001: Venture Development

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 heavily dependent upon your willingness to participate actively in class discussion. Your class participation will be assessed on the quality and consistency of your effort in each and every class.

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

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

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

Group Project Overview

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

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

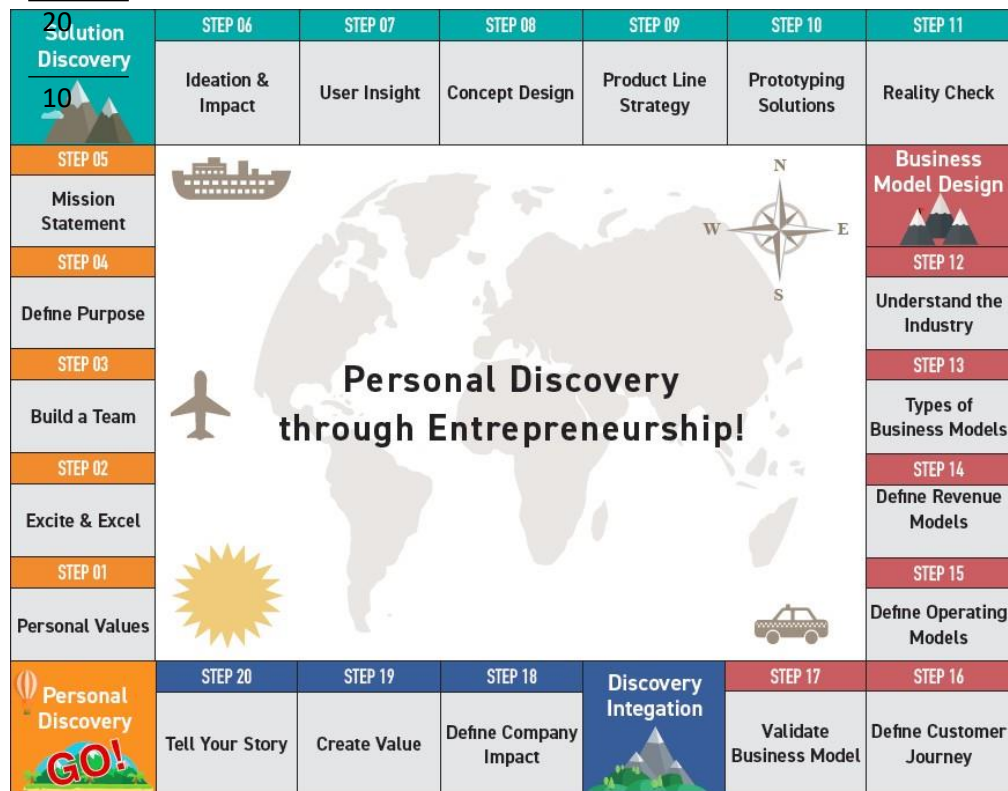
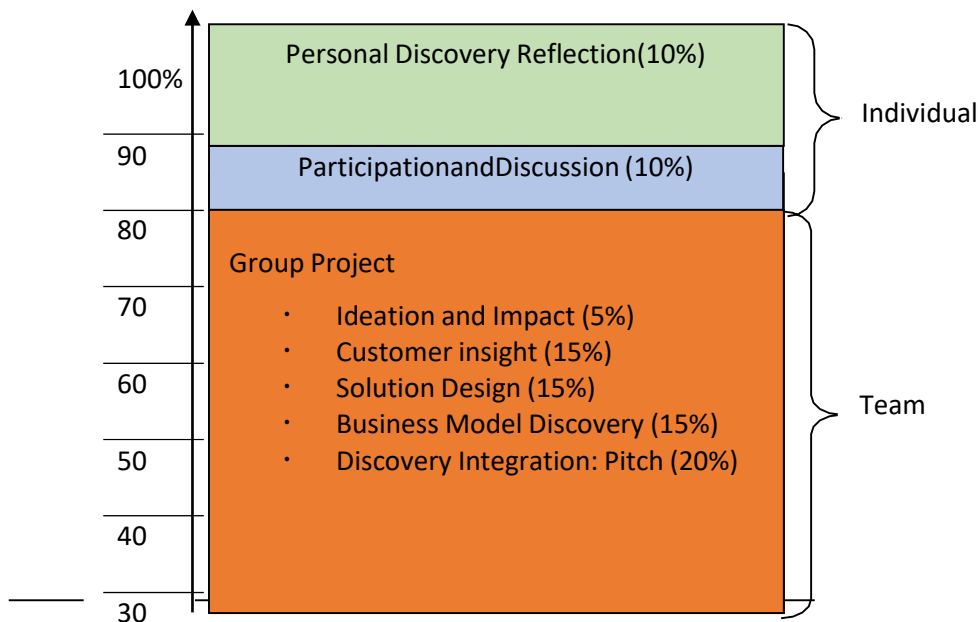
“Design” is fun, particularly when you merge customer insight with your own creativity. Enjoy! In this book, we provide structured methods to be an active listener and learner from customers as well as a product or service designer.

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

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

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

Project Components and Grading



[20 Steps and activities in this course]

Deliverables

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

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

Specific Deliverables

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

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

Customer Interviews and Insight Hand-in Package: 15%
(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 your customers' needs change over the full use case, and what innovative ideas can you propose at each step of the way?

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

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

Business Model Design Hand-in Package: 15%

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

Discovery Integration Hand-in Package: 20%

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



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

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

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

Individual Innovation Assignments

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

(1) Personal Discovery Reflection Journal (10%)

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

(2) Insight Learning Reflection Journal (10%)

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

Course Schedule

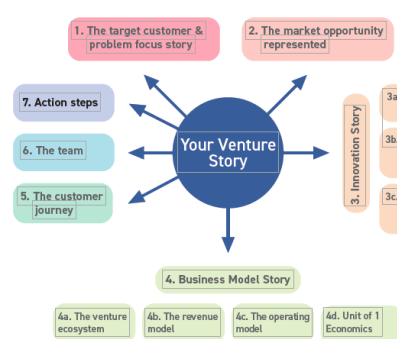
We ek	Sessi on	Topics and Steps	Key CONCEPTS Introduced in Class	Class Focus Activity
1	1	Course Overview	<ol style="list-style-type: none"> 1. Why is entrepreneurship important? 2. What is Personal Discovery through Entrepreneurship? 3. Four Stages; Personal Discovery, Solution Discovery, Business Model Discovery, Discovery Integration 4. Preparation (finding interesting areas) 	Lecture and Discussion
	2	Personal Discovery (Step 01, Step 02)	<ol style="list-style-type: none"> 1. Personal Values 2. Strength and Weakness 	Individual: <ul style="list-style-type: none"> • 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)	<ol style="list-style-type: none"> 1. Review Problem Area Template at the beginning of the book to find classmates who want to work on the same problem area. 2. Find teammates <ol style="list-style-type: none"> (1) Shared values (2) Levels of commitment (3) Skills and experiences (Same or Different?) 	Problem template: Page 9 <ul style="list-style-type: none"> • 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)	<ol style="list-style-type: none"> 1. Methods for defining and refining a venture's purpose 2. Defining a Venture's Purpose 3. Creating a Vision Statement 	Team: <ul style="list-style-type: none"> • Purpose and Mission Templates: Pages 49 and 52 • Be prepare to present to the class. • Personal Discovery Reflection Journal Due

We ek	Sess ion	Topics and Steps	Key CONCEPTS Introduced in Class	Class Focus Activity
3	5	Ideation & Impact (Step 06)	Ideation Methods <ul style="list-style-type: none"> • An in-class ideation exercise 	Team: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • Idea Impact Template, Step 6, Page 69
4	7	User Insights Frameworks (Step 07)	<ul style="list-style-type: none"> • Identify and find the right target users. • Interview style and methods • The Customer Interview template. 	Team: <ul style="list-style-type: none"> • Customer Interviews Template, Step 7, Pages 75 • Edit interview template for your project.
	8		Laddering methods for interviews	Team: <ul style="list-style-type: none"> • Latent Needs Template, Step 7, Page 93
5	9	User Insights Customer Interviews (Step 07)	<ul style="list-style-type: none"> • Finding latent needs • Field work check-in 	Team: <ul style="list-style-type: none"> • Latent Needs Template, Step 7, Page 93 • Field work – customer interviewing
	10		<ul style="list-style-type: none"> • Think about innovation across the entire use case • Field work check-in 	Team: <ul style="list-style-type: none"> • Full Use Case Template, Step 7, Page 99 • Field work – customer interviewing
6	11	User Insights Interpreting Results (Step 07)	<ul style="list-style-type: none"> • Interpreting customer interview results • Field work check-in 	Team: <ul style="list-style-type: none"> • Field work – customer interviewing • Also talk to retailers/dealers if appropriate
	12		<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • Customer Research Reports • Implications for product and service design 	<ul style="list-style-type: none"> • Teams prepare PPTs for class presentation • Customer Insight Template Hand-in Package
	14			

We ek	Sess ion	Topics and Steps	Key CONCEPTS Introduced in Class	Class Focus Activity
8	15	Concept Design (Step 08)	<ul style="list-style-type: none"> • Defining Customer Value • Understanding Customer Value Proposition 	Team: <ul style="list-style-type: none"> • Customer Value Proposition • Template: Step 8, Page 107 • Draft the CVP
	16		<ul style="list-style-type: none"> • Presentation and review of CVPs 	Team: <ul style="list-style-type: none"> • Complete CVP
9	17	Competitive Analysis and Positioning (Step 08)	<ul style="list-style-type: none"> • Understanding of Competitive Matrix • Competitive positioning: creating your separate space 	Team: <ul style="list-style-type: none"> • Identify major competitors, and dimensions for analysis • Template: Step 8, Page 109
	18		<ul style="list-style-type: none"> • Presentations of Competitive Analyses and Positionings 	Team: <ul style="list-style-type: none"> • Perform the competitive analysis and present results, including positioning
10	19	Product Line Strategy (Step 09)	<ul style="list-style-type: none"> • Product line framework: good, better, best on underlying platforms, plus application to Services. 	Team: <ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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
We ek	Sess ion	Topics and Steps	• Key CONCEPTS Introduced in Class	Team or Individual Activity
11	21	Reality Check (Step 11)	<ul style="list-style-type: none"> • The purpose of the Reality Check, testing the product concept, channel preferences, and much other. 	Team: <ul style="list-style-type: none"> • Reality Check Survey Template and Results: Step 11, Page 141, 143-144

	22		<ul style="list-style-type: none"> • Guidance on the number or additional customers for the reality check survey • How to analyze and interpret the results 	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • Team reports on Reality Check Results • Examine major components of an Industry Analysis • Review Templates 	Team: <ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • Defining the Business Model: • Lecture on basic structure and different types. • Illustrating it as the flow of product, money, and information. 	Team: <ul style="list-style-type: none"> • Business Model Illustration Template, Step 13, Page 170

We ek	Sess ion	Topics and Steps	· Key CONCEPTS Introduced in Class	Team or Individual Activity
13	25	Business Model (Steps 14, 15, 16, 17)	<ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • 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.
	26			
14	27	Impact Visioning (Step 18)	<ul style="list-style-type: none"> • Develop clear statements for business and societal impact. • Look at good existing examples of companies that do both. 	Team: <ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • Develop and present Unit of 1 Economics Template, Step 19, Page 229 • Keep working on the Final presentation

We ek	Sess ion	Topics and Steps	Key CONCEPTS Introduced in Class	Team or Individual Activity
15	29	Tell Your Story	<ul style="list-style-type: none">• Presentation Format and Style• Format:<ul style="list-style-type: none">(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! <p>(The Fortify Video is a good example of how a good technical idea can translate into a business model, and next, into a well-funded venture.)</p>	<p>Team:</p> <ul style="list-style-type: none">• The PPT Presentation  <ul style="list-style-type: none">• 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.
	30			
Final Course Deliverables			Due on the Monday after the weekend of the final class meeting.	<p>Team: Your Venture PPTs</p> <p>Individual: Insight Learning Reflection Journal</p>

Course Outcomes

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

DOSP1001: Badminton

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

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

Course Objectives:

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

Course Outcomes:

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

List of Activities:

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

Instructional Plan:

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

Reference:

1. Handbook of the Badminton World Federation (BWF)

DOSP1011: Chess

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

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

Course Objectives:

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

Course Outcomes:

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

List of Activities:

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

Instructional Plan:

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

Reference:

1. International Chess Federation (FIDE) Handbook

DOSP1031: Football

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

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

Course Objectives:

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

Course Outcomes:

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

List of Activities:

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

Instructional Plan:

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

Reference:

1. FIFA Laws of the Game

DOSP1041: Volleyball

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

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

Course Objectives:

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

Course Outcomes:

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

List of Activities:

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

Instructional Plan:

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

Reference:

1. FIVB - Official Volleyball Rules

DOSP1051: Kabaddi

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 Kabaddi - 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-curricular activities
- Learn to manage time effectively
- gain confidence

DOSL1011: Club Activity – Member of the Club

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

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

Course Objectives

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

List of Student Club Activities

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

List of Activities

1. Be a member of a club and organize activities in that particular interest area
2. Learn from diverse perspectives and experiences
3. Learn to design and execute extra-curricular activities
4. Develop management skills through hands on experience
5. Explore different managerial roles and develop competencies

Text Books

1. Small move: big Change (Caroline Arnold)
2. How to Win at College: Surprising Secrets for Success from the Country's Top Students (Cal Newport)

References

1. Making the most of college: Students speak their minds (author - Richard Light)
2. Failing Forward: Turning Mistakes into Stepping Stones for Success (John C Maxwell)
3. The Last Lecture (Randy Pausch)
4. Lean in (Sheryl Sandberg)
5. Youtube- Introduction to various club activities

Course Outcomes

Upon successful completion of the course, student will be able to

- Be a member of a club and organize activities in that particular interest area
- Learn from diverse perspectives and experiences
- Learn to design and execute extra-curricular activities
- Develop management skills through hands on experience
- Explore different managerial roles and develop competencies

DOSL1021: Club Activity – Leader of the Club

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

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

Course Objectives

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

List of Student Club Activities

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

List of Activities

1. Be the leader of the club and implement the charter, vision and mission of the club
2. Learn from diverse perspectives and experiences
3. Learn to lead the team, design and execute extra-curricular activities
4. Develop management skills through hands on experience
5. Explore different managerial roles and develop competencies

Text Books

1. Small move: big Change (Caroline Arnold)
2. How to Win at College: Surprising Secrets for Success from the Country's Top Students (Cal Newport)

References

1. Making the most of college: Students speak their minds (author - Richard Light)
2. Failing Forward: Turning Mistakes into Stepping Stones for Success (John C Maxwell)
3. The Last Lecture (Randy Pausch)
4. Lean in (Sheryl Sandberg)
5. Youtube- Introduction to various club activities

Course Outcomes

Upon successful completion of the course, student will be able to

- Be the leader of the club and implement the charter, vision and mission of the club
- Learn from diverse perspectives and experiences
- Learn to lead the team, design and execute extra-curricular activities
- Develop management skills through hands on experience
- Explore different managerial roles and develop competencies

DOSL1031: Club Activity – Competitor

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

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

Course Objectives

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

List of Student Club Activities

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

List of Activities

1. Be the leader of the club and implement the charter, vision and mission of the club
2. Learn from diverse perspectives and experiences
3. Learn to lead the team, design and execute extra-curricular activities
4. Develop management skills through hands on experience
5. Explore different managerial roles and develop competencies

Text Books

1. Small move: big Change (Caroline Arnold)
2. How to Win at College: Surprising Secrets for Success from the Country's Top Students (Cal Newport)

References

1. Making the most of college: Students speak their minds (author - Richard Light)
2. Failing Forward: Turning Mistakes into Stepping Stones for Success (John C Maxwell)
3. The Last Lecture (Randy Pausch)
4. Lean in (Sheryl Sandberg)
5. Youtube- Introduction to various club activities

Course Outcomes

Upon successful completion of the course, student will be able to

- Be the leader of the club and implement the charter, vision and mission of the club
- Learn from diverse perspectives and experiences
- Learn to lead the team, design and execute extra-curricular activities
- Develop management skills through hands on experience
- Explore different managerial roles and develop competencies

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 Sheryl WuDunn)
2. The story of My Experiments with Truth (author: M. K. Gandhi)
3. List of student run and other Government and non-government community service organizations

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 – Environmental Pollution
III

No of Hours:
10

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

Activity

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

Learning Outcomes:

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

UNIT – IV Social Issues and the Environment

No of Hours:
10

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

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

Activity:

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

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

No of Hours:
10

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

Activity:

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

Text Book(s)

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

B.Sc. FOOD SCIENCE TECHNOLOGY

Faculty Core (FC)

CHEM1011: CHEMISTRY I

The students of undergraduate program in science in Chemistry need to be conversant with the various fields of 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.

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 ψ^2 , 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.

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.

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.

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).

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.

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. Inorganic 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

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.

UNIT – I: 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.

UNIT – II: 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).

UNIT – III: 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.

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 $-\text{COOH}$ group, acetylation of $-\text{NH}_2$ 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.

UNIT –

V: Carbohydrates

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.

Textbook(s):

1. Barrow, G.M. Physical Chemistry Tata McGraw-Hill (2007).
2. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Finar, I. L. Organic Chemistry (Volume 2), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
5. Nelson, D. L. & Cox, M. M. Lehninger's Principles of Biochemistry 7thEd., W. H. Freeman.
6. Berg, J.M., Tymoczko, J.L. & Stryer, L. Biochemistry, W.H. Freeman, 2002.

CSCI1001: BASICS TO INFORMATION TECHNOLOGY

UNIT – I

Data 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.

Acquisition of Video: Computing a moving Scene with a video camera, Compression of Video Data, MPEG Compression standard.

Data 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

Central Processing Unit: Introduction, Structure of a central processing unit, Specifications of a CPU, Interconnection of CPU with memory and I/O units, Embedded processors.

Output 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

Text Books:

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

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.

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 KMnO_4 .
3. Estimation of water of crystallization in Mohr's salt by titrating with KMnO_4 .
4. Estimation of Fe (II) ions by titrating it with $\text{K}_2\text{Cr}_2\text{O}_7$ using internal indicator.
5. Estimation of Cu (II) ions iodometrically using $\text{Na}_2\text{S}_2\text{O}_3$.

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 R_f 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.

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., Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.
4. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960.

CHEM1051: CHEMISTRY III

Preamble

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.

Unit I

9L

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.

Unit II

9L

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^-).

Unit III

9L

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.

Unit IV

9L

Electroanalytical methods: Basic principle, Instrumentation and applications of pH metric, potentiometric and conductometric titrations.

Unit V

9L

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

Text Books

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.

PHYS1041: BIOPHYSICS

UNIT I

Radiation Biophysics: Ionizing 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.

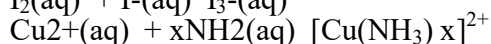
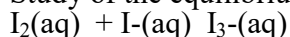
CHEM1041: CHEMISTRY II LAB

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

Section A: Physical Chemistry

Distribution

Study of the equilibrium of one of the following reactions by the distribution method:



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:

- Strong acid vs. strong base
- Weak acid vs. strong base

Potentiometry

Perform the following potentiometric titrations:

- Strong acid vs. strong base
- Weak acid vs. strong base
- Potassium dichromate vs. Mohr's salt

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.

II

- Separation of amino acids by paper chromatography
- Determination of the concentration of glycine solution by formylation method.
- Titration curve of glycine
- Action of salivary amylase on starch
- Effect of temperature on the action of salivary amylase on starch.
- Differentiation between a reducing and a nonreducing sugar.

Textbook(s):

1. 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.
2. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960.
3. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).
4. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry, Universities Press

PHYS1101: BIOPHYSICS LAB

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

RECOMMENDED BOOKS:

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. Drenth, J. (2010) Principles of Protein X-ray Crystallography, Springer

B.Sc. FOOD SCIENCE TECHNOLOGY

Program Core/Major Core (PC/MaC)

MFST1011: PRINCIPLES OF FOOD SCIENCE (THEORY)

Preamble:

Food science is an application of the basic sciences and engineering to study the fundamental physical, chemical and biochemical nature of foods and the concepts underlying food processing. Food science involves many specializations such as food microbiology, food engineering, and food chemistry in an attempt to better understand food processes and ultimately improve food products for the general public.

Course Objectives:

- To impart basic knowledge of Food Dispersions
- To learn the basic concepts and applications of Sensory science
- To understand the importance of food sanitation
- To understand the role of food Packaging in protecting food

Unit I

Characteristics, sols, gels, pectin gels, colloidal sols, stabilization of colloidal system, emulsions, properties of emulsions, formation of emulsion, emulsifying agent, food foams, formation stability and destruction of foam, application of colloidal chemistry to food preparation.

Learning Outcomes:

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

- Describe the characteristics of sols, gels, pectin gels, colloidal sols
- Discuss the basic concepts of emulsions and food foams
- Extend the concepts of colloidal chemistry to food preparation.

Unit II

Objectives, type of food panels, characteristics of panel member, layout of sensory evaluation laboratory, sensitivity tests, threshold value, paired comparison test, duo- trio test, triangle test, hedonic scale, chemical dimension of basic tastes, Amoore's classification of odorous compounds. Sherman and Szczniak classification of food texture. Food as a substrate for microorganism, factors affecting growth of microbes: pH, water activity, O-R potential, nutrient contents, inhibitory substance and biological structure.

Learning Outcomes:

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

- Use sensory evaluation in food product development
- Outline various types of food panels
- Identify the conditions under which microbes can be inactivated, killed or made harmless

Unit III

Principles and applications, Hurdle effect in fermented foods, shelf stable products, intermediate moisture foods, application of hurdle technology. Minimal processing of foods with thermal methods and non-thermal methods-safety criteria in minimally processed foods-Minimal processing in practice-fruits and vegetables-seafood-effect on quality-Future developments.

Learning Outcomes:

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

- Identify the principles and applications of preservation processes
- Extend the concept of Minimal processing of foods
- Appreciate the effect of processing upon various properties of foodstuffs

Unit IV

Principles, equipment and processing, effect on food.Waste water, hardness of water, break point chlorination, physical and chemical of impurities, BOD, COD, waste water treatment, milk plant sanitation, CIP system, sanitizers used in food industry.

Learning Outcomes:

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

- Identify & select processing equipment and methods appropriate for waste water treatment
- Explain the need of sanitation and CIP system in food industry
- Outline the different types of sanitizers used in food industry

Unit V

Objectives of packaging, flexible packaging, properties of the following packaging materials-low density polyethylene, high density polyethylene, polypropylene, polyvinyl chloride,

polyvinylidene chloride, ethylene vinyl alcohol, polystyrene, polyethylene terephthalate, nylon, ethylene vinyl acetate, ethylene acrylic acid, ethylene methacrylic acid, ionomers.

Learning Outcomes:

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

- Explain the objectives of food packaging
- Explain the properties of various food packaging materials
- Identify and examine the method of packaging and packaging materials in shelf life extension of foods

Course Outcomes:

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

- Describe the characteristics of sols, gels, pectin gels, colloidal sols
- Identify the conditions under which microbes can be inactivated, killed or made harmless
- Identify and examine the method of packaging and packaging materials in shelf life extension of foods

MFST1021: PRINCIPLES OF FOOD SCIENCE (PRACTICAL)

1. Estimation of reducing sugar by Fehling's procedure
2. Estimation of salt content in brine
3. Estimation of salt content in butter
4. Preparation of brix solution and checking by hand refractometer
5. Application of colloidal chemistry to food preparation
6. Demonstration of the Soxhlet method for determination of fat content
7. Determination of acidity of water
8. Determination of alkalinity/ hardness of water
9. Demonstration of the Kjeldahl's method for estimation of protein content

Recommended Readings:

1. Coles R, McDowell D and Kirwan MJ, Food Packaging Technology, CRC Press, 2003
2. De S, Outlines of Dairy Technology, Oxford Publishers, 1980
3. Deman JM, Principles of Food Chemistry, 2nd ed. Van Nostrand Reinhold, NY 1990
4. Frazier WC and Westhoff DC, Food Microbiology, TMH Publication, New Delhi, 2004
5. Jenkins WA and Harrington JP, Packaging Foods with Plastics, Technomic Publishing Company Inc., USA, 1991
6. Manay NS and Shadaksharaswamy M, Food-Facts and Principles, New Age International (P) Ltd. Publishers, New Delhi, 1987
7. Meyer LH, Food Chemistry, CBS Publication, New Delhi, 1987
8. Potter NH, Food Science, CBS Publication, New Delhi, 1998
9. Ramaswamy H and Marcott M, Food Processing Principles and Applications CRC Press, 2006
10. Ranganna S, Handbook of Analysis and Quality Control for Fruits and Vegetable Products, 2nd ed.
11. TMH Education Pvt. Ltd, 1986

Course Outcomes:

By the end of the practicals, the student will be able to

- Differentiate between thermal methods and non-thermal methods of food processing
- Understand various application of colloidal chemistry to food preparation
- Classify the physical and chemical of impurities in waste water
- Evaluate the safety criteria in minimally processed foods

MFST1031: FUNDAMENTALS OF FOOD TECHNOLOGY (THEORY)

Preamble:

Food Technology deals with the techniques involved in production, processing, preservation, packaging, labeling, quality management, and distribution of food products. The course also involves techniques and processes that are used to transform raw materials into food. Extensive research goes behind making food items edible as well as nutritious. Food technology greatly contributes to the manufacturing and supply of safe, wholesome and nutritious food products.

Course Objectives:

- To understand the history and evolution of food processing.
- To study the structure, composition, nutritional quality and post harvest changes of various plant foods.
- To study the structure and composition of various animal foods.

Unit I

Introduction-historical evolution of food processing technology. Cereals and millets-Structure and composition, properties and nutritional attributes of rice, wheat, maize, barley, millet and oats, malting, gelatinization of starch, types of browning- Maillard & caramelization, rice-parboiling of rice- advantages and disadvantages.

Learning Outcomes:

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

- Understand various advantages and disadvantages of parboiled rice
- Describe the structure and composition of various cereals and millets
- Understand the concepts of malting, gelatinization and browning

Unit II

Pulses- Structure and composition of pulses, toxic constituents in pulses, processing of pulses-soaking, germination, decortications, cooking and fermentation. Fats and Oils-classification of lipids, types of fatty acids - saturated fatty acids, unsaturated fatty acids, essential fatty acids, trans fatty acids. Refining of oils, types- steam refining, alkali refining, bleaching, steam

deodorization, and hydrogenation. Rancidity –Types- hydrolytic and oxidative rancidity and its prevention.

Learning Outcomes:

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

- Describe the structure and composition of various pulses
- Extend the concepts of classification of lipids and oil Refining
- Summarize different types rancidity

Unit III

Fruits and Vegetables-Classification of fruits and vegetables, general composition, enzymatic browning, names and sources of pigments, Dietary fibre. Post-harvest changes in fruits and vegetables – Climacteric rise, horticultural maturity, physiological maturity, physiological changes, physical changes, chemical changes, pathological changes during the storage of fruits and vegetables.

Learning Outcomes:

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

- Discuss the general composition and Classification of fruits and vegetables
- Identify the sources of pigments
- Summarize different types of post harvest changes during the storage of fruits and vegetables

Unit IV

Compositional, Nutritional and Technological aspects of Animal foods. Flesh Foods-Meat - Definition of carcass, concept of red meat and white meat, composition of meat, marbling, post-mortem changes in meat- rigor mortis, tenderization of meat, ageing of meat. Fish - Classification of fish (fresh water and marine), aquaculture , - microbiological, physiological, biochemical.

Learning Outcomes:

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

- Gain Knowledge on the post-mortem changes in meat

- Compare and contrast red meat and white meat
- Describe the basic concepts of composition, characteristics and spoilage of fish

Unit V

Poultry - Structure of hen's egg, composition and nutritive value, egg proteins, characteristics of fresh egg, deterioration of egg quality, difference between broiler and layers. Milk and Milk Products-Definition of milk, chemical composition of milk, its constituents, processing of milk, pasteurization, homogenization. An overview of types of market milk and milk products.

Learning Outcomes:

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

- Illustrate the concepts of egg structure, composition and nutritive value
- Gain knowledge on types of market milk and milk products
- Compare and contrast broiler and layers

Course Outcomes:

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

- Understand various advantages and disadvantages of parboiled rice
- Describe the structure and composition of various pulses
- Illustrate the concepts of egg structure, composition and nutritive value
- Gain Knowledge on the post-mortem changes in meat

MFST1041: FUNDAMENTALS OF FOOD TECHNOLOGY (PRACTICAL)

1. Study different types of browning reactions: enzymatic and non-enzymatic.
2. To study gelatinization behavior of various starches
3. To study the concept of gluten formation of various flours.
4. To study malting and germination.
5. To study dextrinization in foods.
6. Identification of pigments in fruits and vegetables and influence of pH on them.
7. Quality inspection of animal foods.

Recommended Readings:

1. Bawa. A.S, O.P Chauhan et al. Food Science. New India Publishing agency, 2013
2. Roday,S. Food Science, Oxford publication, 2011.
3. B. Srilakshmi, Food science, New Age Publishers, 2002
4. Meyer, Food Chemistry, New Age, 2004
5. De Sukumar., Outlines of Dairy Technology, Oxford University Press, 2007

Course Outcomes:

By the end of the practicals, the student will be able to

1. List the concepts of conventional and modern food processing methods
2. Understand various concepts of Compositional, Nutritional and Technological aspects of animal foods
3. Identify various Post-harvest changes during storage of plant foods
4. Evaluate the toxic constituents in pulses

MFST2001: TECHNOLOGY OF PLANTATION CROPS

Preamble:

India has been bestowed with wide range of climate and physic-geographical conditions and as such is most suitable for growing various kinds of horticultural crops such as fruits, vegetables, flowers, nuts, spices and plantation crops. Fruits and vegetables are an important supplement to the human diet as they provide the essential minerals, vitamins and fiber required for maintaining health. India is now the second largest producer of fruits and vegetables in the world and is the leader in several horticultural crops.

Course Objectives

- To impart knowledge of different methods of fruits and vegetable processing.
- To learn about processing of various spices, tea, coffee and cocoa.

Unit I

Importance of fruits and vegetable, history and need of preservation, reasons of spoilage, method of preservation (short & long term). Canning and bottling of fruits and vegetables.

Fruits beverages: Processing of fruit juices, preservation of fruit juices, processing of squashes, cordials, nectars, concentrates and powder. Jams, jellies, and marmalades.

Learning Outcomes:

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

- Learn different methods for the preservation fruits and vegetables.
- Understand the detailed account on canning process and bottling.
- Understand the processing of fruits and vegetables in making different products like juices, jam and jellies and marmalade.

Unit II

Pickles, chutneys, and sauces: processing, types, causes of spoilage pickling. Dehydration of foods and vegetables: Sun drying & mechanical dehydration, process variation for fruits and vegetables, packing and storage.

Learning Outcomes:

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

- Learn about the product technologies and the defects in the production of the products.
- Understand the processing of pickles, chutneys and sauces.

Unit III

Milling technology: Wheat-Types, milling, flour grade, flour treatments (bleaching, maturing), flour for various purposes, Products and By-products. Rice – Physicochemical properties, milling (mechanical & solvent extraction), parboiling, ageing of rice, utilization of byproducts. Corn–Milling (wet & dry), cornflakes, corn flour. Barley- Milling (pearl barley, barley flakes & flour) Oats–Milling (oatmeal, oat flour & oat flakes) Sorghum and millets – Traditional & commercial milling (dry & wet).

Learning Outcomes:

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

- Know about the various processing steps of major cereals after harvesting.
- Learn about the production of different processed products and by-products.

Unit IV

Legume technology: Classification of legumes, chemical composition and nutritional value. Methods of dehulling-. Home, cottage, and commercial scale. Modern techniques of dehulling. Milling of legumes: Dal milling principles, methods, equipments and effect on quality. Principle products, fermented products of legumes.

Learning Outcomes:

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

- Learn about the various processing steps and methods of major legumes after harvesting.
- Know about the production of different processed products and fermented products.

Unit V

Technology of Oil seeds: Sources, Composition, Processing of oil seeds – Soya bean, coconut. Hydrogenation. Refining of fats & oils, bleaching, de-odourising, hydroxylation, Protein isolates, Sources of protein (defatted flour, protein concentrates and isolates), properties and uses, protein texturization, fibre spinning.

Learning Outcomes:

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

- Learn about the various processing steps of major oil seeds after harvesting.
- Know about the production of different methods of oil refining and protein products.

Recommended Readings:

1. Kent, N.L. 2003. Technology of Cereal, 5th Ed. Pergamon Press.
2. Chakraverty. 1988. Post-Harvest Technology of Cereals, Pulses and Oilseeds, revised Ed., Oxford & IBH Publishing Co. Pvt Ltd.
3. Marshall, Rice Science and Technology. 1994. Wadsworth Ed., Marcel Dekker, New York.
4. Manay, S. and Sharaswamy, M. 1987. Food Facts and Principles. Wiley Eastern Limited

Course Outcomes:

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

- Know about the various processing steps of major cereals after harvesting.
- Know about equipment used in production and storage of alcohol.
- Learn about the various processing steps and methods of major legumes after harvesting.

MFST2011: FOOD PROCESSING AND PRESERVATION TECHNOLOGY (THEORY)

Preamble:

Food Preservation is defined as a method of maintaining foods at a desired level of properties for their maximum benefit for as long as possible. The subject lies in the core of food science and technology and it is the main purpose of food processing. Food preservation uses many techniques that range from too simple to highly sophisticated

Course Objectives:

- To study the importance and need of food preservation
- To introduce the basics of various food processing and preservation technologies.
- To introduce the concepts of novel food preservation methods
- To familiarize the pros and cons of various food preservation techniques

Unit 1

Principles of Food Preservation, microorganisms associated with foods- bacteria, yeast and mold, Importance of bacteria, yeast and molds in foods. Classification of microorganisms based on temperature, pH, water activity, nutrient and oxygen requirements, typical growth curve of microorganisms. Classification of food based on pH, definition of shelf life, perishable foods, semi perishable foods, and shelf stable foods.

Learning Outcomes:

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

- Identify the important pathogens and spoilage microorganisms in foods
- Identify the conditions under which the important pathogens are commonly inactivated, killed or made harmless in foods.
- Know the principles involving in food preservation via various processes.

Unit II

Thermal Processing- Classification of thermal treatments, Mode of action, Commercial heat preservation, methods: Sterilization, commercial sterilization, Pasteurization and blanching- objectives, types. Pros and cons of high temperature preservation.

Learning Outcomes:

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

- Classify various thermal treatments based on temperature
- Discuss the Pros and cons of high temperature preservation
- Suggest the best thermal treatment for processing different foods

Unit III

Freezing and Refrigeration: Introduction to cool storage, refrigeration, and freezing, principle of freezing, freezing curve, changes occurring during freezing, types of freezing- slow freezing, quick freezing, introduction to thawing, changes during thawing and its effect on food.

Learning Outcomes:

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

- Differentiate Freezing from Refrigeration
- Draw and analyze freeze curve
- Discuss the changes during thawing

Unit IV

Drying and Dehydration - Definition, drying as a means of preservation, heat and mass transfer, factors affecting rate of drying, normal drying curve, types of driers used in the food industry. Evaporation – Definition, factors affecting evaporation, names of evaporators used in food industry.

Learning Outcomes:

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

- Compare and contrast Drying and Dehydration
- Apply the concept of heat and mass transfer in dehydration
- Discuss various factors affecting evaporation

Unit V

Irradiation - Introduction, units of radiation, kinds of ionizing radiations used in food irradiation, mechanism of action, application and benefits of irradiation processing in food industry. Quality and safety of irradiated foods

Learning Outcomes:

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

- Analyze the Quality and safety of irradiated foods
- Categorize different kinds of ionizing radiations used in food irradiation
- Describe the mode of action of various radiations in food industry

Course Outcomes:

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

- Identify the important pathogens and spoilage microorganisms in foods
- Discuss the Pros and cons of high temperature preservation
- Apply the concept of heat and mass transfer in dehydration

MFST2021: TECHNOLOGY OF PLANTATION CROPS (PRACTICAL)

1. Estimation of ascorbic acid and effect of heat treatment on it.
2. Estimation of total soluble solids (TSS).
3. Estimation of pH and acidity of products
4. Estimation of brix: acidity ratio
5. Estimation of Gluten Content of flour
6. Estimation of Pelenshke Value of flour
7. Determination of sedimentation power of flour
8. Dehydration of fruits and vegetables.
9. Rehydration of fruits and vegetables

Recommended Readings:

1. Girdharilal, Siddappaa, G.S and Tandon, G.L.1998. Preservation of fruits & vegetables, ICAR, NewDelhi
2. W B Crusess.2004. Commercial Unit and Vegetable Products, W.V. Special Indian Edition, Pub: AgrobiosIndia
3. Manay, S. &Shadaksharaswami, M.2004. Foods: Facts and Principles, New AgePublishers
4. Ranganna S.1986. Handbook of analysis and quality control for fruits and vegetable products, Tata Mc Graw-Hill publishing company limited, Secondedition.
5. Srivastava, R.P. and Kumar, S. 2006 .Fruits and Vegetables Preservation- Principles and Practices.3rd Ed. International Book DistributingCo.

Course Outcomes

- To impart knowledge of different methods of fruits and vegetable processing.
- To understand the detailed account on canning process and bottling
- To detailed learning on the processing of fruits and vegetables in making different products like juices, jam and jellies and marmalade
- Understand the different methods of processing of spices, oil production, tea and coffee beans.

MFST2031: FOOD PROCESSING AND PRESERVATION TECHNOLOGY (PRACTICAL)

1. Methods of Sampling.
2. Concept of shelf life of different foods
3. To study the concept of Asepsis and sterilization
4. Determination of pH of different foods using pH meter.
5. Study quality characteristics of foods preserved by drying/dehydration/freezing.
6. To perform pasteurization of fluids using different methods.
7. To perform blanching of different plant foods.

Recommended Readings:

1. Text Book on Food Storage and Preservation (2004) by Vijayakhader.
2. Food Science (2002) by B. Srilakshmi.
3. Food Processing and Preservation (2010) by B.SivaShakar.
4. Food Processing and Preservation (2007) by G. Subbalakshmi
5. Food preservation and processing (2007) by ManoranjanKalia

Course Outcomes:

By the end of the course, the student will be able to

- Compare conventional methods of food preservation with novel methods of food preservation(food irradiation, biosensors, microwave)
- Apply principles of food preservation to pilot scale production of processed food and evaluate variation in processing parameters on product properties
- Evaluate the effect of processing upon the nutritional properties of foodstuffs.

MFST2041: FOOD MICROBIOLOGY

Preamble:

Food microbiology is the scientific study of microorganisms, both in food and used for the production of food. This includes microorganisms that contaminate food, as well as those used in its production; for example to produce yoghurt, cheese, beer and wine.

Course Objectives:

- To know the important genera of microorganisms associated with food and their characteristics.
- To understand the role of microbes in fermentation, spoilage and food borne diseases.

Unit I

Food microbiology- definition and importance, Microbial growth in food- intrinsic and extrinsic factors affecting the growth of microorganisms in food, bacterial growth curve. Beneficial role of microorganisms in food. Probiotics, prebiotics and synbiotics.

Learning Outcomes:

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

- Learn about the morphological characteristics important in food bacteriology
- Understand about the importance of microbiology and its relevance to everyday life.

Unit II

Microorganisms associated with food- Bacteria, molds, yeast, virus- General characteristics, structure, morphological characteristics, growth and cultural characteristics. Endospore - structure and significance in food microbiology

Learning Outcomes:

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

- Learn about general characteristics of bacteria, fungi and virus.
- Know procedures of identification of microorganisms

Unit III

Microbial food spoilage - sources of microorganisms in foods, spoilage of different food groups- milk and dairy products, meat, poultry and sea foods, cereal and cereal products, fruits and vegetables and canned products.

Learning Outcomes:

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

- Understand about spoilage. Contamination sources, types, effect of cereals, sugar, vegetables and fruits, meat, milk, canned foods.

Unit IV

Sterilization methods-physical and chemical. Pure culture techniques, methods of isolation. Enumeration of Microorganisms- qualitative and quantitative. Control of Microorganisms in Foods- Principle and methods. Preservation and maintenance of microbial cultures.

Learning Outcomes:

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

- Learn about sterilization methods, pure culture techniques, methods of isolation
- Understand about control of microorganisms in foods, and preservation and maintenance of microbial cultures.

UNIT V

Food infection and food intoxication. Food and water borne diseases by – *Salmonella*, *E. coli*, *Clostridium*, *Listeria*, *Shigella*, *Bacillus*, *Campylobacter*, *Vibrio*. Trends in Food Microbiology- rapid methods of detection, recent Advances

Learning Outcomes:

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

- Understand about the sources of contamination of food, mycotoxins, toxin production and physiological action, sources of infection of food by pathogenic organisms.
- Learn about water, soil and air borne diseases.

Course Outcomes:

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

- Learn about the morphological characteristics important in food bacteriology.

- Understand about the sources of contamination of food, mycotoxins, toxin production and physiological action, sources of infection of food by pathogenic organisms.
- Know procedures of identification of microorganisms

MFST2051: FOOD MICROBIOLOGY PRACTICAL

1. Introduction to the Basic Microbiology Laboratory Practices and equipment
2. Functioning and use of compound microscope
3. Cleaning and sterilization of glassware
4. Preparation and sterilization of nutrient broth
5. Cultivation and sub-culturing of microbes
6. Preparation of slant, stab and plates using nutrient agar
7. Morphological study of bacteria and fungi using permanent slides
8. Simple staining
9. Gram's staining
10. Standard Plate Count Method
11. Introduction of culture procuring and depositing centers, ATCC, DSMZ, and IMTECH

Recommended Readings:

1. Food Microbiology (4th edition) by W. C Frazier.
2. Modern Food Microbiology (7th edition) by J.M. Jay .
3. Food Microbiology (2006) by M.R. Adams.
4. Basic Food Microbiology (2004) by G.J. Banwart.
5. Food Microbiology (2007) by K.Vijaya Ramesh.
6. Fundamentals of Food Microbiology (5th Edition) by B. Ray and A. Bhunia.

Course Outcomes:

By the end of the practicals, the student will be able to

- Learn about important pathogens and spoilage microorganisms in foods and the conditions under which they will grow, conditions under which the important pathogens are commonly inactivated, killed or made harmless in food, principles involving food preservation via fermentation processes
- Understand about the role and significance of microbial inactivation, adaptation and environmental factors (i.e., Aw, pH, temperature) on growth

- Know about the response of microorganisms in various environments, and conditions, including sanitation practices, under which the important pathogens and spoilage microorganisms are commonly inactivated, killed or made harmless in foods.

MFST3001: TECHNOLOGY OF ANIMAL FOODS (THEORY)

Preamble: *The principle interests of the extension program at this time are in the area of dairy Technology deals with processing of milk and milk product. The meat industry topics deals total utilization of flesh foods, particularly poultry and fish, animal welfare, and the sustainability of animal agriculture. Issues of animal welfare are also presented to challenge simplistic, often anthropomorphic assumptions, especially with respect to egg layers. Seafood Processing: Technology, Quality and Safety covers the whole range of current processes which are applied to seafood, as well as quality and safety aspects*

Course objectives:

- To understand need for and importance of livestock, dairy, egg, fishery and poultry industry
- To know the compositional and technological aspects of milk and fish.
- To study structure, composition and nutritional quality of animal products.
- To study processing and preservation of animal foods.
- To understand technology behind preparation of various animal food products and byproduct utilization.

Unit I

Milk: Physical properties of milk, Composition of milk. Market milk industry: Systems of collection of milk Reception, Platform testing, Various stages of processing- Filtration, Clarification, Homogenization, Pasteurization. Receiving and storage of milk. Milk products– Butter, ghee, flavored milk, yoghurt, dahi, shrikhand, ice-cream, condensed milk, milk powder, channa, paneer, cheese (cheddar). Dairy plant sanitization.

Learning Outcomes:

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

- Understand about milk, its properties both physical and functional and composition.
- Learn about different milk products and its production.
- Understand about dairy sanitization and storage

Unit II

Egg: The egg industry, its techniques of working, General management, structure, composition and nutritive value of egg and its products. Preservation of eggs: Refrigeration and freezing, thermal processing, dehydration, coating. Quality identification of shell eggs- Factors affecting egg quality and measures of egg quality.

Learning Outcomes:

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

- Learn about egg structure, composition, nutritive value and quality characteristics.
- Understand about evaluation of quality and grading of eggs;
- Know about the preservation of shell eggs and experiments in by-products utilization.

Unit III

Meat: Development of meat and poultry industry in India and its need in nation's economy

Meat quality: Effects of feed, breed and environment on production of meat animals and their quality. Slaughtering process, post mortem changes and examination, HACCP model.

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

- Learn about muscle structure, chemical composition and physico-chemical properties of meat muscle.
- Understand the procedure of Pre-slaughter operations of meat animals and poultry birds.
- Learn about muscle structure, chemical composition and physico-chemical properties of meat muscle.
- Understand the procedure of Pre-slaughter operations of meat animals and poultry birds.

Unit IV

Fish: Status of fishery industry in India. Chilling and freezing of fish: Relationship between chilling and storage life, MAP, general aspects of freezing, freezing systems (air blast freezing, plate or contact freezing spray or immersion freezing, freezing on board, onshore processing, changes in quality in chilled and frozen storage, thawing.

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

- Learn about the processing of fish by curing agents, drying and salting.
- Understand other processing options of preserving fish by smoking.

- Learn about processing of fish by canning of different variety fishes.

Unit V

Preservation of animal food: Refrigeration and freezing, thermal processing- canning, dehydration/drying, smoking and irradiation of meat and fish. Curing -curing agents, meat and fish curing. RTE meat and fish products. Sausages-processing, types and defects. Fishery by-products: Surimi and fish mince products. Fish protein concentrates (FPC), fish protein extracts (FPE), fish protein hydrolysis (FPH), Fermented fish and products.

Learning Outcomes:

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

- Learn about processing of fish by canning of different variety fishes.
- Understand about fish by-products processing and potential benefits.

Course Outcomes:

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

- Learn about different milk processing and products.
- Understand about dairy sanitization and storage.
- Learn about egg structure, composition, nutritive value and quality characteristics.
- Learn about poultry, meat and marine food industry, market and processing.
- Preservation of animal food and making of products.

- Understand about muscle structure, chemical composition and physico-chemical properties of meat muscle
- Know procedures of Slaughtering of animals and poultry, post-mortem changes, post-mortem inspection and grading of meat properties and shelf life of meat.
- Learn about factors affecting, processing of by curing agents, canning drying, smoking and salting of meat and fish

MFST3011: FOOD BIOCHEMISTRY

Preamble:

Food chemistry deals with the chemical processes and interactions of all biological and non-biological components of foods. The biological substances comprise items like poultry, lettuce, meat, milk and beer. It is parallel to biochemistry in its main components including water, carbohydrates, lipids, proteins and enzymes. Apart from this it also contains areas like vitamins, minerals, food additives, flavors, and colors. This subject also includes how products change under certain circumstances of food processing techniques and methods either to enhance or to prevent them from occurring.

Course Objectives:

- To understand the chemistry of foods - composition of food, role of each component and their interaction.
- To understand the functional aspects of food components and to study their role in food processing.

Unit I

Introduction to Food Chemistry – Definition, Composition of food. Water - Definition of water in food, Structure of water and ice, Types of water, Sorption phenomenon, Water activity and packaging, Water activity and shelf-life

Learning Outcomes:

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

- Understand the concept of micro and macro elements which constitutes the food
- Identify different types of water in the food and its relation to food spoilage
- Differentiate various foods based on shelf life

Unit II

Lipids - Classification of lipids, Physical properties-melting point, softening point, specific gravity, refractive index, smoke, flash and fire point, turbidity point. Chemical properties-reichert-meissel value, polenske value, iodine value, peroxide value, saponification value. Effect of frying on fats, Changes in fats and oils- rancidity, lipolysis, flavor reversion, Auto-oxidation

and its prevention, Technology of edible fats and oils- Refining, Hydrogenation and Interesterification, Fat Mimetics

Learning Outcomes:

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

- Differentiate between various types of fats like saturated and unsaturated and essential fats
- Explain how lipids gets spoiled and how to prevent it
- Extend the concept of processing various types of fats and oils

Unit III

Proteins - classification and structure, Nature of food proteins (plant and animal proteins), Properties of proteins (electrophoresis, sedimentation, amphoterism and denaturation), Functional properties of proteins eg. organoleptic, solubility, viscosity, binding gelation / texturization, emulsification, foaming.

Learning Outcomes:

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

- Differentiate the types of proteins present in plants and animals
- Compare physical and functional properties of proteins
- Use the concepts of emulsification, foaming, gelation etc. for preparing food varieties

Unit IV

Carbohydrates – Classification (mono, oligo and poly saccharides), Structure of important polysaccharides (starch, glycogen, cellulose, pectin, hemicellulose, gums), Chemical reactions of carbohydrates –oxidation, reduction, with acid & alkali, Modified celluloses and starches, resistant starch.

Learning Outcomes:

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

- Understand the types of carbohydrates in food
- Differentiate between processed foods, cereals and whole grain food
- Formulate low and high carbohydrate diet

Unit V

Vitamins – Structure, Importance and Stability of Water soluble vitamins & Fat soluble vitamins

Flavour - Definition and basic tastes, Chemical structure and taste, Description of food flavours, Flavour enhancers

Learning Outcomes:

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

- Compare and contrast the water soluble and fat soluble vitamins
- Illustrate the deficiency disorder caused by lack of vitamins
- Develop variety of food using different flavors and enhancers.

Course Outcomes:

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

- Understand the concept of micro and macro elements which constitutes the food
- Understand the types of carbohydrates in food
- Compare and contrast the water soluble and fat soluble vitamins

MFST3021: TECHNOLOGY OF ANIMAL FOODS PRACTICAL

1. To perform platform tests in milk (Acidity, COB, MBRT, specific gravity, SNF)
2. To estimate milk protein by Folin method.
3. To estimate milk fat by Gerber method.
4. To prepare casein and calculate its yield.
5. Estimation of moisture content of meat
6. Estimation of protein content of meat
7. Cutout analysis of canned meats/retort pouches
8. To study shelf-life of eggs by different methods of preservation
9. Evaluation of eggs for quality parameters (market eggs, branded eggs)
10. To perform freezing of yolk/albumen
11. Identification of different varieties of fish.
12. Fish product formulation/canning.

Recommended Readings:

1. Lawrie R A, Lawrie's Meat Science, 5th Ed, Woodhead Publisher, England, 1998
 2. Parkhurst & Montney, Poultry Meat and Egg Production, CBS Publication, New Delhi, 1997
 3. De Sukumar, Outlines of Dairy Technology, Oxford University Press, Oxford. 2007.
 4. Hall GM, Fish Processing Technology, VCH Publishers Inc., NY, 1992
 5. Sen DP, Advances in Fish Processing Technology, Allied Publishers Pvt. Limited 2005
4. Shahidi F and Botta JR, Seafoods: Chemistry, Processing, Technology and Quality, Blackie Academic & Professional, London, 1994

Course Outcomes:

By the end of the practical, the student will be able to

- Understand milk properties and standard processing methods.
- Know different milk products and its importance.

MFST3031: FOOD BIOCHEMISTRY PRACTICAL

1. Preparation of primary and secondary solutions
2. Estimation of moisture content
3. Determination of gelatinization temperature range (GTR) of different starches and effect of additives on GTR.
4. Determination of refractive index and specific gravity of fats and oils.
5. Determination of smoke point and percent fat absorption for different fat and oils.
6. Determination of percent free fatty acids
7. Estimation of saponification value
8. Estimation of reducing and non-reducing sugars using potassium ferricyanide method.

Recommended Readings:

1. Fennema, Owen R, Food Chemistry, 3rd Ed., Marcell Dekker, New York, 1996
2. Whitehurst and Law, Enzymes in Food Technology, CRC Press, Canada, 2002
3. Wong, Dominic WS, Food Enzymes, Chapman and Hall, New York, 1995
4. Potter, N.N. and Hotchkiss, J.H, Food Science, 5th Ed., Chapman & Hall, 1995
5. DeMan, J.M., Principles of Food Chemistry, AVI, New York, 1980

Learning Outcomes:

By the end of the practicals, the student will be able to

- Prepare different types of solutions
- Differentiate between fats and oils and their adulterations
- Compare and contrast non-reducing and reducing sugars

MFST3041: FOOD CHEMISTRY

Preamble:

Food chemistry plays a key role in warranting that the food being processed is of high quality and safe for eating. Understanding food chemistry helps us develop proper ways of handling food and also develop good manufacturing practices. Chemical substances can play a significant role in food manufacture and safeguarding. Food additives can, for example, prolong the shelf life of foods or can make food more attractive, such as colors. Flavorings are used to make food tastier. Other chemicals can be used to fight diseases in farm animals or crops.

Course Objectives:

- To understand the chemistry of food components and their interactions.
- To know about the role of enzymes and various processing treatments in food industry.
- To understand the concept of new product development.

Unit I

Minerals - Major and minor minerals calcium, phosphorus, Sulphur, magnesium, sodium, potassium, chlorine; minor minerals - iron, Florine, zinc, copper, iodine, chromium, cobalt, Metal uptake in canned foods, Toxic metals.

Learning Outcomes:

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

- Differentiate between trace elements and essential elements in food
- Understand the pros and cons of canned foods
- Illustrate the harmful effects of toxic metals in food

Unit II

Natural Food Pigments- Introduction and classification Food pigments (chlorophyll, carotenoids, anthocyanins and flavonoids, beet pigments, caramel). Browning Reactions In Food - Enzymatic browning, Non – Enzymatic browning, Maillard reaction, Caramelization reaction, Ascorbic acid oxidation

Learning Outcomes:

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

- Illustrate the importance of food colors in maintain and improving the appearance

- Differentiate between natural and artificial colors and pigments
- Apply enzymatic and non-enzymatic reactions for refining the food quality

Unit III

Enzymes - Introduction, classification, General characteristics, Enzymes in food processing, Industrial Uses of Enzymes, Immobilized enzymes

Learning Outcomes:

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

- Use immobilized enzymes for convenience, economy and stability of food in industries
- Understand that enzymes can be used to enhance the digestion of food and the delivery of nutrients to the blood even in a compromised digestive system
- Develop mechanisms to control the speed of chemical reactions in the food using enzymes

Unit IV

Physico-chemical and nutritional changes occurring during food processing treatments -Drying and dehydration, Irradiation, Freezing, Canning

Learning Outcomes:

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

- Comprehend that by processing the food it is possible to maintain a nutritious and safe food supply for the millions of people.
- Reduce the loss and increase the food supply by improving the processing efficiency by enhancing the yield of usable product.
- Appreciate how processing changes some of the food chemicals making it safer to eat, easier to digest and taste better.

Unit V

New product development – Definition, Importance, Need of product development, Steps of product development- Product development tools, Reasons for failure.

Learning Outcomes:

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

- Discuss the elements which can impact on consumers' preferences and demands.
- Understand that new products development is the life & blood of companies
- Determine how to best communicate their products' attributes to their target customers based on customer needs, competitive pressures, available communication channels and reasons for failure of the new product in the market.

Course Outcomes:

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

- Differentiate between trace elements and essential elements in food
- Illustrate the importance of food colors in maintain and improving the appearance
- Use immobilized enzymes for convenience, economy and stability of food in industries
- Understand that new products development is the life and blood of companies

MFST3051: FOOD CHEMISTRY (PRACTICAL)

1. Estimation of total ash
2. Estimation of minerals-demo
3. Determination of thermal inactivation time of enzymes in fruits and vegetables.
4. Estimation of iodine value
5. Estimation of peroxide value
6. Determination of carotenoids w.r.t flour pigments.
7. Extend of non-enzymatic browning by extraction methods.
8. Introduction of the concept of new product development

Recommended Readings:

1. DeMan, John M., Principles of Food Chemistry ,3rd Ed., Springer 1999
2. Desrosier, Norman W. and Desrosier.,JamesN.,The technology of food preservation , 4th Ed.,Westport, Conn. : AVI Pub. Co., 1977.
3. Fennema, Owen R, Food Chemistry, 3rd Ed., Marcell Dekker, New York, 1996
4. Fuller, Gordon W, New Product Development From Concept to Marketplace, CRC Press, 2004.
5. Whitehurst and Law, Enzymes in Food Technology, CRC Press, Canada, 2002

Course Outcomes:

By the end of the practicals, the student will be able to

- Understand the concepts of enzymatic and non-enzymatic browning in food and improve the food quality
- Apply various enzymes in industry for improving the digestion of food and extending the shelf life of a product by preventing certain enzymes
- Develop a new product.

B.Sc. FOOD SCIENCE TECHNOLOGY

Program Elective (PE)#

MFST2201: BAKERY AND CONFECTIONARY TECHNOLOGY

Preamble:

Baking is both an art and a science, and mastery in baking allows the baker to be creative in exploring new and quality products from inconsistent ingredients and process conditions. The course gives a wealth of information about making of various yeast-made products—bread, cakes, biscuits, desserts and pizza—their ingredients in bakery production. The course also allows us to understand the use of modern technology machines in bakery production, icings, decoration, bakery organization, and many other aspects.

Course Objectives:

- To understand the fundamentals of baking
- To learn the technologies behind bakery products
- To understand industry trends

Unit I

Bakery industry: Current status, growth rate, and economic importance. Product types, nutritional quality and safety of products, pertinent standards & regulations. Bread, buns and pizza base: Ingredients & processes for breads, buns, pizza base, equipments used, product quality characteristics, faults and corrective measures. Cakes: Ingredients & processes for cakes, Equipments used, product quality characteristics, faults and corrective measures. Different types of icings.

Learning Outcomes:

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

- Know nutritional quality and safety of bakery products
- Learn about ingredients and making process of bread, buns and pizza base, cakes

Unit II

Biscuits, cookies & crackers: Ingredients & processes, Equipments used, product quality characteristics, faults and corrective measures. Modified bakery products: Modification of bakery products for people with special nutritional requirements e.g. High fibre, low sugar, low fat, gluten free bakery products. Breakfast cereals, macaroni products and malt: Production and

quality of breakfast cereals, macaroni products and malt.

Learning Outcomes:

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

- Identify ingredients and making process of Biscuits, cookies & crackers
- Know ingredients and making process of breakfast cereals, macaroni products and malt

Unit III

Chocolate processing - Different steps involved in chocolate processing - Ingredients, mixing, refining. General technical aspects of Industrial sugar confectionery, composition effects, changes, change of state.

Learning Outcomes:

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

- Identify ingredients and making process of chocolate
- Know about ingredients and making process of confectionery

Unit IV

Boiled sweets - classification - Ingredients used in the preparation - Caramel, toffee and fudge – Processing. Processing of liquorice paste, cream paste and aerated confectionery products - Ingredients- their function - Ingredients and Processing. Tablets, Lozenges, Sugar panini ng tablets, Granulated confectionery, medicated confectionery - Ingredients and Processing.

Learning Outcomes:

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

- Identify ingredients and making process of Boiled sweets
- Know about ingredients and making process of granulated and medical confectionery

Unit V

Chewing gums, fondants, Marzipan - Ingredients & Processing. Crystallized confectionery - Processing - Ingredients and their functions. Quality and standards/regulations to be followed in the confectionery Industry and packaging requirements

Learning Outcomes:

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

- Identify ingredients and making process of Chewing gums, fondants, Marzipan
- Learn quality and standards/regulations to be followed in the confectionery Industry and packaging requirements

Course Outcomes:

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

- Know nutritional quality and safety of bakery products
- Identify ingredients and making process of Biscuits, cookies & crackers
- Identify ingredients and making process of Boiled sweets
- Identify ingredients and making process of Chewing gums, fondants, Marzipan

B.Sc. FOOD SCIENCE TECHNOLOGY

MFST2231: BAKERY AND CONFECTIONARY TECHNOLOGY PRACTICAL

1. Preparation of sponge cake with icing and assessment of its quality.
2. Preparation of biscuits and assessment of quality
3. Determine the effect of heat on sugar solution and perform the thread and cold water test.
4. To study the process of inversion, melting and caramelization in sucrose.
5. Preparation of *Shakarpar* and *Chhanamurki*.
6. Preparation of bread and assessment of its quality

Recommended Readings:

1. Basic Baking 5th Ed. Dubey, S.C. (2007). ChanakyaMudrak Pvt. Ltd.
2. Industrial Chocolate Manufacture. Beckett S.T. (2009), Blackwell Publishing Ltd.
3. Chocolate, Cocoa and Confectionary, Minifie B.W. (1999). Aspen Publication.
4. Text book of Food Science and Technology. Vijayakumar.. ICAR
5. Bakery Technology and Engineering. Samuel A. Matz (1999)., PAN-TECH International Incorporated.

Course Outcomes:

By the end of the practicals, the student will be able to

- Learn about preparation and quality assessment of sponge cakes, biscuits
- Analyze study effect of heat on sugar solution and understand the levels of various sugar solutions
- Do preparation of bread and its assessment.

MFST2211: TECHNOLOGY OF SPICES

Preamble:

Spices are woven into the history of nations. Most of the spices are native of our country and hence India is known as the Land of Spices. Spices impart aroma, color and taste to food preparations. Most of the spices have potential medicinal values. Spices and spice products are also indirectly used as flavoring or coloring agents or as preservatives in many pharmaceutical preparations.

Course Objectives:

- To introduce students to the world of plants and their products with an emphasis on the creative use of spices in enhancing the aroma and taste of many dishes.
- Understand the history of herbs, spices, and medicinal plants.
- Understand the important role of herbs and spices in human history
- Familiarize about the value added products of spices

Unit I

Spices - Definition, Composition, classification. Spice production in India, role of spices in cookery, spice processing technology. Post processing treatment- steam sterilization, irradiation, and chemical fumigation. Nutritive value of spices. Application in food systems

Learning Outcomes:

By the end of the course, the student will be able to

- Familiarize with classification, nutritive value and composition of spices
- Describe role of spices in cookery
- Understand the concepts of spices processing

Unit II

Major spices –pepper, cardamom, chillies, ginger, turmeric composition, production, processing, uses, health benefits, active spice constituents. Minor spices –Asafoetida, ajwain, aniseed, bay leaves, caraway cinnamon, clove, coriander, cumin, fenugreek, garlic, nutmeg, mace, kokam, saffron- uses and active spice constituents.

Learning Outcomes:

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

- Differentiate between major and minor spices
- Understand the technologies involved in spice processing
- Gain knowledge on uses and active spice constituents.

Unit III

Benefits of value added products. Primary and secondary functions of spices. Role of biotechnology in improvement of spice crops. Adulteration of spices. Economic uses of spices.

Learning Outcomes:

By the end of the course the student will be able to

- Discuss various value added products of spices.
- Differentiate between the primary and secondary functions of spices
- Discuss the role of biotechnology in improvement of spice crops

Unit IV

Technology of manufacturing spice extractives - oleoresins and oils, advantages and applications of spice extractives. Spice contaminants- harmful effects, preventive measures, decontamination techniques, sterilization of spices. Spoilage of spices-factors affecting spice spoilage, Preservation of spices.

Learning Outcomes:

By the end of the course, the student will be able to

- Describe various methods for manufacturing spice extracts
- Gain knowledge on spice contaminants
- Identify methods of preservation of spices

Unit V

Packaging and storage of spices- packaging requirements, types and characteristics of packaging materials, labeling considerations of spice and spice products, storage stability. Quality control of spices, spice specific tests. Storage requirements of spice and spice products. Spice board of India.

Learning Outcomes:

By the end of the course, the student will be able to

- Explain the need of proper packaging for spices
- Summarize different types of packaging materials suitable for spices
- Apply the concept of Quality control in spice processing

Course Outcomes:

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

- Describe role of spices in cookery
- Describe various methods for manufacturing spice extracts
- Apply the concept of Quality control in spice processing

MFST2241: TECHNOLOGY OF SPICES PRACTICAL

1. Testing for adulterants in spices
2. Processing of some spices
3. Extraction of various spices
4. Investigating the antimicrobial activity of various spices
5. Visit to commercial crop production and research centers
6. Value addition of spices

Recommended Readings:

1. Handbook of Herbs and Spices (2006) Volume 3 by K. V. Peter
2. Chemistry of Spices (2008) by V. A. Parthasarathy
3. Handbook on Spices & Condiments (Cultivation, Processing and Extraction) 2010 by H. Panda
4. The Complete Book on Spices & Condiments (2006) 2nd edition by NIIR Board
5. Cultivation of Spice Crops (2005) by Azhar Ali Farooqi

Course Outcomes:

By the end of the practicals, the student will be able to

- Understand the importance of spices and herbs in cooking
- List the value added products of various spices
- Summarize various applications of spices
- Differentiate major and minor spices

MFST2221: FOOD AND NUTRITION (THEORY)

Preamble:

Food and nutrition are the way that we get fuel, providing energy for our bodies. We need to replace nutrients in our bodies with a new supply every day. A healthy diet includes a lot of natural foods. A sizeable portion of a healthy diet should consist of fruits and vegetables. Whole grains, such as whole wheat and brown rice, should also play a part in your diet. For adults, dairy products should be non-fat or low-fat. Protein can consist of lean meat and poultry, seafood, eggs, beans, legumes, and soy products such as tofu, as well as unsalted seeds and nuts.

Course Objectives:

- Understand the relationship between food, nutrition and health.
- Understand the functions of food.
- Learn about various food groups and balanced diet.
- Understand digestion, absorption and function of various nutrients and their sources.

Unit I

Functions of food-physiological, psychological and social, Concept of Balanced Diet, Food Groups- major nutrients, Food Pyramid, guidelines for good health. Food exchange list, basal metabolism, factors affecting BMR

Learning Outcomes:

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

- Understand the relationship between nutrition and human well being.
- Know and understand the functions, importance of all nutrients for different age groups and special groups

Unit II

Basic terms in study of food and nutrition- BMI, Nutritional Status, malnutrition, recommended daily allowances (RDA). Factors affecting RDA, uses of RDA. Relationship between food, nutrition and health.

Learning Outcomes:

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

- Learn about functions of foods, definition of nutrition, nutrients, adequate optimum and good nutrition, malnutrition. Food as a source of nutrients.
- Illustrate inter relationship between nutrition and health, visible symptoms of good health.

Unit III

Meal planning-Factors affecting meal planning for different groups of people. Methods of cooking- Dry, moist, frying and microwave cooking, Advantages, disadvantages and effect on foods. Nutritional labeling- Importance, global trends, codex guidelines, nutritional labelling in India, FSSAI guidelines.

Learning Outcomes:

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

- Understand the planning of meal
- Know and understand the different methods of cooking.
- Learn about nutritional labelling and guidelines.

Unit IV

Classification, digestion, functions, dietary sources, Recommended Dietary Allowances, clinical manifestations of deficiency and excess and factors affecting absorption- Energy, lipids carbohydrates and proteins

Learning Outcomes:

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

- Understand the details about dietary sources
- Learn clinical manifestations of macromolecules

Unit V

Classification, digestion, functions, dietary sources, RDA, clinical manifestations of deficiency and excess and factors affecting absorption: Fat soluble vitamins-A, D, E and K. Water soluble vitamins – thiamin, riboflavin, niacin, pyridoxine, folate, vitamin B12 and vitamin C. Minerals–

calcium, iron, iodine, fluorine, copper and zinc

Learning Outcomes:

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

- Understand the details about dietary sources
- Learn clinical manifestations of micromolecules

Course Outcomes:

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

- Understand the relationship between nutrition and human well-being.
- Know and understand the different methods of cooking.
- Learn about functions of foods, definition of nutrition, nutrients, adequate optimum and good nutrition, and malnutrition.

MFST2251: FOOD AND NUTRITION PRACTICAL

1. Identification of food sources for various nutrients using food composition tables.
2. Record diet of self-using 24 hour dietary recall and its nutritional analysis.
3. Introduction to meal planning, concept of food exchange system.
4. Estimation of BMI and other nutritional status parameters.
5. Planning meals for adults of different activity levels for various income groups.
6. Survey of locally available foods and identifying the key nutrients
7. Estimation of BMR and other nutritional status parameters.
8. Formulation of weaning foods
9. Planning and preparation of diets for aged people

Recommended Readings:

1. Dietetics (2007) by B. Srilakshmi.
2. ICMR (2010). Nutrient Requirements and Recommended Dietary Allowances for Indians
3. Text Book of Human Nutrition (2010) by Bamji
4. Essentials of Human Nutrition (2007) by A.S.Truswell.
5. Nutrition & Dietetics 3rd edition Subhangini Joshi
6. Oxford Handbook of Nutrition and Dietetics (2012) Joan Webster
7. Srilakshmi (2007). Food Science, 4th Edition. New Age International Ltd
8. IFCT (2017) Indian Food Composition Tables

Course Outcomes:

By the end of the practicals, the student will be able to

- Understand various functions of foods
- Identify the nutritional requirements of various age groups
- Understand the problems associated with different age groups
- Understand the importance of breast feeding

MFST2261: APPLIED PHYSIOLOGY (THEORY)

Preamble:

This course aims to provide an overview of fundamental human physiology. This course aims to explain about structure and functions of cells and organs in humans such as immune system, gastrointestinal system, renal system. Cardiovascular system, respiratory system, central nervous system and reproductive system.

Course Objectives:

- To provide a thorough knowledge regarding human physiology
- To provide a thorough understanding of structure and functions of cells in human body
- To provide good knowledge about various systems in human body such as Cardiovascular, respiratory, central nervous, gastrointestinal and renal systems
- To teach our students about significance of endocrinology and sensory organs

Unit I

Introduction to human physiology: Cell prokaryotic and eukaryotic cell, cell cycles- mitosis, meiosis, Tissues, Blood- composition of blood and their functions,

Learning Outcomes:

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

- To learn cell functions and cell cycles
- To understand differences between prokaryotic and eukaryotic cell structures
- To know the composition of blood and its role in our body
- To understand the structure and functions of various tissues in our body

Unit II

Immune system- innate and adaptive immune system, humeral and cell mediated immunity
Endocrinology- hormones, endocrine glands-pituitary, thyroid, adrenal gland. Structure and functions of Special senses- Vision, hearing, taste and smell

Learning Outcomes:

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

- To understand the immune system and cells functions and types of immune system

- To study the fundamental concepts of endocrinology- hormones and endocrine glands
- To learn the structure and functions of special sensory organs

Unit III

Physiology of Cardiovascular system: design of CVS, Cardiac cycle, hypertension. Physiology of respiratory system- Organs of respiratory system and mechanism of respiration, regulation of respiration

Learning Outcomes:

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

- To learn the fundamental structural design of cardiovascular system, and hypertension
- To understand the physiology and mechanism of respiratory system

Unit IV

Physiology of Gastrointestinal system –Description of GIT, organs, hormones, enzymes involved in GIT, Utilization and Absorption of Carbohydrates, proteins, fats. Physiology of renal system, organs of urinary system, structure of nephron

Learning Outcomes:

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

- To learn the physiology of gastrointestinal system
- To study the hormones and enzymes involved in gastrointestinal system,
- To understand the absorption of various nutrients in our regular diet
- To learn the physiology and functions of urinary system

Unit V

Structure and functions of Central Nervous System, nerve cell, Structure and organization of central and peripheral nervous system. Physiology of male and female reproductive system, growth and development during pregnancy

Learning Outcomes:

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

- To learn the structure and functions of CNS

- To study organization of central and peripheral nervous system
- To understand the physiology of male and female reproductive system
- To learn the growth and development during pregnancy

Course Outcomes:

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

- To understand the immune system and cells functions and types of immune system
- To learn cell functions and cell cycles
- To study organization of central and peripheral nervous system

MFST2271: INSTRUMENTATION FOR FOOD ANALYSIS (THEORY)

Preamble:

This paper gives student an idea about principles and procedures in performing different chromatographic techniques like in purifying the proteins to homogeneity, testing the purity levels by different electrophoretic techniques, and quantitating the same by spectrophotometric methods. This paper also gives you brief idea about the different radioactive methods for measurement of radioactivity, electrochemical methods in determining the pH of the solution, and about importance of biosensors. This course also helps to quantitate the scientific data, importance of statistics and application of various statistical methods, importantly, standard deviation, correlation, and regression related to bioanalytical techniques.

Course Objectives:

- To understand the detailed principles, procedures and applications of various chromatographic techniques for example in learning the purification of proteins by using ion exchange and affinity chromatography, and molecular weight determination by size exclusion chromatography.
- To learn the principles, procedures and applications of various electrophoretic techniques, importantly knowing the difference between SDS and native PAGE, and isoelectric focussing.
- To study the principles, procedures and applications of various spectrophotometric methods especially in quantitation of desired compound in the given solutions.
- To know the principles, procedures and applications of radioactive methods for measurement of radioactivity, electrochemical methods, and biosensors.
- To focus on the usage of different statistical methods learned with respect to bioanalytical techniques perspectives.

Unit I

Principles and applications of chromatographic techniques: paper chromatography, thin layer chromatography, gel filtration, ion-exchange chromatography, affinity chromatography, gas chromatography, high performance liquid chromatography, fast protein liquid chromatography.

Learning Outcomes:

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

- Understand the detailed principles, procedures and applications of various chromatographic techniques.
- Learn the basics of isolation of proteins to the purification of the proteins to homogeneity, and especially with the usage of high end chromatography columns, and purification procedures.
- Know the prerequisites for making recombinant protein for ease in purification of proteins with tags such as his-tag etc.
- Identify carbohydrates and amino acids by techniques like paper and thin layer chromatography

Unit II

Principles and concepts of electrophoretic techniques: native polyacrylamide gel electrophoresis (PAGE), sodium dodecyl sulphate-PAGE, agarose gel electrophoresis, capillary electrophoresis, isoelectric focusing and two dimensional, pulse field and diagonal electrophoresis.

Learning Outcomes:

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

- Understand the principles, components, and applications of various electrophoretic techniques.
- Know the difference between SDS-PAGE and native PAGE techniques with respect to proteins
- Learn the importance of agarose gel electrophoresis with respect to molecular biology techniques like PCR and molecular cloning
- Visualize the purity of proteins those are purified to homogeneity using various chromatography columns.

Unit III

Principles and applications of UV-visible, infrared, fluorescence spectroscopy, AAS, ESR, NMR. Principles and applications of preparative and analytical ultracentrifuges.

Learning Outcomes:

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

- Know the principles, components, and applications of various spectrometry techniques.
- Learn the utilization of UV-visible to know the concentrations of the solutions.

Unit IV

FTIR, XRF, Differential Scanning Calorimetry, XRD, SEM, TEM, water activity meter, textural analyzer, biosensors, nitrogen analyzers

Learning Outcomes:

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

- Understand the importance of techniques such as XRD for retrieving the structure of the protein with high resolution.
- Understand the principles of Differential scanning calorimetry, SEM, TEM etc.
- Gain knowledge on various biosensors and their applications in many industries

Unit V

Detection and measurement of radioactivity. Radioactive and non-radioactive tracer techniques and their applications in the field of biological sciences. Principles of electrochemical techniques –operation and applications of pH, oxygen, ion-selective and gas sensing electrodes.

Learning Outcomes:

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

- Gain knowledge on various radioactive and stable isotopes, tracer techniques, and about biosensors and their applications in many industries.
- Know the instruments used for measurement of radioactivity
- Learn the working of pH electrode etc.

Course Outcomes:

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

- Understand the detailed principles, procedures and applications of various chromatographic techniques.

- Understand the principles, components, and applications of various electrophoretic techniques.
- Know the principles, components, and applications of various spectrometry techniques.
- Understand the importance of techniques such as XRD for retrieving the structure of the protein with high resolution.

MFST2281: FOOD QUALITY AND SENSORY EVALUATION (THEORY)

Preamble:

Food quality is the quality characteristics of food that is acceptable to consumers. This includes external factors as appearance (size, shape, colour, gloss, and consistency) , texture, and flavor; factors such as federal grade standards and internal (chemical, physical, microbial) . Sensory evaluation is a scientific discipline used to analyze reactions to stimuli perceived through the senses – Sight, Smell, Touch, Taste and Sound. Sensory Analysis is a vital tool for the Food Industry and can be used in a number of applications like new product development.

Course Objectives:

- To understand quality attributes like appearance, flavor prepare our bodies for digestion
- To identify different tastes of the food
- To Identify different odours and classifications
- To recognize the colour abnormalities

Unit I

Introduction to quality attributes of food - Appearance, flavour, textural factors and additional quality factors.

Learning Outcomes:

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

- Realize that quality attributes like appearance, flavor prepare our bodies for digestion
- Recognize that tasting and smelling food can trigger the salivary glands and secretion of digestive juices.

Unit II

Gustation- Introduction and importance of gustation, Structure and physiology of taste organs- tongue, papillae, taste buds, salivary glands. Mechanism of taste perception, Chemical dimensions of basic tastes- sweet, salt, sour, bitter and umami, Factors affecting taste quality, reaction time, taste modification, absolute and recognition threshold, Taste measurement- Electronic Tongue, Taste abnormalities

Learning Outcomes:

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

- Identify different tastes of the food
- Use electronic tongues for improving the taste perception
- Recognize abnormalities in taste of the food items

Unit III

Olfaction - Introduction, definition and importance of odour and flavor, Anatomy of nose, physiology of odour perception, Mechanism of odour perception, Theories of odour classification, chemical specificity of odour. Odour measurement techniques – historical perspective and emphasis on recent techniques- e- nose etc. Olfactory abnormalities

Learning Outcomes:

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

- Identify different odours and classifications
- Measure chemical specificity of odour
- Recognize the olfactory abnormalities

Unit IV

Colour - Introduction and importance of colour, Dimensions of colour and attributes of colour; gloss etc. Perception of colour. Colour Measurement: Munsell colour system, CIE colour system, Hunter colour system. Colour abnormalities

Learning Outcomes:

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

- Apprehend that food colors can maintain or improve the appearance of the food.
- Measure different colors
- Recognize the colour abnormalities

Unit V

Texture - Introduction, definition and importance of texture, Phases of oral processing, Texture perception, receptors involved in texture perception, Rheology of foods, Texture classification,

Texture measurement – basic rheological models, forces involved in texture measurement and recent advances in texture evaluation. Application of texture measurement in cereals, fruits and vegetables, dairy, meat and meat products

Learning Outcomes:

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

- Apprehend that food texture can determine the eating quality of foods and can have a strong influence on food intake and nutrition
- Understand how the texture of food can influence calorie perceptions, food choice, and consumption amount can help nudge consumers towards making healthier choices
- Apply texture measurements for various food products.

Course Outcomes:

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

- Recognize that tasting and smelling food can trigger the salivary glands and secretion of digestive juices
- Apprehend that food colors can maintain or improve the appearance of the food.
- Apprehend that food texture can determine the eating quality of foods and can have a strong influence on food intake and nutrition.

MFST2291: FERMENTATION TECHNOLOGY

Preamble:

Fermentation is a metabolic process that produces chemical changes in organic substrates through the action of enzymes. Industrial fermentation is the intentional use of fermentation by microorganisms such as bacteria and fungi to make products useful to humans. Fermentation technology is a valuable tool for future economic development. Fermented products have applications as food as well as in general industry.

Course Objectives:

- To impart comprehensive overview of the scientific and technical aspects of fermentation technology
- To instill knowledge on regulated methodology in fermentation and process of production

Unit I

Introduction to fermentation processes, microorganisms used in food fermentation. Isolation, primary and secondary screening methods. Preservation and strain improvement methods

Learning Outcomes:

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

- Know about microorganisms used in food fermentation
- Summarize the screening methods
- Gain knowledge on preservation and strain improvement methods.

Unit II

Design of fermentor, types of fermentors: maintenance of aseptic conditions, instrumentation control, physical and chemical environment sensors, control of various physical parameters; fermentation economics.

Learning Outcomes:

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

- Summarize the types of fermentors

- Gain knowledge on fermentation economics
- Describe the design of fermentor

Unit III

Industrial media formulation; substrates for fermentation – carbon and nitrogen sources; antifoams; sterilization; inoculums development, Types of fermentations- batch, continuous, dual or multiple fermentations. Solid state, surface, submerged fermentations, scale up.

Learning Outcomes:

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

- Discuss various carbon and nitrogen sources
- Compare and contrast different types of fermentations
- Gain knowledge on industrial media formulation

Unit IV

Industrial production: Industrial production of enzymes, proteolytic enzymes, pectinases, amylases, organic acids – acetic acid, lactic and citric acid. Production of vitamins (Vitamin B2, Vitamin B12), Baker's yeast, yoghurt.

Learning Outcomes:

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

- Gain knowledge on industrial production of enzymes
- Gain knowledge on industrial production of vitamins
- Gain knowledge on industrial production of organic acids

Unit V

Immobilization technology. Downstream processing- solid-liquid separation, Release of intracellular products, concentration, recovery and purification. Computer applications in fermentation technology.

Learning Outcomes:

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

- Illustrate the immobilization technology

- Summarize downstream processing
- Discuss on the applications of computers in fermentation technology.

Course Outcomes:

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

- Know about microorganisms used in food fermentation
- Gain knowledge on industrial production of enzymes, vitamins, organic acids
- Discuss on the applications of computers in fermentation technology

MFST3181: FOOD ENGINEERING

Preamble:

The amalgamation of food technology with engineering operations has given birth to the discipline of food engineering. This course covers the basic principles, materials and energy balance concepts that prepare a solid ground for easy comprehension of the technology involved. This course also emphasizes about unit operations in food processing, distillation, and several other mechanical operations. The student also learns about food industry management, and the peripheral and integrated food engineering operations.

Course Objectives:

- To understand the principle of Unit operation
- To acquaint with fundamentals of food engineering and its process
- To understand the basics of designing of food plant and systems

Unit I

Concept of unit operation, units and dimensions, unit conversions, dimensional analysis, mass and energy balance, related numericals. Important considerations for designing of food plants, types of layout. Principle and equipments used in food industry.

Learning Outcomes:

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

- Learn about unit operations, mass energy balance
- Learn about the food plants designs, and layout types.
- Understand principles of different equipments used in food industry

Unit II

Liquid transport systems, properties of liquids, Newton's law of viscosity, principle of capillary tube and rotational viscometer, properties of Non-Newtonian fluids, flow characteristics, Reynolds number, Bernoulli's equation, concept of flow measurement devices, related basic numericals.

Learning Outcomes:

By the end of this unit, the student will be able to:

- Know about Newton's laws of viscosity
- Learn importance concepts of Non-Newtonian fluids, Bernoulli's equation, and Reynolds number
- Learn related basic numericals

Unit III

Concept and selection of a refrigerant, description of a refrigeration cycle, pressure enthalpy charts and tables, mathematical expressions useful in analysis of vapour compression refrigeration cycle, numericals based on VCR system, Freon 12 and R-717, superheating and sub cooling, freezing time calculation using Plank's Equation, frozen food storage, related basic numericals

Learning Outcomes:

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

- Learn about vapour-compression-refrigeration cycle
- Know about importance of selection of refrigerants.
- Perform freezing time calculations, methods of frozen food storage.

Unit IV

Systems for heating and cooling food products, thermal properties of food, modes of heat transfer, application of steady state heat transfer-estimation of conductive, convective, overall heat transfer coefficient and design of tubular heat exchanger. Related basic numericals, Fick's law of diffusion, membrane separation systems-electrodialysis system, reverse osmosis, membrane System, and ultrafiltration membrane system, membrane devices used for RO and UF: plate and frame, tubular, spiral wound and hollow fiber devices.

Learning Outcomes:

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

- Learn about conductive and convective heat transfer methods, and heat exchangers.
- Learn about membrane separation systems

Unit V

Properties of dry air, properties of water vapour, properties of air vapour mixture, psychrometric chart, related basic numericals, generation of steam, construction and functions of fire tube and water tube boilers, thermodynamics of phase change, steam tables, boiling point elevation, types of evaporations, design of single effect evaporators, basic drying process, moisture content on wet basis and dry basis, dehydration systems, dehydration system design, related basic numericals

Learning Outcomes:

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

- Learn about evaporators, types, and dehydration systems
- Understand about basic drying process
- Understand about properties of dry air, generation of steam, construction and functions of boilers.

Course Outcomes:

By the end of this Course, the student will be able to:

- Learn about the design of food plant with the learned layout and hygiene concepts.
- Demonstrate the working of various equipments used in food industry
- Understand about the importance of refrigeration, and principles and applications of conduction, convection, and rheology.

MFST3191: FOOD PACKAGING

Preamble:

This course informs the student brief idea about food preservation processes and techniques, product quality and shelf life, and the in-depth knowledge about logistical packaging, packaging materials, machinery and processes, necessary for a wide range of packaging presentations. The course also teaches food packaging innovation have a thorough technical understanding of the requirements of a product for protection and preservation, together with a broad appreciation of the multi-dimensional role of packaging.

Course Objectives:

- To impart comprehensive overview of the scientific and technical aspects of food packaging.
- To instill knowledge on packaging machinery, systems, testing and regulations of packaging.

Unit I

Packaging functions and Requirements, printing of packages. Barcodes and other marking, Labeling Laws. Paper and paper-based materials, corrugated fiber board (CFB).Plastics, formation- molding, types of plastics, biodegradable plastics, edible packaging, environmental concerns.

Learning Outcomes:

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

- Understand the idea of food packaging, importance of printings and barcoding
- Understand the packaging products-paper and plastics
- Learn the Labelling and related Laws, importance of labelling of nutrient information

Unit II

Metal packaging- Metals: Tinplate, tinning process, components of tinplate, tin free can (TFC) types of can, metallic films, lacquers Glass: Composition, Properties, Methods of bottle making, and types of closures.

Learning Outcomes:

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

- Understand about food packaging materials such as metal packaging materials manufacture and types, and importance of metal cans
- Understand about food packaging materials such as glass packaging materials manufacture and types, and importance

Unit III

Package design for fresh horticultural produce and animal foods, dry and moisture sensitive foods, frozen foods, fats and oils, thermally processed foods and beverages.

Learning Outcomes:

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

- Learn about appropriate suitable packaging designs for various foods

Unit IV

Testing Procedures for Packaging Materials- thickness, tensile strength, puncture resistance, bursting strength, seal strength, water vapor permeability, CO₂ permeability, oxygen permeability, grease resistance, Testing Procedures for Packaged Foods - Compatibility and shelf life studies, evaluation of transport worthiness of filled packages. Food Packaging Laws and Regulations.

Learning Outcomes:

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

- Understand testing (variety of methods to know the quality of packaging material) and regulatory aspects of food packaging.
- Know about food packaging laws and regulations

Unit V

Bottling machines, Cartoning systems, Seal and Shrink packaging machine; Form, Fill and Sealing machine (FFS). Vacuum, Controlled and Modified atmosphere packaging systems; Aseptic packaging systems; Retort packaging, Active and Intelligent packaging systems.

Learning Outcomes:

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

- Understand the principle and working of different packaging machinery and systems
- Importance of smart packaging that deals active and intelligent packaging systems.

Course Outcomes:

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

- Understand the idea of food packaging, importance of printings and barcoding
- Learn about appropriate suitable packaging designs for various foods
- Understand the principle and working of different packaging machinery and systems

MFST3201: FUNCTIONAL FOODS AND NUTRACEUTICALS (THEORY)

Preamble:

Functional food or medicinal food is any fresh or processed food claimed to have a health-promoting and/or disease-preventing property beyond the basic nutritional function of supplying nutrients. This is an emerging field in food science, in which such foods are usually accompanied by health claims for marketing purposes. Functional foods are sometimes called nutraceuticals, a portmanteau of nutrition and pharmaceutical, and can include food that has been genetically modified. Fermented foods with live cultures are often also considered to be functional foods with probiotic benefits.

Course Objectives:

- To develop comprehensive understanding of different nutraceuticals and functional foods
- To understand the potential of various functional foods in promoting human health

Unit I

Functional foods and Nutraceuticals -Definitions, sources, Health benefits, bioactive components of functional foods. Development of functional foods, challenges and safety considerations, Future trends of functional foods. Dietary supplements and fortified foods- need, health benefits adverse effects.

Learning Outcomes:

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

- Know about health benefits and adverse effects of Functional foods and Nutraceuticals
- Learn about development of functional foods, challenges and safety considerations

Unit II

Functional foods of animal origin: Dairy products, sea foods, egg, Functional foods of plant origin: fruits, vegetables, nuts, spices, cereals, and beverages. Probiotics, prebiotics and synbiotics as functional foods, Effects of probiotics on health.

Learning Outcomes:

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

- Learn about probiotics, prebiotics and synbiotics effects on health

- Know about functional foods of animal origin and plant origin

Unit III

Types of functional foods: whole foods, enriched foods, enhanced foods, fortified foods, modified foods. Market of functional foods, Challenges for Functional food delivery, Factors affecting consumer interest.

Learning Outcomes:

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

- Understand types and challenges of functional foods
- Know about factors affecting consumer interest.

Unit IV

Diet and disease relationship – nutrition and health claims, Food component – approved health claims, labeling considerations for functional ingredients, Permissible and impermissible functional claims, Role of biotechnology in the development of functional foods.

Learning Outcomes:

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

- Understand nutritional benefits functional foods
- Know about diet and disease relationship and health claims

Unit V

Nutraceutical compounds – Phytochemicals, phytosterols and other bioactive compounds, peptides and proteins, carbohydrates, prebiotics, probiotics and synbiotics, lipids, vitamins and minerals; their sources and role in promoting human health.

Learning Outcomes:

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

- Know about phytochemicals, phytosterols and other bioactive compounds role in promoting human health
- Understand about sources of Nutraceutical compounds

Course Outcomes:

By the end of the course, the student will be able to

- Develop comprehensive understanding of different nutraceuticals and functional foods.

Understand and acquire knowledge about the potential of various functional foods in promoting human health

MFST3211: CLINICAL NUTRITION (THEORY)

Preamble:

Food is the basic necessity of life. Nutrition is the scientific study of food and its relation to health. Therapeutic nutrition refers to the use of food and the nutrients it contains to prevent or treat a disease or condition. Therapeutic nutrition brings awareness about the main etiological factors responsible for various ailments of the present day generation.

Course Objectives:

- To provide an overview of fundamental knowledge in food and nutrition.
- To introduce students to clinical dietary and nutritional principles
- To translate basic concepts of medical nutrition therapy for the different diseases into practical menu planning application
- To familiarize the concept of lifestyle changes

Unit I

Therapeutic diet-Principles of diet therapy. Factors to be considered during meal planning. Therapeutic modification of normal diet, assessment of patient needs, special feeding methods- tube feeding, parenteral feeding. Nutrition counseling, Risk factors of different nutritional and metabolic disorders.

Learning Outcomes:

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

- Know about the status of nutraceuticals and functional food market
- Understand types of nutraceutical compounds and their health benefits

Unit II

Dietary management- Diabetes mellitus – etiology, prevalence, risk factors, symptoms, classification, diagnosis, complications, insulin. Obesity- etiology, types, theories, assessment, risk factors, complications, dietary and non- dietary treatment. Underweight- etiology, dietary modifications.

Learning Outcomes:

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

- Learn about dietary management for Diabetes mellitus, Obesity, Underweight
- Understand complications, diagnosis of various health risk factors

Unit III

Anatomy and functions of gastro intestinal tract, common gastro intestinal disorders – dyspepsia, diarrhoea, peptic ulcers, constipation- etiology symptoms and dietary treatment. Structure and functions of liver. Liver disorders - hepatitis, cirrhosis and hepatic coma- etiology, symptoms, diagnosis and dietary management

Learning Outcomes:

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

- Learn anatomy and functions of gastro intestinal tract, common gastro intestinal disorders
- Understand diagnosis and dietary management for Gastro intestinal and liver disorders.

Unit IV

Cardiovascular system components, Anatomy and functions of heart, cardiovascular diseases: etiology, prevalence, modifiable and non-modifiable risk factors, symptoms, diagnosis, medications, Dietary management in atherosclerosis, hypertension, myocardial infarction.

Learning Outcomes:

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

- Learn about anatomy and functions of heart
- Know about cardiovascular diseases and its dietary management

Unit V

Anatomy and functions of kidneys- symptoms, etiology, diagnosis Dietary management of kidney and urinary tract: Nephritis, renal calculi. Etiology, symptoms and dietary management – Anaemia, Inborn errors of metabolism- phenylketonuria, galactosemia, Lactose intolerance.

Learning Outcomes:

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

- Learn about anatomy and functions of kidney
- Understand about renal diseases and its dietary management

Course Outcomes:

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

- Know about the status of nutraceuticals and functional food market
- Learn about dietary management for Diabetes mellitus, Obesity, Underweight
- Learn anatomy and functions of gastro intestinal tract, common gastro intestinal disorders

MINOR COURSES IN FOOD SCIENCE AND TECHNOLOGY

MFST1011: PRINCIPLES OF FOOD SCIENCE (THEORY)

Preamble:

Food science is an application of the basic sciences and engineering to study the fundamental physical, chemical and biochemical nature of foods and the concepts underlying food processing. Food science involves many specializations such as food microbiology, food engineering, and food chemistry in an attempt to better understand food processes and ultimately improve food products for the general public.

Course Objectives:

- To impart basic knowledge of Food Dispersions
- To learn the basic concepts and applications of Sensory science
- To understand the importance of food sanitation
- To understand the role of food Packaging in protecting food

Unit I

Characteristics, sols, gels, pectin gels, colloidal sols, stabilization of colloidal system, emulsions, properties of emulsions, formation of emulsion, emulsifying agent, food foams, formation stability and destruction of foam, application of colloidal chemistry to food preparation.

Learning Outcomes:

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

- Describe the characteristics of sols, gels, pectin gels, colloidal sols
- Discuss the basic concepts of emulsions and food foams
- Extend the concepts of colloidal chemistry to food preparation.

Unit II

Objectives, type of food panels, characteristics of panel member, layout of sensory evaluation laboratory, sensitivity tests, threshold value, paired comparison test, duo- trio test, triangle test, hedonic scale, chemical dimension of basic tastes, Amoore's classification of odorous compounds. Sherman and Szczniak classification of food texture. Food as a substrate for microorganism, factors affecting growth of microbes: pH, water activity, O-R potential, nutrient contents, inhibitory substance and biological structure.

Learning Outcomes:

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

- Use sensory evaluation in food product development
- Outline various types of food panels
- Identify the conditions under which microbes can be inactivated, killed or made harmless

Unit III

Principles and applications, Hurdle effect in fermented foods, shelf stable products, intermediate moisture foods, application of hurdle technology. Minimal processing of foods with thermal methods and non-thermal methods-safety criteria in minimally processed foods-Minimal processing in practice-fruits and vegetables-seafood-effect on quality-Future developments.

Learning Outcomes:

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

- Identify the principles and applications of preservation processes
- Extend the concept of Minimal processing of foods
- Appreciate the effect of processing upon various properties of foodstuffs

Unit IV

Principles, equipment and processing, effect on food. Waste water, hardness of water, break point chlorination, physical and chemical of impurities, BOD, COD, waste water treatment, milk plant sanitation, CIP system, sanitizers used in food industry.

Learning Outcomes:

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

- Identify & select processing equipment and methods appropriate for waste water treatment
- Explain the need of sanitation and CIP system in food industry
- Outline the different types of sanitizers used in food industry

Unit V

Objectives of packaging, flexible packaging, properties of the following packaging materials-low density polyethylene, high density polyethylene, polypropylene, polyvinyl chloride, polyvinylidene chloride, ethylene vinyl alcohol, polystyrene, polyethylene terephthalate, nylon, ethylene vinyl acetate, ethylene acrylic acid, ethylene methacrylic acid, ionomers.

Learning Outcomes:

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

- Explain the objectives of food packaging
- Explain the properties of various food packaging materials
- Identify and examine the method of packaging and packaging materials in shelf life extension of foods

Course Outcomes:

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

- Describe the characteristics of sols, gels, pectin gels, colloidal sols
- Identify the conditions under which microbes can be inactivated, killed or made harmless
- Identify and examine the method of packaging and packaging materials in shelf life extension of foods

MFST1021: PRINCIPLES OF FOOD SCIENCE (PRACTICAL)

1. Estimation of reducing sugar by Fehling's procedure
2. Estimation of salt content in brine
3. Estimation of salt content in butter
4. Preparation of brix solution and checking by hand refractometer
5. Application of colloidal chemistry to food preparation
6. Demonstration of the Soxhlet method for determination of fat content
7. Determination of acidity of water
8. Determination of alkalinity/ hardness of water
9. Demonstration of the Kjeldahl's method for estimation of protein content

Recommended Readings:

1. Coles R, McDowell D and Kirwan MJ, Food Packaging Technology, CRC Press, 2003
2. De S, Outlines of Dairy Technology, Oxford Publishers, 1980
3. Deman JM, Principles of Food Chemistry, 2nd ed. Van Nostrand Reinhold, NY 1990
4. Frazier WC and Westhoff DC, Food Microbiology, TMH Publication, New Delhi, 2004
5. Jenkins WA and Harrington JP, Packaging Foods with Plastics, Technomic Publishing Company Inc., USA, 1991
6. Manay NS and Shadaksharaswamy M, Food-Facts and Principles, New Age International (P) Ltd. Publishers, New Delhi, 1987
7. Meyer LH, Food Chemistry, CBS Publication, New Delhi, 1987
8. Potter NH, Food Science, CBS Publication, New Delhi, 1998
9. Ramaswamy H and Marcott M, Food Processing Principles and Applications CRC Press, 2006
10. Ranganna S, Handbook of Analysis and Quality Control for Fruits and Vegetable Products, 2nd ed.
11. TMH Education Pvt. Ltd, 1986

Course Outcomes:

By the end of the practicals, the student will be able to

- Differentiate between thermal methods and non-thermal methods of food processing
- Understand various application of colloidal chemistry to food preparation
- Classify the physical and chemical of impurities in waste water
- Evaluate the safety criteria in minimally processed foods

MFST1031: FUNDAMENTALS OF FOOD TECHNOLOGY (THEORY)

Preamble:

Food Technology deals with the techniques involved in production, processing, preservation, packaging, labeling, quality management, and distribution of food products. The course also involves techniques and processes that are used to transform raw materials into food. Extensive research goes behind making food items edible as well as nutritious. Food technology greatly contributes to the manufacturing and supply of safe, wholesome and nutritious food products.

Course Objectives:

- To understand the history and evolution of food processing.
- To study the structure, composition, nutritional quality and post harvest changes of various plant foods.
- To study the structure and composition of various animal foods.

Unit I

Introduction-historical evolution of food processing technology. Cereals and millets-Structure and composition, properties and nutritional attributes of rice, wheat, maize, barley, millet and oats, malting, gelatinization of starch, types of browning- Maillard & caramelization, rice-parboiling of rice- advantages and disadvantages.

Learning Outcomes:

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

- Understand various advantages and disadvantages of parboiled rice
- Describe the structure and composition of various cereals and millets
- Understand the concepts of malting, gelatinization and browning

Unit II

Pulses- Structure and composition of pulses, toxic constituents in pulses, processing of pulses-soaking, germination, decortications, cooking and fermentation. Fats and Oils-classification of

lipids, types of fatty acids - saturated fatty acids, unsaturated fatty acids, essential fatty acids, trans fatty acids. Refining of oils, types- steam refining, alkali refining, bleaching, steam deodorization, and hydrogenation. Rancidity –Types- hydrolytic and oxidative rancidity and its prevention.

Learning Outcomes:

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

- Describe the structure and composition of various pulses
- Extend the concepts of classification of lipids and oil Refining
- Summarize different types rancidity

Unit III

Fruits and Vegetables-Classification of fruits and vegetables, general composition, enzymatic browning, names and sources of pigments, Dietary fibre. Post-harvest changes in fruits and vegetables – Climacteric rise, horticultural maturity, physiological maturity, physiological changes, physical changes, chemical changes, pathological changes during the storage of fruits and vegetables.

Learning Outcomes:

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

- Discuss the general composition and Classification of fruits and vegetables
- Identify the sources of pigments
- Summarize different types of post harvest changes during the storage of fruits and vegetables

Unit IV

Compositional, Nutritional and Technological aspects of Animal foods. Flesh Foods-Meat - Definition of carcass, concept of red meat and white meat, composition of meat, marbling, post-mortem changes in meat- rigor mortis, tenderization of meat, ageing of meat. Fish -

Classification of fish (fresh water and marine) , aquaculture , - microbiological, physiological, biochemical.

Learning Outcomes:

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

- Gain Knowledge on the post-mortem changes in meat
- Compare and contrast red meat and white meat
- Describe the basic concepts of composition, characteristics and spoilage of fish

Unit V

Poultry - Structure of hen's egg, composition and nutritive value, egg proteins, characteristics of fresh egg, deterioration of egg quality, difference between broiler and layers. Milk and Milk Products-Definition of milk, chemical composition of milk, its constituents, processing of milk, pasteurization, homogenization. An overview of types of market milk and milk products.

Learning Outcomes:

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

- Illustrate the concepts of egg structure, composition and nutritive value
- Gain knowledge on types of market milk and milk products
- Compare and contrast broiler and layers

Course Outcomes:

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

- Understand various advantages and disadvantages of parboiled rice
- Describe the structure and composition of various pulses
- Illustrate the concepts of egg structure, composition and nutritive value
- Gain Knowledge on the post-mortem changes in meat

MFST2001: TECHNOLOGY OF PLANTATION CROPS (THEORY)

Preamble:

India has been bestowed with wide range of climate and physic-geographical conditions and as such is most suitable for growing various kinds of horticultural crops such as fruits, vegetables, flowers, nuts, spices and plantation crops. Fruits and vegetables are an important supplement to the human diet as they provide the essential minerals, vitamins and fiber required for maintaining health. India is now the second largest producer of fruits and vegetables in the world and is the leader in several horticultural crops.

Course Objectives

- To impart knowledge of different methods of fruits and vegetable processing.
- To learn about processing of various spices, tea, coffee and cocoa.

Unit I

Importance of fruits and vegetable, history and need of preservation, reasons of spoilage, method of preservation (short & long term). Canning and bottling of fruits and vegetables.

Fruits beverages: Processing of fruit juices, preservation of fruit juices, processing of squashes, cordials, nectars, concentrates and powder. Jams, jellies, and marmalades.

Learning Outcomes:

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

- Learn different methods for the preservation fruits and vegetables.
- Understand the detailed account on canning process and bottling.
- Understand the processing of fruits and vegetables in making different products like juices, jam and jellies and marmalade.

Unit II

Pickles, chutneys, and sauces: processing, types, causes of spoilage pickling. Dehydration of foods and vegetables: Sun drying & mechanical dehydration, process variation for fruits and vegetables, packing and storage.

Learning Outcomes:

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

- Learn about the product technologies and the defects in the production of the products.
- Understand the processing of pickles, chutneys and sauces.

Unit III

Milling technology: Wheat-Types, milling, flour grade, flour treatments (bleaching, maturing), flour for various purposes, Products and By-products. Rice – Physicochemical properties, milling (mechanical & solvent extraction), parboiling, ageing of rice, utilization of byproducts. Corn–Milling (wet & dry), cornflakes, corn flour. Barley- Milling (pearl barley, barley flakes & flour) Oats–Milling (oatmeal, oat flour & oat flakes) Sorghum and millets – Traditional & commercial milling (dry & wet).

Learning Outcomes:

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

- Know about the various processing steps of major cereals after harvesting.
- Learn about the production of different processed products and by-products.

Unit IV

Legume technology: Classification of legumes, chemical composition and nutritional value. Methods of dehulling-. Home, cottage, and commercial scale. Modern techniques of dehulling. Milling of legumes: Dal milling principles, methods, equipments and effect on quality. Principle products, fermented products of legumes.

Learning Outcomes:

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

- Learn about the various processing steps and methods of major legumes after harvesting.
- Know about the production of different processed products and fermented products.

Unit V

Technology of Oil seeds: Sources, Composition, Processing of oil seeds – Soya bean, coconut. Hydrogenation. Refining of fats & oils, bleaching, de-odourising, hydroxylation, Protein isolates, Sources of protein (defatted flour, protein concentrates and isolates), properties and uses, protein texturization, fibre spinning.

Learning Outcomes:

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

- Learn about the various processing steps of major oil seeds after harvesting.
- Know about the production of different methods of oil refining and protein products.

Recommended Readings:

1. Kent, N.L. 2003. Technology of Cereal, 5th Ed. Pergamon Press.
2. Chakraverty. 1988. Post-Harvest Technology of Cereals, Pulses and Oilseeds, revised Ed., Oxford & IBH Publishing Co. Pvt Ltd.
3. Marshall, Rice Science and Technology. 1994. Wadsworth Ed., Marcel Dekker, New York.
4. Manay, S. and Sharaswamy, M. 1987. Food Facts and Principles. Wiley Eastern Limited

Course Outcomes:

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

- Know about the various processing steps of major cereals after harvesting.
- Know about equipment used in production and storage of alcohol.
- Learn about the various processing steps and methods of major legumes after harvesting.

MFST2011: FOOD PROCESSING AND PRESERVATION TECHNOLOGY (THEORY)

Preamble:

Food Preservation is defined as a method of maintaining foods at a desired level of properties for their maximum benefit for as long as possible. The subject lies in the core of food science and technology and it is the main purpose of food processing. Food preservation uses many techniques that range from too simple to highly sophisticated

Course Objectives:

- To study the importance and need of food preservation
- To introduce the basics of various food processing and preservation technologies.
- To introduce the concepts of novel food preservation methods
- To familiarize the pros and cons of various food preservation techniques

Unit 1

Principles of Food Preservation, microorganisms associated with foods- bacteria, yeast and mold, Importance of bacteria, yeast and molds in foods. Classification of microorganisms based on temperature, pH, water activity, nutrient and oxygen requirements, typical growth curve of microorganisms. Classification of food based on pH, definition of shelf life, perishable foods, semi perishable foods, and shelf stable foods.

Learning Outcomes:

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

- Identify the important pathogens and spoilage microorganisms in foods
- Identify the conditions under which the important pathogens are commonly inactivated, killed or made harmless in foods.
- Know the principles involving in food preservation via various processes.

Unit II

Thermal Processing- Classification of thermal treatments, Mode of action, Commercial heat preservation, methods: Sterilization, commercial sterilization, Pasteurization and blanching- objectives, types. Pros and cons of high temperature preservation.

Learning Outcomes:

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

- Classify various thermal treatments based on temperature
- Discuss the Pros and cons of high temperature preservation
- Suggest the best thermal treatment for processing different foods

Unit III

Freezing and Refrigeration: Introduction to cool storage, refrigeration, and freezing, principle of freezing, freezing curve, changes occurring during freezing, types of freezing- slow freezing, quick freezing, introduction to thawing, changes during thawing and its effect on food.

Learning Outcomes:

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

- Differentiate Freezing from Refrigeration
- Draw and analyze freeze curve
- Discuss the changes during thawing

Unit IV

Drying and Dehydration - Definition, drying as a means of preservation, heat and mass transfer, factors affecting rate of drying, normal drying curve, types of driers used in the food industry. Evaporation – Definition, factors affecting evaporation, names of evaporators used in food industry.

Learning Outcomes:

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

- Compare and contrast Drying and Dehydration

- Apply the concept of heat and mass transfer in dehydration
- Discuss various factors affecting evaporation

Unit V

Irradiation - Introduction, units of radiation, kinds of ionizing radiations used in food irradiation, mechanism of action, application and benefits of irradiation processing in food industry.
Quality and safety of irradiated foods

Learning Outcomes:

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

- Analyze the Quality and safety of irradiated foods
- Categorize different kinds of ionizing radiations used in food irradiation
- Describe the mode of action of various radiations in food industry

Course Outcomes:

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

- Identify the important pathogens and spoilage microorganisms in foods
- Discuss the Pros and cons of high temperature preservation
- Apply the concept of heat and mass transfer in dehydration

MFST2031: FOOD PROCESSING AND PRESERVATION TECHNOLOGY (PRACTICAL)

1. Methods of Sampling.
2. Concept of shelf life of different foods
3. To study the concept of Asepsis and sterilization
4. Determination of pH of different foods using pH meter.
5. Study quality characteristics of foods preserved by drying/dehydration/freezing.
6. To perform pasteurization of fluids using different methods.
7. To perform blanching of different plant foods.

Recommended Readings:

1. Text Book on Food Storage and Preservation (2004) by Vijayakhader.
2. Food Science (2002) by B. Srilakshmi.
3. Food Processing and Preservation (2010) by B.SivaShakar.
4. Food Processing and Preservation (2007) by G. Subbalakshmi
5. Food preservation and processing (2007) by ManoranjanKalia

Course Outcomes:

By the end of the course, the student will be able to

- Compare conventional methods of food preservation with novel methods of food preservation(food irradiation, biosensors, microwave)
- Apply principles of food preservation to pilot scale production of processed food and evaluate variation in processing parameters on product properties
- Evaluate the effect of processing upon the nutritional properties of foodstuffs.

MFST2041: FOOD MICROBIOLOGY (THEORY)

Preamble:

Food microbiology is the scientific study of microorganisms, both in food and used for the production of food. This includes microorganisms that contaminate food, as well as those used in its production; for example to produce yoghurt, cheese, beer and wine.

Course Objectives:

- To know the important genera of microorganisms associated with food and their characteristics.
- To understand the role of microbes in fermentation, spoilage and food borne diseases.

Unit I

Food microbiology- definition and importance, Microbial growth in food- intrinsic and extrinsic factors affecting the growth of microorganisms in food, bacterial growth curve. Beneficial role of microorganisms in food. Probiotics, prebiotics and synbiotics.

Learning Outcomes:

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

- Learn about the morphological characteristics important in food bacteriology
- Understand about the importance of microbiology and its relevance to everyday life.

Unit II

Microorganisms associated with food- Bacteria, molds, yeast, virus- General characteristics, structure, morphological characteristics, growth and cultural characteristics. Endospore - structure and significance in food microbiology

Learning Outcomes:

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

- Learn about general characteristics of bacteria, fungi and virus.
- Know procedures of identification of microorganisms

Unit III

Microbial food spoilage - sources of microorganisms in foods, spoilage of different food groups- milk and dairy products, meat, poultry and sea foods, cereal and cereal products, fruits and vegetables and canned products.

Learning Outcomes:

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

- Understand about spoilage. Contamination sources, types, effect of cereals, sugar, vegetables and fruits, meat, milk, canned foods.

Unit IV

Sterilization methods-physical and chemical. Pure culture techniques, methods of isolation. Enumeration of Microorganisms- qualitative and quantitative. Control of Microorganisms in Foods- Principle and methods. Preservation and maintenance of microbial cultures.

Learning Outcomes:

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

- Learn about sterilization methods, pure culture techniques, methods of isolation
- Understand about control of microorganisms in foods, and preservation and maintenance of microbial cultures.

UNIT V

Food infection and food intoxication. Food and water borne diseases by – *Salmonella*, *E. coli*, *Clostridium*, *Listeria*, *Shigella*, *Bacillus*, *Campylobacter*, *Vibrio*. Trends in Food Microbiology- rapid methods of detection, recent Advances

Learning Outcomes:

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

- Understand about the sources of contamination of food, mycotoxins, toxin production and physiological action, sources of infection of food by pathogenic organisms.
- Learn about water, soil and air borne diseases.

Course Outcomes:

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

- Learn about the morphological characteristics important in food bacteriology.
- Understand about the sources of contamination of food, mycotoxins, toxin production and physiological action, sources of infection of food by pathogenic organisms.
- Know procedures of identification of microorganisms

MFST3001: TECHNOLOGY OF ANIMAL FOODS (THEORY)

Preamble: *The principle interests of the extension program at this time are in the area of dairy Technology deals with processing of milk and milk product. The meat industry topics deals total utilization of flesh foods, particularly poultry and fish, animal welfare, and the sustainability of animal agriculture. Issues of animal welfare are also presented to challenge simplistic, often anthropomorphic assumptions, especially with respect to egg layers. Seafood Processing: Technology, Quality and Safety covers the whole range of current processes which are applied to seafood, as well as quality and safety aspects*

Course objectives:

- To understand need for and importance of livestock, dairy, egg, fishery and poultry industry
- To know the compositional and technological aspects of milk and fish.
- To study structure, composition and nutritional quality of animal products.
- To study processing and preservation of animal foods.
- To understand technology behind preparation of various animal food products and byproduct utilization.

Unit I

Milk: Physical properties of milk, Composition of milk. Market milk industry: Systems of collection of milk Reception, Platform testing, Various stages of processing- Filtration, Clarification, Homogenization, Pasteurization. Receiving and storage of milk. Milk products– Butter, ghee, flavored milk, yoghurt, dahi, shrikhand, ice-cream, condensed milk, milk powder, channa, paneer, cheese (cheddar). Dairy plant sanitization.

Learning Outcomes:

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

- Understand about milk, its properties both physical and functional and composition.

- Learn about different milk products and its production.
- Understand about dairy sanitization and storage

Unit II

Egg: The egg industry, its techniques of working, General management, structure, composition and nutritive value of egg and its products. Preservation of eggs: Refrigeration and freezing, thermal processing, dehydration, coating. Quality identification of shell eggs- Factors affecting egg quality and measures of egg quality.

Learning Outcomes:

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

- Learn about egg structure, composition, nutritive value and quality characteristics.
- Understand about evaluation of quality and grading of eggs;
- Know about the preservation of shell eggs and experiments in by-products utilization.

Unit III

Meat: Development of meat and poultry industry in India and its need in nation's economy

Meat quality: Effects of feed, breed and environment on production of meat animals and their quality. Slaughtering process, post mortem changes and examination, HACCP model.

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

- Learn about muscle structure, chemical composition and physico-chemical properties of meat muscle.
- Understand the procedure of Pre-slaughter operations of meat animals and poultry birds.
- Learn about muscle structure, chemical composition and physico-chemical properties of meat muscle.
- Understand the procedure of Pre-slaughter operations of meat animals and poultry birds.

Unit IV

Fish: Status of fishery industry in India. Chilling and freezing of fish: Relationship between

chilling and storage life, MAP, general aspects of freezing, freezing systems (air blast freezing, plate or contact freezing spray or immersion freezing, freezing on board, onshore processing, changes in quality in chilled and frozen storage, thawing.

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

- Learn about the processing of fish by curing agents, drying and salting.
- Understand other processing options of preserving fish by smoking.
- Learn about processing of fish by canning of different variety fishes.

Unit V

Preservation of animal food: Refrigeration and freezing, thermal processing- canning, dehydration/drying, smoking and irradiation of meat and fish. Curing -curing agents, meat and fish curing. RTE meat and fish products. Sausages-processing, types and defects. Fishery by-products: Surimi and fish mince products. Fish protein concentrates (FPC), fish protein extracts (FPE), fish protein hydrolysis (FPH), Fermented fish and products.

Learning Outcomes:

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

- Learn about processing of fish by canning of different variety fishes.
- Understand about fish by-products processing and potential benefits.

Course Outcomes:

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

- Learn about different milk processing and products.
- Understand about dairy sanitization and storage.
- Learn about egg structure, composition, nutritive value and quality characteristics.
- Learn about poultry, meat and marine food industry, market and processing.
- Preservation of animal food and making of products.

MFST3021: TECHNOLOGY OF ANIMAL FOODS (PRACTICAL)

13. To perform platform tests in milk (Acidity, COB, MBRT, specific gravity, SNF)
14. To estimate milk protein by Folin method.
15. To estimate milk fat by Gerber method.
16. To prepare casein and calculate its yield.
17. Estimation of moisture content of meat
18. Estimation of protein content of meat
19. Cutout analysis of canned meats/retort pouches
20. To study shelf-life of eggs by different methods of preservation
21. Evaluation of eggs for quality parameters (market eggs, branded eggs)
22. To perform freezing of yolk/albumen
23. Identification of different varieties of fish.
24. Fish product formulation/canning.

Recommended Readings:

6. Lawrie R A, Lawrie's Meat Science, 5th Ed, Woodhead Publisher, England, 1998
 7. Parkhurst & Montney, Poultry Meat and Egg Production, CBS Publication, New Delhi, 1997
 8. De Sukumar, Outlines of Dairy Technology, Oxford University Press, Oxford. 2007.
 9. Hall GM, Fish Processing Technology, VCH Publishers Inc., NY, 1992
 10. Sen DP, Advances in Fish Processing Technology, Allied Publishers Pvt. Limited 2005 4.
- Shahidi F and Botta JR, Seafoods: Chemistry, Processing, Technology and Quality, Blackie Academic & Professional, London, 1994

Course Outcomes:

By the end of the practical, the student will be able to

- Understand milk properties and standard processing methods.
- Know different milk products and its importance.

- Understand about muscle structure, chemical composition and physico-chemical properties of meat muscle
- Know procedures of Slaughtering of animals and poultry, post-mortem changes, post-mortem inspection and grading of meat properties and shelf life of meat.
- Learn about factors affecting, processing of by curing agents, canning drying, smoking and salting of meat and fish

MFST3011: FOOD BIOCHEMISTRY

Preamble:

Food chemistry deals with the chemical processes and interactions of all biological and non-biological components of foods. The biological substances comprise items like poultry, lettuce, meat, milk and beer. It is parallel to biochemistry in its main components including water, carbohydrates, lipids, proteins and enzymes. Apart from this it also contains areas like vitamins, minerals, food additives, flavors, and colors. This subject also includes how products change under certain circumstances of food processing techniques and methods either to enhance or to prevent them from occurring.

Course Objectives:

- To understand the chemistry of foods - composition of food, role of each component and their interaction.
- To understand the functional aspects of food components and to study their role in food processing.

Unit I

Introduction to Food Chemistry – Definition, Composition of food. Water - Definition of water in food, Structure of water and ice, Types of water, Sorption phenomenon, Water activity and packaging, Water activity and shelf-life

Learning Outcomes:

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

- Understand the concept of micro and macro elements which constitutes the food
- Identify different types of water in the food and its relation to food spoilage
- Differentiate various foods based on shelf life

Unit II

Lipids - Classification of lipids, Physical properties-melting point, softening point, specific gravity, refractive index, smoke, flash and fire point, turbidity point. Chemical properties-reichert-meissel value, polenske value, iodine value, peroxide value, saponification value. Effect of frying on fats, Changes in fats and oils- rancidity, lipolysis, flavor reversion, Auto-oxidation and its prevention, Technology of edible fats and oils- Refining, Hydrogenation and Interesterification, Fat Mimetics

Learning Outcomes:

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

- Differentiate between various types of fats like saturated and unsaturated and essential fats
- Explain how lipids gets spoiled and how to prevent it
- Extend the concept of processing various types of fats and oils

Unit III

Proteins - classification and structure, Nature of food proteins (plant and animal proteins), Properties of proteins (electrophoresis, sedimentation, amphoterism and denaturation), Functional properties of proteins eg. organoleptic, solubility, viscosity, binding gelation / texturization, emulsification, foaming.

Learning Outcomes:

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

- Differentiate the types of proteins present in plants and animals
- Compare physical and functional properties of proteins
- Use the concepts of emulsification, foaming, gelation etc. for preparing food varieties

Unit IV

Carbohydrates – Classification (mono, oligo and poly saccharides), Structure of important polysaccharides (starch, glycogen, cellulose, pectin, hemicellulose, gums), Chemical reactions of

carbohydrates –oxidation, reduction, with acid & alkali, Modified celluloses and starches, resistant starch.

Learning Outcomes:

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

- Understand the types of carbohydrates in food
- Differentiate between processed foods, cereals and whole grain food
- Formulate low and high carbohydrate diet

Unit V

Vitamins – Structure, Importance and Stability of Water soluble vitamins & Fat soluble vitamins

Flavour - Definition and basic tastes, Chemical structure and taste, Description of food flavours,

Flavour enhancers

Learning Outcomes:

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

- Compare and contrast the water soluble and fat soluble vitamins
- Illustrate the deficiency disorder caused by lack of vitamins
- Develop variety of food using different flavors and enhancers.

Course Outcomes:

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

- Understand the concept of micro and macro elements which constitutes the food
- Understand the types of carbohydrates in food
- Compare and contrast the water soluble and fat soluble vitamins