

# GITAM

(DEEMED TO BE UNIVERSITY)

(Estd. u/s 3 of the UGC Act, 1956)

VISAKHAPATNAM ✧ HYDERABAD ✧ BENGALURU

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

Curriculum and Level I Course Syllabi of  
BTech Programmes  
(w.e.f. 2021-22 admitted batch)

A University Committed to Excellence

## PROGRAMME STRUCTURE

BTech Programme consists of courses which could be grouped under University Core (UC), Faculty Core (FC), Major/Programme Core (PC), Major/Programme Electives (PE) and University Electives (UE) as the below breakup

Category	Credits	% of Program (in credits)
University Core (UC)	12	8%
Faculty Core (FC)	57	36%
Major Core (PC)	52	33%
Major Electives (PE)	15	9%
Open Electives (UE)	24	15%
<b>Total</b>	<b>160</b>	

Courses offered under University Core are common to all undergraduate level programmes offered by GITAM. Courses offered under Faculty core are common to all BTech programmes offered by GITAM and are meant to acquaint the student with general engineering principles in all disciplines of engineering. Based on the chosen BTech Programme, the student shall complete courses under Major Core (specific to be chosen branch of engineering).

Each course is assigned a certain number of credits depending upon the number of contact hours (lectures/tutorials/practical) per week. In general,

- **Theory:** A student attending classroom lecture/ tutorial/ skill development activity of 50 minutes duration per week, spread over the entire semester is awarded one credit.
- **Practical:** A student attending a minimum of 100 minutes per week of laboratory session/ practical is awarded - one credit.
- **Project Work:** A student working for 50 minutes of project work per week with 3 hours of work performed independent of the instructor during the entire semester is awarded - one credit
- **Internship:** 8 hours in a day for four weeks is required for earning internship credits.

The list of courses to be taken by Students under **University Core** are listed below

Course Code	Course Name	L	T	P	S	J	C	Course Owner	Course Content	Grading
LANG1001	Communication Skills in English – Beginners	0	0	4	0	0	2	ENGL	HUM	P/F
LANG1011	Communication Skills in English	0	0	4	0	0	2	ENGL	HUM	Letter Grade
LANG1021	Advanced Communication Skills in English	0	0	4	0	0	2	ENGL	HUM	Letter Grade
CLAD1001	Soft Skills 1 - Emotional Intelligence & Reasoning Skills	0	0	0	1	0	1	GCGC	HUM	Letter Grade
CLAD1011	Soft Skills 2 - Leadership Skills & Quantitative Aptitude	0	0	0	1	0	1	GCGC	HUM	Letter Grade
CLAD1021	Soft Skills 3 - Verbal Ability & Quantitative Ability	0	0	0	1	0	1	GCGC	HUM	Letter Grade
CLAD1031	Soft Skills 4 - Practicising Verbal Ability & Quantitative Aptitude	0	0	0	1	0	1	GCGC	HUM	Letter Grade
CLAD1041	Soft Skills 5A - Preparation for Campus Placement Soft Skills 5B - Preparation For Higher Education (GRE/ GMAT) Soft Skills 5C - Preparation for CAT/ MAT	0	0	0	1	0	1	GCGC	HUM	Letter Grade
CLAD1051	Soft Skills 6A – Preparation for Campus Placement Soft Skills 6B – Preparation For Higher Education (GRE/ GMAT) Soft Skills 6C– Preparation for CAT/ MAT	0	0	0	1	0	1	GCGC	HUM	Letter Grade
VEDC1001	Venture Development	0	0	0	2	0	2	VDC	HUM	Letter Grade
DOSP10XX	Sports 1	0	0	0	2	0	2	SPTS	EXC	P/F
DOSL10XX	Club Activity	0	0	0	2	0	2	LIFE	EXC	P/F
	Indian Constitution and History	2	0	0	0	0	2	HUM	HUM	P/F
	Gandhian Values/ Ethics	2	0	0	0	0	2	UNIV	HUM	P/F
DOSL10XX	Community Service	0	0	0	0	2	2	LIFE	EXC	P/F
	Environmental Studies	3	0	0	0	0	3	UNIV	SCI	P/F
	Financial and Tax Literacy / Personal Financial Planning	0	0	2	0	0	1	UNIV	MGMT	P/F
	Health and Wellbeing	0	0	2	0	0	1	UNIV	SCI	P/F
CSEN1001	IT Productivity Tools	0	0	2	0	0	1	UNIV	ENG	P/F

**Note:** LTPSJC for each course represents Lecture (L), Tutorial (T), Practical (P), skill development (S), Project work/ Internship (J) and the total instructional delivery indicated as credits (C).

The list of courses to be taken by students under **Faculty Core** are listed below

Course Code	Course Name	L	T	P	S	J	C	Course Owner	Course Content	Grading
	Management Basket	3	0	0	0	0	3	MGMT	MGMT	Letter Grade
PHYS1001	Physics Basket 1	2	1	2	0	0	4	PHYS	SCI	Letter Grade
PHYSXXXX	Physics Basket 2	3	1	0	0	0	4	PHYS	SCI	Letter Grade
CHEM1001	Chemistry	2	1	2	0	0	4	CHEM	SCI	Letter Grade
MATHXXXX	Maths Basket 1	2	0	0	0	0	2	MATH	SCI	Letter Grade
MATHXXXX	Maths Basket 2	2	0	0	0	0	2	MATH	SCI	Letter Grade
MATHXXXX	Maths Basket 3	2	0	0	0	0	2	MATH	SCI	Letter Grade
MATHXXXX	Maths Basket 4	2	0	0	0	0	2	MATH	SCI	Letter Grade
MATHXXXX	Maths Basket 5	2	0	0	0	0	2	MATH	SCI	Letter Grade
MATHXXXX	Maths Basket 6	2	0	0	0	0	2	MATH	SCI	Letter Grade
	Design Thinking	0	0	2	0	0	1	MECH	ENG	Letter Grade
	Artificial Intelligence Applications	0	0	2	0	0	1	COMP	ENG	Letter Grade
	Probability and Statistics	3	0	0	0	0	3	MATH	SCI	Letter Grade
MECH1011	Engineering Visualization and Product Realization	0	0	4	0	0	2	MECH	ENG	Letter Grade
MECH1021	Workshop	0	0	4	0	0	2	MECH	ENG	Letter Grade
EECE1001	Basic Electrical and Electronics Engineering	2	1	2	0	0	4	EEE	ENG	Letter Grade
CSEN1011	Problem Solving and Programming in C	0	0	6	0	0	3	COMP	ENG	Letter Grade
CSEN1021	Programming with Python	0	0	6	0	0	3	COMP	ENG	Letter Grade
	Internship 1	0	0	0	0	1	1	MISC	ENG	P/F
	Internship 2	0	0	0	0	1	3	MISC	ENG	Letter Grade
	Comprehensive Examination	1	0	0	0	0	1	MISC	ENG	P/F
	Capstone Project - Introduction	0	0	0	0	2	2	MISC	ENG	Letter Grade
	Capstone Project - Final	0	0	0	0	6	6	MISC	ENG	Letter Grade
	Universal Human Values	3	0	0	0	0	3	UNIV	HUM	P/F
	Project Exhibition 1	0	0	0	0	1	1	MISC	ENG	P/F
	Project Exhibition 2	0	0	0	0	1	1	MISC	ENG	P/F

Note: LTPSJC for each course represents Lecture (L), Tutorial (T), Practical (P), skill development (S), Project work/ Internship (J) and the total instructional delivery indicated as credits (C).

### Courses Offered under Mathematics Basket

S. No	Level	Course code	Course name	Offered to
1	1	MATH1001	Single variable calculus	All BTech branches
2	1	MATH1011	Several variable Calculus	
3	1	MATH1021	Transform Techniques	
4	1	MATH1031	Differential Equations	
5	1	MATH1041	Discrete Mathematics	CSE
6	1	MATH1051	Graph Theory	CSE
7	1	MATH1061	Introduction to Mathematics - I	BT
8	1	MATH1071	Introduction to Mathematics - II	BT

### Courses Offered for BioTechnology Department

S. No	Level	Course code	Course name	Offered to
1	1	BTEN1001	Introduction to Biotechnology-I	BT
2	1	BTEN1011	Biotechnology Workshop	BT
3	1	BTEN1021	Introduction to Biotechnology-II	BT
4	1	BTEN1031	Process Calculations	BT

### Courses Offered under Physics Basket

S. No	Level	Course code	Course name	Offered to
1	1	PHYS1001	Physics	All B.Tech branches
2	1	PHYS1011	Mechanics and Properties of Matter	AE, CE, ME
3	1	PHYS1021	Principles of Quantum Mechanics	CSE
4	1	PHYS1031	Physics of Semi Conducting devices	ECE, EEE
5	1	PHYS1041	Mechanics and Modern Physics	BT

### Courses Offered under Sports Basket

S.No.	Course Code	Category	Sport
1	DOSP1001	BDMTTE	BADMINTON + TABLE TENNIS
2	DOSP1011	BDMTEN	BADMINTON + TENNIS
3	DOSP1021	CHSCRM	CHESS + CARROM
4	DOSP1031	HBLFBL	HANDBALL + FOOTBALL
5	DOSP1041	BKBFBL	BASKETBALL + FOOTBALL
6	DOSP1051	HBLBKB	HANDBALL + BASKETBALL
7	DOSP1061	VVOTHB	VOLLEYBALL + THROWBALL
8	DOSP1071	KABKHO	KABADDI + KHO KHO

### Courses Offered under Club Activity Basket

S.No.	Course Code	Category	Course Name
1	DOSL1001	Participant	Club Activity (Participant)
2	DOSL1011	Member	Club Activity (Member of Club)
3	DOSL1021	Leader	Club Activity (Leader of Club)
4	DOSL1031	Competitor	Club Activity (Competitor)

### Courses Offered under Community Service Basket

S.No.	Course Code	Category	Course Name
1	DOSL1041	Volunteer	Community Services – Volunteer
2	DOSL1051	Mobilizer	Community Services – Mobilizer

### CONTINUOUS EVALUATION PATTERN (FOR LEVEL-I COURSES)

S.No.	Course	Assessment Procedure
1	CSE Programming Courses CSEN1011, CSEN1021	<ol style="list-style-type: none"> <li>1. Number of Quizzes: 12 (4 marks each), Consider 10 out of 12 quizzes: <math>10 \times 4 = 40</math> marks. This is like a weekly assessment program that can be graded automatically.</li> <li>2. Summative Assessments: 3 (10 marks each): <math>3 \times 10 = 30</math> marks. These are like mid-term exams that can be conducted in the lab and may include conceptual and programming concepts.</li> <li>3. End semester examination: 30 marks. This is also a lab exam that can have multiple programming conceptual questions covering various modules.</li> </ol>
2	BEEE/Physics/Chemistry (Theory + Practical) Combined	<ol style="list-style-type: none"> <li>1. Number of Quizzes: 12 (2 marks each), Consider 10 out of 12 quizzes: <math>10 \times 2 = 20</math> marks</li> <li>2. Summative Assessments: 3 (10 marks each): <math>3 \times 10 = 30</math> marks</li> <li>3. Assignments: 2 (10 marks each): <math>2 \times 10 = 20</math> marks</li> <li>4. End semester examination: 30 marks</li> </ol>
3	Mathematics (Each of the 2 credit courses):	<ol style="list-style-type: none"> <li>1. Number of Quizzes: 6 (4 marks each), Consider 5 out of 6 quizzes: <math>5 \times 4 = 20</math> marks</li> <li>2. Summative Assessments: 1 (30 marks): <math>1 \times 30 = 30</math> marks</li> <li>3. Assignments: 1 (20 marks): <math>1 \times 20 = 20</math> marks</li> <li>4. End semester examination: 30 marks</li> </ol>
4	Laboratory Courses	<ol style="list-style-type: none"> <li>1. Weekly assessments: 10 (8 marks each) <math>10 \times 8 = 80</math> marks</li> <li>2. End semester examination: 20 marks</li> </ol>
5	Engineering Visualization and Product Realization	<ol style="list-style-type: none"> <li>1. Number of Quizzes: 12 (2 marks each), Consider 10 out of 12 quizzes: <math>10 \times 2 = 20</math> marks</li> <li>2. Summative Assessments: 3 (10 marks each): <math>3 \times 10 = 30</math> marks</li> <li>3. Project: 20 marks</li> <li>4. End semester examination: 30 marks</li> </ol>
6	Workshop	<ol style="list-style-type: none"> <li>1. Number of jobs: 12 (10 marks each), Consider 10 out of 12 jobs: <math>10 \times 10 = 100</math> marks</li> </ol>

## MATH1001 - SINGLE VARIABLE CALCULUS

L	T	P	C
2	0	0	2

*This course is designed to impart knowledge on differentiation and integration of function, emphasizing their inter-relationship and applications to engineering.*

### Course Objectives:

- To familiarize the students in the concepts the derivatives and its underlying concepts like limits and continuity.
- To explain the concept of derivative and calculation of extreme values of extreme values of various functions.
- To impart knowledge on integration for the computation of areas, arc lengths.
- To demonstrate various techniques of integrations.

### Unit I: Limits and continuity of single and several variables

(6 hours)

Limit of a Function and Limit Laws, The Precise Definition of a Limit, One-Sided Limits, Continuity (Without proofs). Functions of Several Variables, Limits and Continuity in Higher Dimensions (Without proofs)

### Learning Outcomes:

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

- define and calculate limits and one-sided limits of single variables
- define and calculate limits of several variables.
- define continuity and determine whether a function is continuous of single and several variables.

### Unit II: Derivatives and applications

(7 hours)

The Derivative as a Function, Differentiation Rules, The Chain Rule, Extreme Values of Functions on Closed Intervals, Monotonic Functions (Without proofs)

### Learning Outcomes:

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

- know the definition of derivative and how to use the most common rules of derivatives
- apply various rules to obtain the derivatives of different functions.
- find the extreme values of various functions.

### Unit III: Integrals and applications

(7 hours)

The Definite Integral, The Fundamental Theorem of Calculus, Indefinite Integrals and the Substitution Method, Definite Integral Substitutions and the Area between Curves, Arc Length (Without proofs)

### Learning Outcomes:

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

- know about anti-derivative and the Fundamental Theorem of Calculus and its applications
- apply concept of integration to evaluate geometric area and solve other applied problems
- apply substitution to compute definite integrals.

**Unit IV: Techniques of integration****(6 hours)**

Using basic Integration Formulas, Integration by Parts, Trigonometric Integrals, Trigonometric Substitutions, Integration of Rational Functions by Partial Fractions (Without proofs)

**Learning Outcomes:**

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

- evaluate integrals using integration by parts.
- evaluate indefinite and definite integrals using by the method of substitution.
- evaluate integrals of trigonometric and rational functions.

**Textbook:**

1. Joel Hass, Christopher Heil, Maurice D. Weir, Thomas' Calculus, Fourteenth edition, Pearson Addison Wesley (2018).

**References:**

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2018.
2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.
3. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015.
4. Hyghes-Hallett, Gleason, McCallum et al. Single Variable Calculus (6th Edn) John Wiley and Sons New York, 2013.

**Course Outcomes:**

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

- determine limit, one sided limit, continuity of single and several variable functions.
- solve problems in a range of mathematical applications using the derivative or the integral.
- apply the fundamental theorem of calculus.
- evaluate integrals using various techniques.



## MATH1011- SEVERAL VARIABLE CALCULUS

L	T	P	C
2	0	0	2

This course is designed to impart knowledge on calculus of functions of more variables which are useful in modelling and analyzing physical phenomena involving continuous change of variables or parameters and have applications across all branches of engineering.

### Course Objectives:

- To teach basic concepts of partial derivatives.
- To explain the evaluation of double integrals and its applications.
- To demonstrate the evaluation and applications of triple integrals.
- To acquaint the knowledge of line and surface integrals and applications.

### Unit I: Partial derivatives and applications

(7 hours)

Partial Derivatives of a Function of Two Variables and More Than Two Variables, Second-order Partial derivatives, The Chain Rule for Functions of Two and Three variables, Extreme Values and Saddle Points, Lagrange Multipliers, Taylor's Formula for Two Variables (Without proofs)

#### Learning Outcomes:

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

- find partial derivatives of various functions
- apply chain rule for functions of two and three variables
- evaluate maxima and minima of functions

### Unit II: Double integrals

(6 hours)

Double and iterated Integrals over Rectangles, Double Integrals over General Regions, Area by Double Integration : Area of bounded region in a plane, Double Integrals in Polar Form. (Without proofs)

#### Learning Outcomes:

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

- evaluate double integrals of functions of several variables in two dimensions in Cartesian and polar coordinates.
- calculate the areas bounded by a region using double integration techniques.

### Unit III: Triple integrals

(5 hours)

Triple Integrals in Rectangular Coordinates: Triple Integrals, Volume of a Region in Space, Finding limits of integration, Triple Integrals in Cylindrical and Spherical Coordinates. (Without proofs)

#### Learning Outcomes:

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

- find limits of integration
- evaluate multiple integrals in Cartesian, cylindrical and spherical geometries.
- find volumes using triple integrals.

### Unit IV: Integrals and Vector fields

(8 hours)

Vector Fields and Line Integrals: Line Integrals of Vector Fields, Line Integrals with Respect to  $dx$ ,  $dy$ , or  $dz$ , Work Done by a Force over a Curve in Space, Green's Theorem in the Plane: Tangential form, Using Green's Theorem to Evaluate the Line Integral and Verification, Surface Integrals: Surface Integrals of Vector Fields, Stokes' Theorem (Without proofs)

**Learning Outcomes:**

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

- find the work done in moving a particle along the path over a force field.
- find the rate of flow of a fluid across a surface.
- apply Green's and Stokes' theorem in evaluation of line, surface and volume integrals.

**Textbook:**

1. Joel Hass, Christopher Heil, Maurice D. Weir, Thomas' Calculus, Fourteenth edition, Pearson Addison Wesley (2018).

**References:**

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2018.
2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.
3. Hyghes-Hallett, Gleason, McCallum et al. Multivariable Variable Calculus (6th Edn) John Wiley and Sons New York, 2013.
4. James Stewart. Multivariate Calculus, Concepts and Contexts. (3rd Edn) Thomson/Brooks/Cole, Canada, 2005.

**Course Outcomes:**

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

- utilize functions of several variables in optimization.
- employ the tools of calculus for calculating the areas.
- calculate volumes using multiple integrals.
- determine the work done and rate of flow of a fluid using vector calculus

## LANG1001: COMMUNICATION SKILLS IN ENGLISH - BEGINNERS

L T P C  
0 0 4 2

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

### Course Objectives

- Train learners to listen actively, follow what is spoken in standard English, and answer questions to demonstrate their understanding of the main points of the speech, repeat part of what someone has said to confirm mutual understanding, though occasionally, there may be a need to ask for repetition or clarification. (Bloom's Taxonomy Level/s: 2 & 3)
- Equip learners with the skills to read and comprehend straightforward texts and simple argumentative writing to identify the topic, the desired/relevant information, the main points of the argument, and the major conclusion/s. (Bloom's Taxonomy Level/s: 2 & 4)
- Help learners apply their knowledge and language skills to make mini oral presentations, and produce short coherent written texts using appropriate cohesive devices, suitable vocabulary and grammatical structures. (Bloom's Taxonomy Level/s:3)
- Enable learners to communicate with reasonable accuracy in familiar contexts with adequate fluency and generally good control by equipping them with a repertoire of frequently used vocabulary, structures, and speech patterns. (Bloom's Taxonomy Level/s: 2 & 3)

### List of Activities & Tasks for Assessment

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

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

### References

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

### Online References

- [www.teachingenglish.org.uk](http://www.teachingenglish.org.uk)
- [learnenglishteens.britishcouncil.org](http://learnenglishteens.britishcouncil.org)
- <https://eslflow.com/>
- <https://www.englishclub.com/>
- <https://www.oxfordlearnersdictionaries.com/>
- <https://dictionary.cambridge.org/>
- [learnenglishteens.britishcouncil.org](http://learnenglishteens.britishcouncil.org)
- <https://freerice.com/categories/english-vocabulary>

### Course Outcomes

- Listen actively, understand and extract the essential information from short talks/conversations/discussions that are delivered in clear, standard speech. (Bloom's Taxonomy Level/s: 2 & 3)
- Read, understand, and extract specific information from straightforward factual and simple argumentative texts on general topics and subjects of interest. (Bloom's Taxonomy Level/s: 2 & 3)
- Speak clearly with some confidence on matters related to his/her interests and academic work, and make short structured oral presentations on topics of personal interest. (Bloom's Taxonomy Level/s: 3)
- Write short straightforward connected texts on a range of familiar/general topics using appropriate linking devices to achieve a clear sequence of ideas. (Bloom's Taxonomy Level/s: 3)
- Acquire sufficient language competency to express oneself in speech and writing with some confidence, using appropriate vocabulary and simple grammatical structures though lexical limitations and/or difficulty with formulation might be evident at times. (Bloom's Taxonomy Level/s: 2 & 4)

## LANG1011: COMMUNICATION SKILLS IN ENGLISH

**L T P C**  
**0 0 4 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. [learnenglishteeners.britishcouncil.org](http://learnenglishteeners.britishcouncil.org)
8. <https://freerice.com/categories/english-vocabulary>
9. <http://www.5minuteenglish.com/>
10. <https://breakingnewsenglish.com/>
11. <https://www.digitalbook.io/>
12. <https://librivox.org/>

## Course Outcomes

- Understand the speaker's point of view in fairly extended talks on general or discipline-specific topics, and follow simple lines of argument in discussions on familiar contemporary issues. (Bloom's Taxonomy Level/s: 3)
- "Read and demonstrate understanding of articles and reports on limited range of contemporary issues in which the writers adopt particular stances. Also provide samples of written communication containing fairly complex information and reasons for choices/opinions/stances. (Bloom's Taxonomy Level/s: 2 & 3)"
- Make short presentations on a limited range of general topics using slides, and engage in small group discussions sharing experiences/views on familiar contemporary issues and give reasons for choices/opinions/plans. (Bloom's Taxonomy Level/s: 3 & 4)
- Write clear, fairly detailed text (a short essay) on a limited range of general topics, and subjects of interest, and communicate clearly through email/letter to seek/pass on information or give reasons for choices/opinions/plans/actions. (Bloom's Taxonomy Level/s: 3)
- Reflect on others' performance, give peer feedback on fellow learners' presentations, responses to writing tasks and reading comprehension questions. (Bloom's Taxonomy Level/s: 5)

## LANG1021: ADVANCED COMMUNICATION SKILLS IN ENGLISH

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

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

### Course Objectives

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



## List of Activities & Tasks for Assessment

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

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

### Reference Books

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

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

### **Online Resources**

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

### **Course Outcomes**

- Listen to extended lectures, presentations, and discussions on a wide range of contemporary issues and demonstrate understanding of relatively complex lines of argument. (Bloom's Taxonomy Level/s: 2)
- Make presentations using suitable AV aids and engage in formal group discussions on a wide range of topics of contemporary interest, demonstrating awareness of standard/widely accepted conventions. (Bloom's Taxonomy Level/s: 3)
- Read and demonstrate understanding of the writer's stance/viewpoint in articles and reports on a wide range of contemporary issues and discipline-specific subjects. (Bloom's Taxonomy Level/s: 2 & 4)
- Write analytical essays on a wide range of general topics/subjects of interest, and engage in written communication (emails/concise reports) to exchange relatively complex information, giving reasons in support of or against a particular stance/point of view. (Bloom's Taxonomy Level/s: 3 & 4)
- Complete a mini project that necessitates the use of fairly advanced communication skills to accomplish a variety of tasks and submit a report in the given format. (Bloom's Taxonomy Level/s: 4 & 5)

## MATH1061 - INTRODUCTION TO MATHEMATICS I

L	T	P	C
2	0	0	2

This course is designed to provide an introduction to the mathematics required for basic physics, engineering mathematics, and introductory engineering courses.

### Course Objectives:

- To explain the concepts of Trigonometry.
- To explain the basic concepts of differentiation and differential equations
- To teach the evaluation of definite and indefinite integrals.

### Unit- I :

3 hrs

Representations for Scalars, Vectors, Matrices and Tensors.

Coordinate systems: cartesian and polar coordinate systems.

### Learning Outcomes:

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

- Describe representational forms (L1)
- Understand the basis of coordinate systems (L1)

3 hrs

### Unit- II : Trigonometry

Trigonometric functions, periodicity, trigonometric ratio of compound angles, multiple and sub multiple angles, transformations, brief introduction of inverse trigonometric, hyperbolic and inverse hyperbolic functions.

### Learning Outcomes:

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

- identify trigonometric functions and their properties (L3)
- apply the trigonometric ratio techniques of compound angles, multiple and sub multiple angles in calculations (L3)
- find inverse trigonometric and hyperbolic functions (L3)

8 hrs

### Unit- III : Differential Calculus

**Limits and Continuity:** Definition of right hand limit, left hand limit, standard limits

$$\begin{array}{llll} \lim_{x \rightarrow a} \frac{x^n - a^n}{x - a} & \lim_{\theta \rightarrow 0} \frac{\sin \theta}{\theta} & \lim_{n \rightarrow 0} \left( \frac{1}{1+n} \right)^n & \lim_{x \rightarrow 0} \frac{e^x - 1}{x} \\ 1) & 2) & 3) & 4) \end{array}$$

$$5) \lim_{x \rightarrow 0} \frac{a^x - 1}{x}$$

(without proofs), definition of continuity and simple illustrations.

Differentiation: Introduction, definition, differentiation of a function at a point and on an interval, derivative of a function, differentiation of sum, difference, product and quotient of functions, differentiation of algebraic, exponential, logarithmic functions, composite, implicit, parametric, hyperbolic, inverse hyperbolic functions, logarithmic differentiation, derivatives of first and second order.

### Learning Outcomes:

After completing this unit, the student will be able to

- find derivative of sum, difference, product and quotient of functions (L3)
- apply differentiation techniques in different forms of functions (L3)
- calculate the derivatives of simple functions (L4)

8 hrs

#### Unit IV: Integration

**Indefinite Integrals:** Integration as the inverse process of differentiation, standard forms, properties of integrals, integration by the method of substitution covering algebraic, trigonometric, exponential functions, integration by parts, logarithmic functions, inverse trigonometric functions.

**Definite Integrals:** Definition of a definite integral and its properties (without proof), formulae

Of  $\int_0^{\pi/2} \sin^n \theta d\theta$ ,  $\int_0^{\pi/2} \cos^n \theta d\theta$  and  $\int_0^{\pi/2} \cos^n \theta \sin^m \theta d\theta$  (without proofs).

#### Learning Outcomes:

After completing this unit, the student will be able to

- find integrals of special functions (L3)
- apply partial fractions technique on evaluation of integrals of rational functions (L3)
- solve definite integrals in trigonometric functions (L3)
  - solve simple integrals (L3)
  - apply substitution and by parts techniques in evaluation of integrals (L3)
  - find logarithmic, inverse trigonometric functions (L3)

10 hrs

#### Unit V: Introduction to differential equations and Multivariable calculus

Linear first order differential equations with constant coefficients, linear second order differential equations with constant coefficients (Definitions only). Only basic concepts of Partial differentiation. Only basic concepts of Differential forms: gradient, divergence and curl. Introduction to line, surface and volume integrals (without problems) illustrated with Stokes, Gauss, and Green's theorems (Only statements).

#### Learning Outcomes:

- solve problems involving trigonometric functions (L3)
- understand the principles of differential and integral calculus (L3)
- solve first order linear differential equations with constant coefficients (L3)
- solve first order linear differential equations with constant coefficients (L3)
- understand the basic concepts of vector calculus (L1)

#### Course Outcomes:

After the completion of the course the student should be able to

- solve problems involving trigonometric functions (L3)
- understand the principles of differential and integral calculus (L3)
- solve first order linear differential equations with constant coefficients (L3)
- solve first order linear differential equations with constant coefficients (L3)
- understand the basic concepts of vector calculus (L1)

#### Text Books:

1. Text book for Intermediate Mathematics, Board of Intermediate Education, AP, Volumes IA, IB & IIA, 2018.
2. NCERT class XI and XII (part 1) Mathematics text books.

#### References:

1. V. Venkateswara Rao, N. Krishna Murthy, B.V.S. Sharma, Intermediate Mathematics, S.Chand & Company Ltd., Volume I & II.
2. Chandrika Prasad, A first Course in Mathematics.
3. Text book for Intermediate Mathematics, Deepti Publications.

## MATH1071 - INTRODUCTION TO MATHEMATICS II

L	T	P	C
2	0	0	2

This course is designed to provide an introduction to the mathematics required for basic physics, engineering mathematics, and introductory engineering courses.

### Course Objectives:

- To describe the basic concepts of matrices
- To introduce complex numbers and their properties.
- To teach the techniques based on partial fractions
- To explain the concepts of straight lines and circles

### Unit I: Matrices

8hr

Matrices, determinants, definition, types of matrices, algebra of matrices, properties of determinants of  $2 \times 2$ ,  $3 \times 3$  matrices, inverse of a matrix, solving simultaneous linear equations in two and three variables using matrix inverse method, Cramer's rule and Gauss Jordan method. Eigenvalues and Eigenvector of matrices.

#### Learning Outcomes:

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

- find determinants of matrices (L3)
- apply crammer's rule for solving linear equations (L3)
- find inverse of a matrix (L3)

### Unit- II : Complex Numbers

6 hrs

Complex number as an ordered pair of real numbers, representation of  $z = (a, b)$  in the form  $(a + ib)$  conjugate complex numbers, modulus and amplitude of a complex number, geometrical representation of a complex number, Argand diagram.

#### Learning Outcomes:

- solve arithmetic problems involving complex numbers (L3)
- find the conjugate, modulus and amplitude of a complex number (L3)
- describe the relationship between a complex number and Argand plane (L3)

### Unit III: Partial Fractions

6 hrs

Introduction, resolving  $g(x)$  into partial fractions when  $g(x)$  contains non repeated linear factors, repeated linear factors, repeated and non-repeated irreducible quadratic factors.

#### Learning Outcomes:

After completing this unit, the student will be able to

- find a fractional function and resolve it into partial fractions (L3)
- make use of resolving techniques of repeated and non repeated linear factors (L3)
- apply this technique in evaluation of integrals (L3)

### Unit IV: Co-ordinate Geometry

14 hrs

**Straight lines:** Recapitulation of general equation of a straight line, forms of equation of a straight

line: slope intercept form, intercept form, point -slope form, two point form, normal form  $x \cos \alpha + y \sin \alpha = p$ , point of intersection of two straight lines, line passing through the point of intersection of two given lines, condition for concurrency of three straight lines, angle between two intersecting lines, condition for perpendicularity and parallelism, length of the perpendicular from a point to a straight line, distance between two parallel lines (without proofs).

**Circles:** Equation of a circle, standard form, centre and radius, equation of a circle with a given line segment as diameter, equation of a circle through three non collinear points, parametric equations of a circle, position of a straight line in the plane of the circle.

**3D Geometry:** Equation of a plane, Intersection of two planes, Equation of a sphere in spherical and cartesian coordinates, Intersection of a plane and a sphere.

**Learning Outcomes:**

After completing this unit, the student will be able to

- identify the equation to straight line in different forms(L3)
- find the length of perpendicular from a point to a straight line(L3)
- find the equation of a circle passing through three non collinear points(L3)

**Course Outcomes:**

After the completion of the course the student should be able to

- describe the properties of matrices (L3)
- describe the properties of complex numbers (L3)
- illustrate straight line and circle properties(L3)

**Text Books:**

1. Text book for Intermediate Mathematics, Board of Intermediate Education, AP, Volumes IB, IIA & IIB, 2018.
2. NCERT class XI and XII (part 1 & 2) Mathematics text books.

**References:**

1. V. Venkateswara Rao, N. Krishna Murthy, B.V.S. Sharma, Intermediate Mathematics, S. Chand & Company Ltd., Volume I & II.
2. Chandrika Prasad, A first Course in Mathematics.
3. Text book for Intermediate Mathematics, Deepti Publications.

## MATH1021 - TRANSFORM TECHNIQUES

L	T	P	C
2	0	0	2

*This course is designed to impact the knowledge on (Laplace, Fourier) transforms and applications of these transforms on differential equations.*

### Course Objectives:

- To introduce and explain the concepts of Laplace transforms and properties.
- To demonstrate the evaluation of Laplace transforms of special functions and additional properties.
- To evaluation of integrals using Laplace transforms, finding the inverse Laplace transform and to solve differential equations (initial value) using Laplace transforms.
- To introduce and explain the concepts of Fourier transforms and properties.
- To explain the evaluation of Fourier transforms of various function and then applications to boundary value problem.

### Unit-1: Laplace transforms

(4 hrs)

Introduction, transforms of elementary functions, properties of Laplace transforms

#### Learning Outcomes:

After completion of this unit student able to

- find Laplace transform of a function (L3).
- examine the properties of Laplace transforms(L4).

### Unit-2: Laplace transforms of various functions

(9 hrs)

Periodic functions, special functions, transforms of derivatives, transforms of Integrals, Multiplication by  $t^n$ , Division by  $t$ ,

#### Learning Outcomes:

After completion of this unit student able to

- find Laplace transform of special functions(L3).
- determine Laplace transform of functions like transforms of Integrals, Multiplication by  $t^n$ , Division by  $t$  (L4).

### Unit-3: Applications of Laplace transforms

(4 hrs)

Evaluation of integrals by Laplace transforms, Inverse transforms, Solution of Differential equations, Convolution theorem

#### Learning Outcomes:

After completion of this unit student able to

- find the inverse Laplace transform of a function(L3)
- determine the inverse Laplace transform of a product of functions using Convolution theorem(L4).
- Solve ordinary differential equations by using Laplace transformation technique(L3).

### Unit-4: Fourier transforms

(4 hrs)

Introduction, Fourier integrals, Fourier transforms, properties, Convolution theorem

#### Learning Outcomes:

After completion of this unit student able to

- examine the properties of Fourier transforms(L3).



- find Fourier transforms using convolution theorem(L3).

### **Unit-5: Fourier transforms of various functions**

**(7 hrs)**

Relation between Fourier and Laplace transform, transform of derivatives, Applications to boundary value problems

#### **Learning Outcomes:**

After completion of this unit student able to

- examine with the relationship between Laplace and Fourier transforms(L3)
- apply transforms to boundary value problems(L4).

#### **Text Book(s):**

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2018.
2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.

#### **References:**

1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
2. George B. Thomas, Maurice D. Weir and Joel R. Hass, Thomas' Calculus, 13/e, Pearson Publishers, 2014.
3. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson Publishers, 2011.

#### **Course Outcomes:**

At the end of the course students will be able to

- find Laplace transform of a function along with properties(L3).
- determine the Laplace transform of special functions(L3).
- apply the Laplace transform for solving differential equations (continuous systems) (L4)
- find the Fourier transform of a function along with properties(L3).
- solve boundary value problems by Fourier transforms(L3).

## MATH1031: DIFFERENTIAL EQUATIONS

L	T	P	C
2	0	0	2

*This course is designed to impact the knowledge on ordinary, partial differential equations and their applications.*

### Course Objectives:

- To familiarize the students with the basic concepts of ordinary differential equations.
- To demonstrate the evaluation and applications of first order differential equations.
- To explain the evaluations of linear homogeneous and non-homogeneous differential equations.
- To familiarize the students with the basic concepts of partial differential equations.
- To explain the concepts of first order partial differential equations.

### Unit-1: Introduction to Ordinary Differential Equations (4 hrs)

Definitions, Formation of an Ordinary Differential Equation, Order and Degree of an ODE, Solution of a differential equation – Geometric meaning.

#### Learning Outcomes:

- explain the concept of ordinary differential equation (L3).
- find the ordinary differential equations (L3).
- explains the meaning of solution of a differential equation (L3).

### Unit-2: Ordinary Differential Equations of First Order (9 hrs)

ODE's of first order and first degree, variable separable method, Homogeneous equations, Equations reducible to homogeneous form, Linear Equations, Exact equations, Equations reducible to exact equations

#### Learning Outcomes:

- apply various methods to solve first and first degree differential equations (L3).
- distinguish between linear and non linear differential equations (L4).
- solve exact and linear differential equations (L3).

### Unit-3: Linear Ordinary Differential Equations (4hrs)

Definitions, Complete Solution, Operator D, Complimentary function, Inverse operator, Particular integral, Method of Variation of Parameter, Method of undermined coefficients.

#### Learning Outcomes:

- classify the solutions of linear differential equations (L3)
- identify the essential characteristics of linear differential equations with constant coefficients (L3)
- solve the linear differential equations with constant coefficients by appropriate methods (L3)

**Unit-4:Introduction to Partial Differential Equations****(4 hrs)**

Definition , Formation of an Partial Differential Equation, Solutions of a PDE, Equations solvable by direct integration.

**Learning Outcomes:**

- find the partial differential equation (L3).
- find the solution of a partial differential equation.
- solve PDE by direct integration (L3)

**Unit-5:Partial Differential Equations of First order****(7 hrs)**

First order partial differential equations, solutions of first order linear PDEs, Charpit's method. Solutions to homogenous and non-homogenous linear partial differential equations.

**Learning Outcomes:**

- apply a range of techniques to find solutions of PDEs (L3)
- identify the basic properties of PDEs (L3)
- find the solutions of homogenous and non-homogenous linear partial differential equations (L3).

**Text Books:**

1. Simmons, G.F., Differential Equations with Applications and Historical Notes, Second Edition, McGraw-Hill, Inc., 1991.
2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.

**References:**

1. Shepley L. Ross, *Differential Equations*, 3rd Ed., John Wiley and Sons, 1984
2. Sneddon, *Elements of Partial Differential Equations*, McGraw-Hill, International Edition, 1967.
3. Erwin Kreyszig, *Advanced Engineering Mathematics*, 10/e, John Wiley & Sons, 2018.

**Course Outcomes:**

- form and find the solution of an ordinary differential equation (L3).
- solve first order differential equation using various methods (L3).
- apply the concept of differential equations to solve real world problems (L3). □ evaluate linear homogeneous and non homogeneous differential equations (L3) □ form and find the solution of a partial differential equation (L3).
- evaluate first order partial differential equations (L3).

## MATH1041: DISCRETE MATHEMATICS

L	T	P	C
2	0	0	2

### Course Objectives:

- To introduce basics of set theory and computations using these concepts.
- Familiarize closed form solution of linear recurrence relations by various methods.
- Bring awareness of basic concepts of group theory and group codes.
- Familiarize the concepts of Boolean algebra.

### Unit-1: Mathematical Logic

(8 hours)

Connectives, negation, conjunction, disjunction, conditional and bi-conditional, well formed formulae, tautologies, equivalence of formulae, duality, tautological implications, functionally complete set of connectives, principal disjunctive and conjunctive normal forms, inference calculus, rules of inference, indirect method of proof, conditional proof.

#### Learning Outcomes:

After completion of this unit, student will be able to

- find equivalence formulas, implementation of logic for mathematical proofs
- apply inference theory to verify the consistence of data
- Able to detect programming errors efficiently through enhanced logical capabilities using above concepts

### Unit-2: Set theory

(5 hours)

Inclusion and equality of sets, The power set, operations on sets, Venn diagrams, relations, properties of binary relations in a set, Equivalence relations, composition of binary relations, Partial ordering, Partially ordered set.

#### Learning Outcomes:

After completion of this unit, student will be able to

- identify different types of sets and relations
- test the given set is an equivalence relation or not
- understand for formalizing and reasoning about computation and the objects of computation using these concepts.

### Unit-3: Recurrence relations

(5 hours)

Recurrence relations, solving linear recurrence relations by characteristic roots method, system of recurrence relations, non-linear recurrence relations.

#### Learning Outcomes:

After completion of this unit, student will be able to

- construct recurrence relations of the sequences
- solve homogeneous linear recurrence relations
- solve complementary function and particular integral for non-homogeneous linear recurrence relations

### Unit-4: Group theory

(6 hours)

Groups, subgroups, Lagrange's theorem on finite groups, normal subgroups, permutation groups, cyclic groups (definition and examples), Group codes (single error detection and correction).

#### Learning Outcomes:

After completion of this unit, student will be able to

- test the given algebraic structure is a group or not
- identify different types of groups
- examine single error detection and correction

**Unit-5: Boolean algebra****(4 hours)**

Lattice - definition and examples, sublattices. Boolean algebra - definition and examples, Subalgebra, Boolean functions.

**Learning Outcomes:**

After completion of this unit, student will be able to

- identify different lattices and sublattices
- Learn Boolean algebra and Boolean functions
- Learn to analyze and simplify the digital (logic) circuits using these concepts

**Text Books:**

1. J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill, 1997.
2. Kenneth H. Rosen, Discrete Mathematics and Applications, Seventh edition, Tata McGrawHill, 2012.

**Reference books:**

1. Keneth. H. Rosen, Discrete Mathematics and its Applications, 6/e, Tata McGraw-Hill, 2009.
2. Bhishma Rao, Mathematical Foundations of Computer Science, SciTech Publications (India) Pvt Ltd.

**Course Outcomes :**

Upon successful completion of this course the student should be able to

- identify programming errors efficiently through enhanced logical capabilities
- analyze the concepts in set theory
- find a general solution of recurrence equation
- build the algebraic structures and implement in algorithms
- learn to analyze and simplify the digital (logic) circuits using Boolean algebra concepts

## MATH1051: GRAPH THEORY

L	T	P	C
2	0	0	2

### Course Objectives:

- To introduce basics of group theory and its applications
- Bring awareness of basic concepts of paths and circuits
- To teach the topics on Trees, spanning trees, shortest spanning trees
- To teach the matrix representation of graphs

### Unit-1: Introduction

(5 hours)

Finite and Infinite Graphs, Incidence and Degree, Isolated Vertex, Pendant Vertex, and Null Graph.

#### Learning Outcomes:

After completion of this unit, student will be able to

- Learn the basic terminology of the graph theory
- Learn the vertex of the graph and identify the types of vertices of the graph

### Unit-2: Paths and circuits

(8 hours)

Isomorphism, Subgraphs, Walks, Paths, and Circuits, Connected Graphs, Disconnected Graphs, and Components, Euler Graphs, Operations On Graphs, More on Euler Graphs, Hamiltonian Paths and Circuits, The Traveling Salesman Problem.

#### Learning Outcomes:

After completion of this unit, student will be able to

- identify different graphs and their properties
- construct Euler and Hamiltonian graphs

### Unit 3: Trees and Fundamental circuits

(8 hours)

Trees, Some Properties of Trees, Pendant Vertices in a Tree, Distance and Centers in a Tree, Rooted and Binary Trees, On Counting Trees, Spanning Trees, Fundamental Circuits, Finding All Spanning Trees of a Graph.

#### Learning Outcomes:

After completion of this unit, student will be able to

- construct the spanning tree and binary tree from graphs
- build minimal spanning tree by using different algorithms

### Unit-4: Matrix representations of graphs

(5 hours)

Incidence Matrix, Submatrices of  $A(G)$ , Circuit Matrix, Fundamental Circuit Matrix, Path Matrix, Adjacency Matrix

#### Learning Outcomes:

After completion of this unit, student will be able to

- Identify the types of matrix representation of graph

### Text Book:

1. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science, Prentice Hall of India, 2006

### Reference Book:

1. Bhishma Rao, Mathematical Foundations of Computer Science, SciTech Publications (India) Pvt Ltd.

**Course Outcomes :**

Upon successful completion of this course the student should be able to

- analyze the concepts in graph theory
- apply graph theory concepts in core subjects such as data structures and network theory effectively

CSEN1011 - PROBLEM SOLVING AND PROGRAMMING WITH C				
	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	0	0	6	3
<i>The course is designed to enable the student to write programs for problem solving. After an introduction to program logic design using algorithms and flowcharts, converting the logic into programs is taught. The features of structured programming are explained with the C programming language as an example. This course lays the foundation both for developing program logic and for writing programs in C according to the developed logic.</i>				
<b>Course Objectives:</b>				
<ol style="list-style-type: none"><li>1. Familiarize the student with the steps involved in writing and running a compiled program.</li><li>2. Enable the student to build program logic with algorithms and flowcharts.</li><li>3. Explain with the features and constructs of C programming such as data types, expressions, loops, functions, arrays, pointers, and files.</li><li>4. Demonstrate the handling of variables and input-output operations in C.</li><li>5. Train the student to convert program logic into C language code using a top-down approach.</li></ol>				
<b>Module I:</b>	<b>Introduction to Computer Problem-Solving</b>			<b>12 P</b>
Introduction, the Problem-Solving Aspect, Top-Down Design, Introduction to the idea of an algorithm, Introduction to Flowchart using Raptor tool.				
<b>Introduction to C Language</b> – Structure of a C Program, Keywords, Identifiers, Data Types (int, float, char, unsigned int) and Variable declaration, Constants, Input / Output function. Operators, Expressions, Precedence and Associativity, Expression Evaluation, Type conversions.				
<b>Exercises: Construct a flowchart and write a program to</b>				
<ul style="list-style-type: none"><li>• Develop a calculator to convert time, distance, area, volume and temperature from one unit to another.</li><li>• Calculate simple and compound interest for various parameters specified by the user</li><li>• To enter marks of five subjects and calculate total, average and percentage.</li><li>• Calculate net salary of employee given basic,da,hra,pf and lic</li><li>• retrieve remainder after division of two numbers without using mod operator</li><li>• Convert an upper-case character to a lower-case character.</li><li>• Swap two numbers</li><li>• Enter two angles of a triangle and find the third angle.</li><li>• Check Least Significant Bit (LSB) of a number</li><li>• Input any number from user and check whether nth bit of the given number is set (1) or not (0)(hint: Use bitwise operators)</li></ul>				
<b>Learning Outcomes</b>				
After completion of this unit the student will be able to				
<ul style="list-style-type: none"><li>• Develop algorithms and basic flowcharts for performing Input, Output and Computations (L3)</li><li>• Interpret the structure of C program and various key features of C (L2)</li><li>• Translate mathematical expressions to C notation using operators (L2).</li></ul>				
<b>Module II:</b>	<b>Control Structures</b>			<b>15 P</b>
<ul style="list-style-type: none"><li>• <b>Control Structures:</b> Selection Statements (making decisions) – if, if-else, nested if, else if ladder and switch statements. Repetition statements (loops)-while, for, do-while statements, Nested Loops.</li></ul>				



- Unconditional statements-break, continue, goto.
- Pointers – Pointer variable, pointer declaration, Initialization of pointer, accessing variables through pointers, pointers to pointers, pointers to void.

**Exercises: Construct a Flowchart and Write a Program to**

- Check whether the triangle is equilateral, isosceles, or scalene triangle.
- Check whether entered year is a leap year or not
- Find minimum among three numbers.
- Check whether a number is divisible by 5 and 11 or not.
- Check whether a number is positive, negative or zero using switch case.
- Design a calculator that performs arithmetic operations on two numbers using switch case
- Find Roots of a Quadratic Equation
- Find factorial of a number
- Check whether number is a palindrome or not
- Check whether number is perfect or not
- Convert a decimal number to binary number
- To find the sum of the series [  $1 - X^2/2! + X^4/4! - \dots$  ].
- Print following patterns

```
*
*
* *
* * *
* * * *
```

```
A
B B
C CC
D D D D
E E E EE
```

```
1
2 3
4 5 6
7 8 9 10
```

- Calculate the greatest common divisor of two numbers
- Generate first n numbers in the Fibonacci series
- Generate n prime numbers
- Swap two numbers using pointers.
- Performs all the five arithmetic operations using Pointers.

**Learning Outcomes:**

After completion of this unit the student will be able to

- Construct C programs using various conditional statements (L3).
- Develop C programs using loops and nested loops (L6).
- Demonstrate the usage of pointers (L3).

**Module III:**

**Functions**

15

P

Functions-Designing Structured Programs, user defined function- function definition, function prototype, function call, Types of functions. Parameter Passing by value, parameter passing by address, Recursive functions. Dynamic Memory allocation Functions, pointers to functions. Storage classes-auto, register, static, extern.

<b>Exercises: Write a program using functions to</b> <ul style="list-style-type: none"> <li>• Print even and odd numbers in a given range</li> <li>• Find power of a number</li> <li>• Return maximum of given two numbers</li> <li>• To print all strong numbers between given interval using functions.</li> <li>• Check whether a number is prime, Armstrong or perfect number using functions.</li> <li>• Demonstrate call by value and call by reference mechanisms.</li> <li>• Find power of any number using recursion.</li> <li>• Generate Fibonacci series using recursion</li> <li>• Find product of two numbers using recursion</li> <li>• Find the sum of digits of a number. Number must be passed to a function using pointers.</li> <li>• Find GCD (HCF) of two numbers using recursion.</li> <li>• Find LCM of two numbers using recursion.</li> </ul>			
<b>Learning Outcomes:</b>			
After completion of this unit the student will be able to <ul style="list-style-type: none"> <li>• understand the concept of subprograms and recursion (L2).</li> <li>• apply the in-built functions to develop custom functions for solving problems (L3).</li> <li>• make use of parameter passing mechanisms (L3).</li> <li>• infer the effect of storage classes on variables (L2).</li> </ul>			
<b>Module IV:</b>	<b>Arrays and Strings</b>	15	P
Arrays – Declaration and Definition of Array, accessing elements in array, Storing values in array, linear search, binary search, bubble sort, Two – dimensional arrays, multidimensional arrays. Arrays and Pointers, Pointer Arithmetic and arrays, array of pointers, Passing array to function. Strings – Declaration and Definition of String, String Initialization, unformatted I/O functions, arrays of strings, string manipulation functions, string and pointers.			
<b>Exercises: Write a program to</b> <ul style="list-style-type: none"> <li>• Find minimum and maximum element in an array</li> <li>• Implement linear search.</li> <li>• Sort an array in descending order.</li> <li>• Given a two-dimensional array of integers and a row index, return the largest element in that row.</li> <li>• Find transpose of a matrix.</li> <li>• Perform multiplication of two matrices</li> <li>• Count total number of vowels and consonants in a string.</li> <li>• Reverse the given string without using String handling functions.</li> <li>• Sort strings in dictionary order</li> <li>• To perform addition of two matrices.</li> <li>• Read an array of elements of size ‘n’ and find the largest and smallest number using functions</li> <li>• find total number of alphabets, digits or special character in a string using function</li> </ul>			
<b>Learning Outcomes:</b>			
After completion of this unit the student will be able to <ul style="list-style-type: none"> <li>• develop programs for storing and managing collections of items using arrays (L3).</li> <li>• make use of the in-built functions to manipulate strings (L3).</li> <li>• solve problems related to arrays and strings (L3).</li> </ul>			

<b>Module V:</b>	<b>Structures and Files</b>	15	P
<p>Structures–Declaration, initialization, accessing structures, operations on structures, structures containing arrays, structures containing pointers, nested structures, self-referential structures, arrays of structures, structures and functions, structures and pointers, unions.</p> <p>Files – Concept of a file, Opening and Closing files, file input / output functions (standard library input / output functions for text files)</p>			
<p><b>Exercises: Write a program to</b></p> <ul style="list-style-type: none"> <li>• Store information of a student using structure</li> <li>• Add two complex numbers by passing structures to a function</li> <li>• Store information of 10 students using structures</li> <li>• Store Employee information using nested structure</li> <li>• Read file contents and display on console.</li> <li>• Read numbers from a file and write even and odd numbers to separate file.</li> <li>• Count characters, words and lines in a text file.</li> </ul>			
<p><b>Learning Outcomes:</b></p> <p>After completion of this unit, the student will be able to:</p> <ul style="list-style-type: none"> <li>• develop programs using structures and unions for storing dissimilar data items (L6).</li> <li>• compare the utilization of memory by structures and unions (L5).</li> <li>• make use of files and file operations to store and retrieve data (L3).</li> </ul>			
<p><b>Text Books(s)</b></p> <ol style="list-style-type: none"> <li>1. B. A. Forouzan and R. F. Gilberg, Computer Science: A Structured Programming Approach Using C, 3/e, Cengage Learning</li> </ol>			
<p><b>Reference Book(s)</b></p> <ol style="list-style-type: none"> <li>1. Jeri R Hanly, Elliot B Koffman, Problem Solving and Program Design in C, 7/e, Pearson Education, 2012.</li> <li>2. B.W. Kernighan and Dennis M. Ritchie, The C Programming Language, 2/E, Pearson education, 2015.</li> <li>3. B. Gottfried, Programming with C, 3/e, Schaum’s outlines, McGraw Hill (India), 2017.</li> <li>4. P. Dey and M Ghosh, Programming in C, 2/e, Oxford University Press, 2011.</li> </ol>			
<p><b>Course Outcomes:</b></p> <p>After completion of this course the student will be able to</p> <ul style="list-style-type: none"> <li>• Build logic for solving a problem and translate it into a program. (L3).</li> <li>• Define variables and construct expressions using C language (L1).</li> <li>• Utilize arrays, structures and unions for storing and manipulating data (L3).</li> <li>• Develop efficient, modular programs using functions (L3).</li> <li>• Write programs to store and retrieve data using files (L3).</li> </ul>			
<p><b>Additional Exercises:</b></p> <ul style="list-style-type: none"> <li>• Given numbers x, y, and target, return whichever of x and y is closer to the target. If they have the same distance, return the smaller of the two</li> <li>• There are three friends Ram, Raheem and Robert. Ram’s age is 20, Raheem is aged three times more than his friend Ram. After 8 years, he would be two and a half times of Ram’s age. After further 8 years, how many times would he be of Rams age? Robert’s age is 25 now. Now program</li> </ul>			

your computer to determine the final ages of all the three people after 16 years and also show who is elder.

- Given an actual time and an alarm clock time, both in “military” format (such as 0730 for 7:30am), print how many more minutes before the alarm rings. But if the time is after the alarm, print "Alarm already went off".
- Let there be a scenario where you and your friend are going to a restaurant. You have lunch there every fourth day, and he has his lunch there every sixth day. How many days before you meet again for lunch at the same restaurant?
- Two friends Suresh and Ramesh have **m** red candies and **n** green candies respectively. They want to arrange the candies in such a way that each row contains equal number of candies and also each row should have only red candies or green candies. Help them to arrange the candies in such a way that there are maximum number of candies in each row.
- On a chessboard, positions are marked with a letter between a and h for the column and a number between 1 and 8 for the row. Given two position strings, return true if they have the same colour.
- Given two strings s0 and s1, return whether they are anagrams of each other.
- Write a program to encrypt and decrypt a password which is alphanumeric
- Given a string, return the string with the first and second half swapped. If the string has odd length, leave the middle character in place.
- Given an array of integers, return the second-largest element.
- Given lists of integers people, jobs, profits. Each person i in people have people[i] amount of strength, and performing job j requires jobs[j] amount of strength and nets profits[j] amount of profit. Given that each person can perform at most one job, although a job can be assigned to more than one person, return the maximum amount of profit that can be attained.
- Mr. Roxy has arranged a party at his house on the New Year’s Eve. He has invited all his friends - both men and women (men in more number). Your task is to generate the number of ways in which the invitees stand in a line so that no two women stand next to each other. Note that the number of men is more than the number of women and Roxy doesn’t invite more than 20 guests. If there are more than 20 guests or an arrangement as per the given constraints is not possible, print ‘invalid’.
- Two friends have entered their date of birth and they want to know who is elder among them. Make a structure named Date to store the elements day, month and year to store the dates.

#### **Case Study:**

- Create a structure containing book information like accession number, name of author, book title and flag to know whether book is issued or not. Create a menu in which the following functions can be done: Display book information, Add a new book, Display all the books in the library of a particular author, Display the number of books of a particular title, Display the total number of books in the library, Issue a book (If we issue a book, then its number gets decreased by 1 and if we add a book, its number gets increased by 1)
- Ranjan is maintaining a store. Whenever a customer purchases from the store, a bill is generated. Record the customer name, amount due, the amount paid, mobile number with purchased items in file. At the end of day print the total income generated by store.
- Contact Management System- Create structure to store Contact information like name,gender,mail,phone number and address. Users can add new contact and can also edit and delete existing contact. (Hint: Use Files to store data)

CSEN1021 - PROGRAMMING WITH PYTHON								
				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	
				0	0	6	3	
<b>Course Objectives:</b>								
<ul style="list-style-type: none"><li>To elucidate problem solving through python programming language</li><li>To introduce function-oriented programming paradigm through python</li><li>To train in development of solutions using modular concepts</li><li>To teach practical Python solution patterns</li></ul>								
<b>Module I:</b>		<b>Introduction to Python</b>					<b>12</b>	<b>H</b>
Python – Numbers, Strings, Variables, operators, expressions, statements, String operations, Math function calls, Input/output statements, Conditional If, while and for loops.								
<b>Exercises:</b>								
<ul style="list-style-type: none"><li>Accept input from user and store it in variable and print the value.</li><li>Use of print statements and use of (.format )for printing different data types.</li><li>Take 2 numbers as user input and add, multiply, divide, subtract, remainder and print the output (Same operations on floating point input as well)</li><li>Conversion of one unit to another (such as hours to minutes, miles to km and etc)</li><li>Usage of mathematical functions in python like math.ceil, floor, fabs, fmod, trunc, pow, sqrt etc.</li><li>Building a mathematical calculator that can perform operations according to user input. Use decision making statement.</li><li>Accepting 5 different subject marks from user and displaying the grade of the student.</li><li>Printing all even numbers, odd numbers, count of even numbers, count of odd numbers within a given range.<ul style="list-style-type: none"><li>Compute the factorial of a given number. b) Compute GCD of two given numbers. c) Generate Fibonacci series up to N numbers.</li></ul></li><li>Check whether the given input is a) palindrome b) strong c) perfect</li><li>Compute compound interest using loop for a certain principal and interest amount</li></ul>								
<b>Learning Outcomes:</b>								
After completion of this unit the student will be able to								
<ul style="list-style-type: none"><li>solve simple problems using control structures, input and output statements. (L3)</li><li>develop user defined functions (recursive and non-recursive). (L3)</li></ul>								
<b>Module II:</b>		<b>Functions</b>					<b>15</b>	<b>H</b>

User defined Functions, parameters to functions, recursive functions. Lists, Tuples, Dictionaries, Strings.

Exercises:

- Create a function which accepts two inputs from the user and compute  $nCr$
- Recursive function to compute GCD of 2 numbers
- Recursive function to find product of two numbers
- Recursive function to generate Fibonacci series
- Program to print a specified list after removing the 0th, 4th and 5th elements.  
Sample List : ['Red', 'Green', 'White', 'Black', 'Pink', 'Yellow']  
Expected Output : ['Green', 'White', 'Black']
- Program to get the difference between the two lists.
- Program to find the second smallest number and second largest number in a list.
- Given a list of numbers of list, write a Python program to create a list of tuples having first element as the number and second element as the square of the number.
- Given list of tuples, remove all the tuples with length K.  
Input : test\_list = [(4, 5), (4, ), (8, 6, 7), (1, ), (3, 4, 6, 7)], K = 2  
Output : [(4, ), (8, 6, 7), (1, ), (3, 4, 6, 7)]  
Explanation : (4, 5) of len = 2 is removed.
- Program to generate and print a dictionary that contains a number (between 1 and n) in the form (x, x\*x).  
Sample Input: (n=5) :  
Expected Output : {1: 1, 2: 4, 3: 9, 4: 16, 5: 25}
- Program to remove a key from a dictionary
- Program to get the maximum and minimum value in a dictionary.
- Program to perform operations on string using unicodes ,splitting of string,accessing elements of string using locations
- Program for Counting occurrence of a certain element in a string, getting indexes that have matching elements.For ex -.In Rabbit count how many times b has occurred .  
Example-I have to go to a doctor and get myself checked. Count the number of occurrences of 'to'.
- Program for replacing one substring by another For example - Rabbit - Replace 'bb' by 'cc'
- Program to Acronym generator for any user input (ex-input is Random memory access then output should be RMA).Example - Random number (RN)
- Python function that accepts a string and calculates the number of uppercase letters and lowercase letters.
- Program to count the number of strings where the string length is 2 or more and the first and last character are same from a given list of strings
- Sample List : ['abc', 'xyz', 'aba', '1221'] Expected Result : 2

<b>Learning Outcomes:</b>			
After completion of this unit the student will be able to			
<ul style="list-style-type: none"> <li>understand the concept of subprograms and recursion (L2).</li> <li>apply the in-built functions to develop custom functions for solving problems (L3).</li> <li>make use of parameter passing mechanisms (L3).</li> <li>develop user defined functions (recursive and non-recursive). (L3)</li> <li>summarize the features of lists, tuples, dictionaries, strings and files. (L2)</li> </ul>			
<b>Module III:</b>	<b>Files and Packages</b>	<b>15</b>	<b>H</b>
Files—Python Read Files, Python Write/create Files, Python Delete Files.			
Pandas -- Read/write from csv, excel, json files, add/ drop columns/rows, aggregations, applying functions.			
Exercises			
<ul style="list-style-type: none"> <li>read an entire text file.</li> <li>read the first n lines of a file.</li> <li>append text to a file and display the text.</li> <li>Read numbers from a file and write even and odd numbers to separate files.</li> <li>Count characters, words and lines in a text file.</li> <li>To write a list to a file.</li> <li>Given a CSV file or excel file to read it into a dataframe and display it.</li> <li>Given a dataframe, select rows based on a condition.</li> <li>Given is a dataframe showing the name, occupation, salary of people. Find the average salary per occupation.</li> <li>To convert Python objects into JSON strings. Print all the values.</li> <li>Write a Pandas program to read specific columns from a given excel file.</li> </ul>			
<b>Learning Outcomes:</b>			
After completion of this unit the student will be able to			
<ul style="list-style-type: none"> <li>read data from files of different formats and perform operations like slicing, insert, delete, update(L3).</li> <li>Ability to define and use of Packages(L2).</li> </ul>			
<b>Module IV:</b>	<b>Operations in database with suitable libraries</b>	<b>15</b>	<b>H</b>
SQLite3: CRUD operations (Create, Read, Update, and Delete) to manage data stored in a database. Matplotlib -- Visualizing data with different plots, use of subplots. User defined packages, define test cases.			
<b>Exercises</b>			
Special commands to sqlite3 (dot-commands)			
Rules for "dot-commands"			
Changing Output Formats			
Querying the database schema			
Redirecting I/O			
Writing results to a file			
Reading SQL from a file			
File I/O Functions			
The edit() SQL function			
Importing CSV files			
Export to CSV			
Export to Excel			
Reference - <a href="https://www.sqlite.org/cli.html">https://www.sqlite.org/cli.html</a>			
Matplotlib can be practiced by considering a dataset and visualizing it.			
It is left to the instructor to choose appropriate dataset.			

<b>Learning Outcomes:</b>			
After completion of this unit the student will be able to			
<ul style="list-style-type: none"> <li>• visualize the data (L4).</li> <li>• Understanding the various operations performed with SQLite3. (L2)</li> <li>• make use of SQLite3 operations to store and retrieve data (L3).</li> </ul>			
<b>Module V:</b>	Regular Expressions	<b>15</b>	<b>H</b>
Regular expression: meta character, regEx functions, special sequences, Web scrapping, Extracting data.			
<b>Exercises</b>			
Write a Python program to check that a string contains only a certain set of characters (in this case a-z, A-Z and 0-9).			
Write a Python program that matches a string that has an a followed by zero or more b's			
Write a Python program that matches a string that has an a followed by one or more b's			
Write a Python program that matches a string that has an a followed by zero or one 'b'			
Write a Python program that matches a string that has an a followed by three 'b'			
Write a Python program to find sequences of lowercase letters joined with an underscore			
Write a Python program to test if a given page is found or not on the server.			
Write a Python program to download and display the content of robot.txt for en.wikipedia.org.			
Write a Python program to get the number of datasets currently listed on data.gov			
Write a Python program to extract and display all the header tags from en.wikipedia.org/wiki/Main_Page			
.			
<b>Learning Outcomes:</b>			
After completion of this unit, the student will be able to:			
<ul style="list-style-type: none"> <li>• make use of Web scrapping operations (L3).</li> <li>• Use regular expressions to extract data from strings.(L3)</li> </ul>			
<b>Text Books(s)</b>			
1. Programming with python, T R Padmanabhan, Springer			
2. Python Programming: Using Problem Solving Approach, Reema Thareja, Oxford University Press			
<b>Reference Book(s)</b>			
1. Programming with python, T R Padmanabhan, Springer			
2. Python Programming: Using Problem Solving Approach, Reema Thareja, Oxford University Press			
3. Python for Data Analysis, Wes McKinney, O.Reeilly			
<b>Course Outcomes:</b>			
<ul style="list-style-type: none"> <li>• After completion of this course the student will be able to</li> <li>• Define variables and construct expressions (L1).</li> <li>• Utilize arrays, storing and manipulating data (L3).</li> <li>• Develop efficient, modular programs using functions (L3).</li> <li>• Write programs to store and retrieve data using files (L3).</li> </ul>			



## MECH1011: ENGINEERING VISUALIZATION AND PRODUCT REALIZATION

L	T	P	C
0	0	4	2

The course enables the students to convey the ideas and information graphically that come across in engineering. This course includes projections of lines, planes, solids sectional views, and utility of drafting and modeling packages in orthographic and isometric drawings.

### Course Objectives

- Create awareness of the engineering drawing as the language of engineers.
- Familiarize how industry communicates, practices for accuracy in presenting the technical information.
- Develop the engineering imagination essential for successful design.
- Train in 2D and 3D modeling softwares.
- Teach assembly of simple components and their animation.
- Teach basic 3D printing software for preparation of simple components

### Manual Drawing:

(8 P hours)

**Introduction to Engineering graphics:** Principles of Engineering Graphics and their significance-Conventions in drawing-lettering - BIS conventions. Dimensioning, sectioning and datum planes

### Free hand sketching

(4 P hours)

Free hand sketching of isometric & orthographic views and interpretation of drawings.

### Computer Aided Drafting

(12 P hours)

Introduction to CAD software: Basic drawing and editing commands: line, circle, rectangle, erase, view, undo, redo, snap, object editing, moving, copying, rotating, scaling, mirroring, layers, templates, polylines, trimming, extending, stretching, fillets, arrays, dimensions. Dimensioning principles and conventional representations.

### Assemble drawings

(12 P hours)

Constraints and assembly drawings. Engineering animation including motion curves, coordinating multiple moving parts under joint-constraints and the notion and impact of lighting and camera.

### 3D printing

(8 P hours)

introduction to 3D printing software. slicing, grading and rendering of simple geometries using software

### Project by group of students in the following themes

(12 P hours)

IC engine model and 3D printed mini model

Belt drive for a bike

Four-wheel drivable ATV robot

Toy making - Carrom board, chess board & pieces model toy train, avengers

Buildings, bridges dams etc.

Wind turbine model

Design of Programmable Intelligent Controllers – PIC

Design of Printed Circuit Boards

Arduino Board Design and 3D Printing of Enclosures for Arduino Boards

Design of Radar and 3D Printing of Radar Models

Design of Mini Motherboards

**Course Outcomes**

After completing the course, the student will be able to

- utilize Engineering visualization as Language of Engineers. (L3)
- prepare drawings as per international standards. (L3)
- create 2D and 3D models using CAD packages. (L3)
- use 3D printing software and create model for printing of simple objects

## MECH1021: WORKSHOP

L	T	P	C
0	0	4	2

This course enables the students to familiarize with the basic fabrication practices and to explore the various devices, tools and equipment used. Hands-on exercise is provided in various trade sections. Essentially student should understand the labor involved, machinery or equipment necessary, time required to fabricate and should be able to estimate the cost of the product or job work which are fundamental tasks for engineering plans.

### Course Objectives

- Explain tools used in carpentry, fitting and sheet metal and practice procedure of doing experiments.
- Make the students to learn types of basic electric circuit connections and PCBs.
- Provide training to prepare FRP composites.
- Train the students on preparing 3D plastics using injection molding.
- Demonstrate on utilizing 3D printer for printing 3D objects

### List of Jobs

1. Wood Working - Cross halving Joint/Dove Tail Joint/End Bridle Joint (Any two)
2. Sheet Metal working - Taper tray/conical funnel/Elbow pipe (Any Two) (including soldering).
3. Fitting- V fit/Dove Tail fit/ Semicircular fit (Any Two)
4. Electrical Wiring -Parallel and series connection
5. Electrical Wiring -Two-way switch connection
6. Electrical Wiring- Wiring of lighting systems
7. Injection molding-Make any two plastic components using injection molding machine.
8. 3D printing Demonstartion

### Text Books

1. P. Kannaiah, K. L. Narayana, 'Workshop Manual', 2/e, Scitech Publications, India, 2007.
2. B. L Juneja , 'Workshop Practice ', 1/e, Cengage Learning ,Delhi, 2015

### Additional Reading

1. K Mallick, 'Fiber-Reinforced Composites: Materials, Manufacturing, and Design', 3/e, CBC Press, New York, 2007.

### Course Outcomes:

After completion of this lab the student will be able to

- Summarize application of different power tools (L1)
- Develop different parts with metal sheet/wood working/fits in real time applications. (L3)
- Demonstrate electrical circuits in various applications. (L2)
- Prepare models using injection molding m/c . (L3)
- Familiarize with 3D printer operations (L1)

## CHEM1001: CHEMISTRY

L	T	P	C
3	0	2	4

This course enables the students to gain knowledge on various aspects of Water and its treatment, electrochemical energy systems, Construction of batteries, renewable energy sources, Semiconductors, Steel, Cement and Polymers, Corrosion and its control, nano-materials, Analytical instruments and applications. The knowledge gained in this course can be applied to the latest developments in technology.

### Course objectives

- To impart knowledge on various aspects of water and its treatment.
- To study about electrochemical energy systems, renewable energy sources, solar cells and their applications.
- To gain knowledge on materials such as steel, cement and polymers
- To create awareness on corrosion and its control.
- To introduce different types of nano-materials.
- To expose the students to latest instrumental techniques such as scanning electronic microscope (SEM) & transmission electron microscope (TEM).

### Unit-1: Water and its treatment

9L

Water and its treatment: Introduction – hardness of water – Causes of hardness - Types of hardness: temporary and permanent – expression and units of hardness. Estimation of hardness of water by complexometric method. Potable water and its specifications. Steps involved in treatment of water – Disinfection of water by chlorination and ozonization- industrial water treatment- Boiler feed water and its treatment -internal conditioning– Calgon and Phosphate conditioning. External treatment of water – Ion exchange process. Desalination of water – Reverse osmosis.

#### Learning outcomes:

After the completion of the Unit I, the student will be able to

- list the differences between temporary and permanent hardness of water. (L-1)
- explain the principles of reverse osmosis. (L-2)
- compare the quality of drinking water with BIS and WHO standards. (L-2)
- illustrate problems associated with hard water. (L-2)
- demonstrate the Industrial water treatment processes. (L-2)

### Unit-2: Electrochemical Energy Systems

9L

**Battery Technology:** Basic concepts, battery characteristics, classification of batteries, Important applications of batteries, Classical batteries-dry/Leclanche cell, Modern batteries-zinc air, Lead-acid storage battery, lithium cells- Lithium ion cell, Li MnO<sub>2</sub> cell. Fuel cells- Introduction - classification of fuel cells – hydrogen and oxygen fuel cell, propane and oxygen fuel cell- Merits of fuel cell. **Renewable energy sources – Types of renewable energy sources. Semiconductors:** Definition, types of semiconductors: doping- n type and p – type semiconductors and applications.- **Solar cells:** Introduction, harnessing solar energy, Photovoltaic cell, solar water heaters.

#### Learning outcomes:

After the completion of the Unit II, the student will be able to

- define electrode potential. (L-1)
- explain Nernst's equation. (L-2)
- illustrate difference between primary and secondary cells. (L-2)
- summarize the applications of solar energy. (L-2)
- construct different cells. (L-3)

### **Unit-3: Engineering materials and Polymer Chemistry**

**8L**

**Steel** – Types of Steel, chemical composition – applications of alloy steels

**Cement:** Portland cement, constituents, Manufacture of Portland Cement, chemistry of setting and hardening of cement (hydration, hydrolysis, equations).

**Polymer Chemistry:** Concept of polymerization – Types of Polymerization, Chain growth polymerization – mechanisms of free radical and cationic polymerizations, Thermoplastic resins and Thermosetting resins: examples- Polyethylene, Styrene, Nylon 6,6 and Bakelite. and applications, Conducting polymers:– Examples – and applications.

#### **Learning outcomes:**

After the completion of the Unit IV, the student will be able to

- classify the types of steel. (L-2)
- illustrate the chemical reactions involved in the manufacturing of cement. (L-2)
- identify preparation and properties of polymers. (L-3)
- distinguish between thermoplastic and thermo setting resins. (L-4)

### **Unit-4: Corrosion and its control**

**8L**

Corrosion and Its Prevention: Electrochemical theory of corrosion, Corrosion due to dissimilar metal cells (galvanic cells), Corrosion due to differential aeration cells, Uniform corrosion, pitting corrosion and stress corrosion cracking, Effect of pH, temperature and dissolved oxygen on corrosion rate. Corrosion prevention and control by cathodic protection- protective coatings- paints.

#### **Learning outcomes:**

After the completion of the Unit III, the student will be able to

- explain theories of corrosion. (L-2)
- classify different corrosion methods. (L-2)
- summarize the various factors affecting corrosion. (L-2)
- identify different organic coatings. (L-3)
- apply the principles of corrosion control. (L-3)

### **Unit-5: Nanomaterials and Analytical Instrumental Techniques**

**8L**

**Nanomaterials:** Introduction to nanomaterial: nanoparticles, nanocluster, carbon nanotube (CNT) and nanowires. Chemical synthesis of nanomaterials: sol-gel method. Characterization: Principle and applications of scanning electron microscope (SEM) and transmission electron microscope (TEM)

#### **Analytical Instrumental Techniques**

Review of electromagnetic spectrum, Quantization of energy. Absorption of radiation: Beer-Lambert's law. Principle and applications of pH metry, potentiometry, conductometry, IR and UV-spectroscopy with examples.

#### **Learning outcomes:**

After the completion of the Unit V, the student will be able to

- classify nanomaterials. (L-2)
- explain the synthesis and characterization methods of nano materials. (L-2)
- describe the principles of different analytical techniques. (L-3)
- compare the principles of SEM and TEM. (L-4)

### **Course outcomes**

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

- list the important purification methods of water. (L-1)
- illustrate the principles and applications of batteries, solar energy. (L-2)
- explain the importance of materials such as steel, cement and polymers
- identify different protective coatings. (L-3)
- analyze the importance of nano materials and the principles of SEM and TEM. (L-4)

### **Text Books:**

1. P.C. Jain and M. Jain, Engineering Chemistry, 15/e, Dhanapat Rai & Sons, Delhi (2014).
2. B.K. Sharma, Engineering Chemistry, Krishna Prakashan, Meerut.
3. O G Palanna, Engineering Chemistry, Tata McGraw Hill Education Private Limited, (2009).

### **Reference Books:**

1. Sashi chawla, A Textbook of Engineering Chemistry, Dhanapath Rai and sons, (2003)
2. B.S Murthy and P. Shankar, A Text Book of NanoScience and NanoTechnology, University Press (2013).
3. S.S. Dara, A Textbook of Engineering Chemistry, S.Chand & Co, (2010)
4. N.Krishna Murthy and Anuradha, A text book of Engineering Chemistry, Murthy Publications (2014).
5. K. Sesha Maheshwaramma and Mridula Chugh, Engineering Chemistry, Pearson India Edn services, (2016).

## **CHEMISTRY LABORATORY**

The course enables the students to gain knowledge on various, instrumental methods of analysis, measurements of physical parameters, volumetric analysis, preparation of polymers, analysis of water, and chromatographic separation techniques.

### **Course objectives**

- To familiarize the students with the basic concepts of Chemistry lab.
- To train the students on how to handle the instruments.
- To demonstrate the digital and instrumental methods of analysis.
- To expose the students in practical aspects of the theoretical concepts.

### **List of experiments**

1. Determination of Mohr's salt by potentiometric method
2. Determination of strength of an acid by pH metric method
3. Determination of conductance by conductometric method
4. Determination of viscosity of a liquid
5. Determination of surface tension of a liquid
6. Determination of sulphuric acid in lead-acid storage cell
7. Determination of chromium (VI) in potassium dichromate
8. Determination of copper in a copper ore
9. Determination of Zinc by EDTA method.
10. Estimation of active chlorine content in Bleaching powder
11. Preparation of Phenol-Formaldehyde resin
12. Preparation of Urea-Formaldehyde resin
13. Thin layer chromatography
14. Preparation of TiO<sub>2</sub>/ZnO nano particles
15. SEM analysis of nano materials

**Course Outcomes:**

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

- explain the functioning of the instruments such as pH, Conductometric and Potentiometric methods. (L-2)
- identify different ores (Cr & Cu) and their usage in different fields (industry, software devices, electronic goods). (L-3)
- experiment with the physical parameter of organic compounds. (L-3)
- compare the viscosities of oils. (L-4)
- list the preparation of polymers and nano materials. (L-4)

**Text Books**

1. Mendham J, Denney RC, Barnes JD, Thomas M and Sivasankar B Vogel's Quantitative Chemical Analysis 6/e, Pearson publishers (2000).
2. N.K Bhasin and Sudha Rani Laboratory Manual on Engineering Chemistry 3/e, Dhanpat Rai Publishing Company (2007).

## EECE1001: BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

L	T	P	C
2	1	2	4

This course introduces the fundamental principles and building blocks of electrical and electronics engineering. The first three units cover the electric circuit laws, theorems, and principles of electrical machines. The last two units cover semiconductor devices and their applications.

### Course Objectives:

- To impart the analysis and design aspects of DC networks in electrical and electronic circuits
- To explain the basic concepts of AC networks used in electrical and electronic circuits.
- To demonstrate the importance and operating principles of electrical machines (transformers, motors and generators)
- To impart the knowledge about the characteristics, working principles and applications of semiconductor diodes, Metal Oxide Semiconductor Field Effect Transistors (MOSFETs).
- To expose basic concepts and applications of Operational Amplifier and configurations.

### Unit I:

7L

DC Circuits: Basic circuit elements and sources, Ohms law, Kirchhoff's laws, series and parallel connection of circuit elements, Node voltage analysis, Mesh current analysis, Superposition, Thevenin's and maximum power transfer theorem.

#### Learning Outcomes

After completion of this unit the student will be able to

- state Ohms law and Kirchhoff's Laws (L1).
- calculate equivalent resistance of series and parallel connections in a circuit (L1).
- able to calculate voltage and current using voltage and current division methods (L2).
- determine the current, voltage and power in the given electrical circuit (L4).
- apply various theorems to analyze an electric circuit (L3).

### Unit II:

8L

AC Circuits: Alternating voltages and currents, AC values, single phase RL, RC, RLC series circuits, power in AC circuits, Power Factor, three phase systems-Star and Delta Connection-Three phase power measurement.

#### Learning Outcomes:

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

- describe AC voltages and currents (L1).
- analyze Series RL, RC and RLC circuits (L4).
- Learn calculations of power factor and power measurement (L2)
- Understand star and delta connections in three phase systems (L3).

### Unit III:

9L

Electrical Machines: Construction, working principle and application of DC machines, Transformers, single phase and three phase Induction motors, special machines-Stepper motor, Servo motor and BLDC motor.

#### Learning Outcomes:

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

- Understand working principle of dc machines (L1).
- demonstrate principle operation of transformer (L3).
- discuss about open and short- circuit tests of transformer (L2).



- explain the working principle of three phase induction motor (L5).
- gain knowledge on applications as special machines, stepper motor (L1).
- Identify and choose servo motor and BLDC motor applications (L2).

#### **Unit IV:**

**8L**

Semiconductor Devices: p-n Junction diode - Basic operating principle, current-voltage characteristics, rectifier circuits (half-wave, full-wave, rectifier with filter capacitor), Zener diode as Voltage Regulator; Metal oxide semiconductor field effect transistor (MOSFET): Operation of NMOS and PMOS FETs, MOSFET as an amplifier and switch.

#### **Learning Outcomes:**

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

- describe the device structure and physical operation of a diode (L1).
- discuss V-I characteristics of diodes (L2).
- explain the use of diode as switch and in electronic circuits (L2).
- describe the construction and operation of n-channel and p-channel MOSFETs (L1).
- explain the use of MOSFET as an amplifier and bidirectional switch(L2).

#### **Unit V:**

**8L**

Operational Amplifiers: The Ideal Op-amp, The Inverting Configuration, The closed loop gain, Effect of Finite open-loop gain, The Noninverting Configuration, The closed loop gain, Characteristics of Non-Inverting Configuration, Difference amplifiers, A Single Op-amp difference amplifier. Adders, subtractors, integrators, differentiators, filter circuits using Opamps,

#### **Learning Outcomes:**

After completion of this unit the student will be able to

- list the characteristics of an ideal Op Amp (L1).
- design the Inverting and Noninverting configurations of Op-Amp(L2).
- construct a single Op-amp difference amplifier (L3).
- List several applications of opamps

### **Basic Electrical and Electronics Engineering Laboratory**

#### **List of Experiments:**

1. Verification of Kirchhoff's Laws.
2. Verification of DC Superposition Theorem.
3. Verification of Thevenin's Theorem.
4. Verification of Maximum power transfer Theorem.
5. Load test on DC generator.
6. Load test on single phase transformer.
7. Measurement of voltage, current and power factor of single phase RL, RC series circuits.
8. Measurement of voltage, current and power factor of single phase RLC series circuit.
9. Measurement of power in a three phase circuit.
10. Current Voltage Characteristics of a p-n Junction Diode/LED.
11. Diode Rectifier Circuits.
12. Voltage Regulation with Zener Diodes.
13. Design of a MOSTFET amplifier and MOSFET inverter/NOR gate
14. Inverting and Non-inverting Amplifier Design with Op-amps.
15. Simulation experiments using PSPICE
  - (a) Diode and Transistor Circuit Analysis.
  - (b) MOSFET Amplifier design.
  - (c) Inverting and Noninverting Amplifier Design with Op-amps.

**Text Book(s):**

1. D. P. Kothari, I. J. Nagrath, Basic Electrical and Electronics Engineering, 1/e, McGraw Hill Education (India) Private Limited, 2017.
2. B. L. Theraja, Fundamentals of Electrical Engineering and Electronics, 1/e, S. Chand Publishing, New Delhi, 2006.
3. Adel S. Sedra and Kenneth C. Smith, Microelectronic Circuits 6/e, Oxford University Press, 2014.

**References:**

1. S.K. Bhattacharya, Basic Electrical and Electronics Engineering, Pearson Education, 2011.
2. Dharma Raj Cheruku, B T Krishna, Electronic Devices and Circuits, 2/e, Pearson Education, 2008.
3. R. K. Rajput, Basic Electrical and Electronics Engineering, University Science Press, New Delhi, 2012.

**Course Outcomes:**

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

- predict and analyze the behavior of an electrical circuit (L3).
- analyze the performance quantities such as losses, efficiency and identify applications of DC machines (L4).
- explain the use of transformers in transmission and distribution of electric power and other applications (L2).
- demonstrate the operation and applications of various electronic devices (L2).
- construct Inverting and Noninverting configurations of Op-amp (L3).

## **CSEN1001: IT PRODUCTIVITY TOOLS**

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

### **List of Experiments**

1. Create a typical document consisting of text, tables, pictures, multiple columns, with different page orientations.
2. Create a technical paper / technical report consisting of table of contents, table of figures, table of tables, bibliography, index, etc.
3. Compose and send customized mail / e-mail using mail-merge.
4. Create / modify a power point presentation with text, multimedia using templates with animation.
5. Create spreadsheet with basic calculations with relative reference, absolute reference and mixed reference methods.
6. Simple report preparation using filtering tool / advanced filtering commands / pivot tables in spreadsheet application.
7. Analyse the results of a examination studentwise, teacherwise, coursewise, institute-wise.
8. Collecting and consolidating data using collaborative tools like google docs, sheets, forms.
9. Create charts / pictures using online tools like: [www.draw.io](http://www.draw.io) or smartdraw
10. Create a website of his interest.

### **Text Books:**

1. Katherin Murray, 'Microsoft Office 365 Connect and collaborate virtually anywhere, anytime', Microsoft Press, ISBN: 978-0-7356-5694-9
2. EXCEL 2021 The Comprehensive Beginners to Advanced Users Guide to Master Microsoft Excel 2021. Learn the Essential Functions, New Features, Formulas, Tips and Tricks, and Many More
3. <https://drawio-app.com/tutorials/video-tutorials/>
4. Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics Fourth Edition ISBN-13: 978-1449319274

### **References/Online Resources**

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

**Course Outcomes**

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

This course is designed with fundamentals of electromagnetism and properties of materials for advanced courses in their respective engineering branches. It introduces electromagnetic theory with relevant mathematical tools, optical fibres and their propagation characteristics, properties of dielectric and magnetic materials. It also introduces principles of semiconductors and some widely used semiconductor devices for various applications.

**Course Objectives**

- To introduce mathematical principles to estimate forces, fields and waves.
- To familiarize students with electromagnetics in modern communication systems.
- To impart knowledge concerning the electrical behaviour of dielectric materials.
- To demonstrate the properties of magnets.
- To introduce semiconductor physics and devices.

**UNIT I: Basics of Electromagnetics****9 L**

Electrostatic field: Coulomb's law and Gauss' law, derivation of Coulombs law from Gauss' law, applications of Gauss' law (line charge, thin sheet of charge and solid charged sphere), Gauss' law of electrostatics in dielectric medium, divergence and curl of electric fields, electric potential, relation between potential and force, Poisson's and Laplace equations.

Magnetostatic field: Biot–Savarts' law, divergence and curl of magnetic fields, Faraday's and Ampere's laws in integral and differential form, displacement current, continuity equation, Maxwell's equations.

**Learning Outcomes:**

- apply Coulomb's and Gauss' laws to electric field configurations from charge distributions (L3)
- apply the Biot-Savarts' law to derive magnetostatic field distributions (L3)
- use vector calculus to describe electromagnetic phenomena(L2)
- relate the law of conservation of charge to continuity equation(L3)
- illustrate the Maxwell's equations, Maxwell's displacement current and correction of Ampere's law(L2)

Pedagogy tools: Blended learning, Case let, video lectures, self-reading

**UNIT II: Fiber Optics****7 L**

Introduction, advantages of optical fibers, principle and structure, acceptance angle, numerical aperture, modes of propagation, classification of fibers, fiber optic communication, importance of V-number, fiber optic sensors (Temperature, displacement and force), applications.

**Learning Outcomes:**

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

- apply the principle of propagation of light in optical fibers(L3)
- explain the working and classification of optical fibers(L2)
- analyse propagation of light through optical fibers based on the concept of modes (L4)
- summarize applications of optical fibers in medical, communication and other fields(L2)

Pedagogy tools: Blended learning, Case let, video lectures, self-reading

**UNIT III: Dielectric, Magnetic and superconducting Materials****10 L**

Dielectric materials: Introduction, electric polarization, dielectric polarizability, susceptibility and dielectric constant, types of polarizations (qualitative treatment only). Magnetic materials: Introduction, magnetic dipole moment, magnetization, magnetic susceptibility and permeability, origin of permanent magnetic moment, classification of magnetic materials, Weiss theory of ferromagnetism (qualitative), domain theory, hysteresis, soft and hard magnetic materials. Superconductivity: definition –Meissner effect –type I & II superconductors –BCS theory (qualitative) –high temperature superconductors –Josephson effects applications.

**Learning Outcomes:**

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

- explain the concept of dielectric constant and polarization in dielectric materials (L2)
- interpret dielectric loss, Lorentz field and Claussius-Mosotti relation (L2)
- classify the magnetic materials(L2)
- explain the phenomenon of hysteresis for a ferromagnetic material and summarize the properties of hard and soft magnetic materials (L2)
- understand the concept of superconductivity (L2)

Pedagogy tools: Blended learning, Case let, video lectures, self-reading

**UNIT IV: Semiconductor Physics****8 L**

Introduction, origin of energy band, intrinsic and extrinsic semiconductors, mechanism of conduction in intrinsic semiconductors, generation and recombination, carrier concentration in intrinsic semiconductors, variation of intrinsic carrier concentration with temperature, n-type and p-type semiconductors, carrier concentration in n-type and p-type semiconductors, Drift and diffusion currents in semiconductors.

**Learning Outcomes:**

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

- outline the properties of semiconductors(L2)
- interpret expressions for carrier concentration in intrinsic and extrinsic semiconductors(L2)
- assess the variation of carrier concentration in semiconductors with temperature (L5)

Pedagogy tools: Blended learning, Case let, video lectures, self-reading

**UNIT V: Semiconductor Devices****8 L**

Zener Diode, Tunnel diode, Hall effect and its applications, magnetoresistance, p-n junction layer formation and V-I characteristics, direct and indirect band gap semiconductors, construction and working of photodiode, LED, solar cell.

**Learning Outcomes:**

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

- explain the drift and diffusion currents and formation of junction layer (L2)
- state Einstein's relations(L1)
- explain Hall effect and its applications(L3)
- illustrateandinterprettheV-Icharacteristicsofap-njunctiondiode(L2)
- describe applications of p-n junction diodes in photodiodes, LEDs and solar cells (L3).

Pedagogy tools: Blended learning, Case let, video lectures, self-reading

**Text Book(s)**

1. David J.Griffiths, “Introduction to Electrodynamics”, 4/e, Pearson Education, 2014.
2. Charles Kittel, “Introduction to Solid State Physics”, Wiley Publications, 2011.
3. M. N. Avadhanulu, P.G. Kshirsagar, “A Text book of Engineering Physics”, 11/e, S. Chand Publications, 2019.

#### **Reference book(s)**

1. Principles of Physics, 10ed, ISV, Jearl Walker, David Halliday, Robert Resnick, Wiley India.
2. Gerd Keiser, “Optical Fiber Communications”, 4/e, Tata Mc Graw Hill, 2008.
3. S.O.Pillai, “Solid StatePhysics”, 8/e, New Age International, 2018.
4. S.M. Sze, “Semiconductor Devices-Physics and Technology” , Wiley, 2008.

#### **Journal(s):**

1. <https://aapt.scitation.org/doi/abs/10.1119/1.3317450>
2. <https://aapt.scitation.org/doi/full/10.1119/1.5144798>
3. <https://aapt.scitation.org/doi/abs/10.1119/1.1511591>

### **PHYSICS LABORATORY**

#### **List of Experiments**

1. To determine the magnetic field along the axis of a circular coil carrying current.
2. To determine the numerical aperture of a given optical fiber and hence to find its acceptance angle
3. To determine magnetic susceptibility by Quincke’s tube method
4. To determine the Hall coefficient using Hall effect experiment
5. To determine the resistivity of semiconductor by Four probe method
6. To determine the energy gap of a semiconductor.
7. To study the characteristics of PN Junction diode.
8. To study magnetic hysteresis loop (B-H curve).
9. To determine the dielectric constant of a substance by resonance method.
10. To determine hysteresis loss by CRO.
11. To study the characteristics of Photodiode
12. To study the characteristics of Solar Cell
13. To study the characteristics of Zener diode
14. To study the resonance of LCR circuit

#### **Text Book:**

1. S. Balasubramanian, M.N. Srinivasan “A Text book of Practical Physics”- S Chand Publishers,2017

## PHYS1011: PRINCIPLES OF QUANTUM MECHANICS

L	T	P	C
3	1	0	4

This course is designed with principles of Quantum mechanics for advanced courses in their respective engineering branches. It introduces Quantum mechanics with relevant mathematical tools and provides a basis for further study of quantum mechanics. It also introduces basics of Qubits for Quantum computing applications.

### Course Objectives

- To introduce the basic principles of quantum mechanics.
- To introduce wave equation and significance of wave function.
- To teach solving the Schrödinger's equation for spinless particles moving in one-dimensional potential.
- To develop an understanding of concepts of angular momentum.
- To introduce Dirac bra-ket formalism and the concept of QUBITS.

### UNIT – I: Introduction to Quantum Physics

(10 Hours)

Introduction, Classical Mechanics vs Quantum Mechanics, Planck's quantum theory (qualitative), Photo-electric effect. De Broglie wavelength and matter waves; Davisson-Germer experiment. Wave description of particles by wave packets. Group and Phase velocities and relation between them, Wave-particle duality, Heisenberg uncertainty principle: ground state energy of hydrogen atom.

#### Learning Outcomes:

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

- Get a grasp on the elementary aspects of energy and momentum of a photon and de Broglie wavelength of a particle.
- Know about the uncertainty principle for position and momentum and for energy and time.
- To study the basic principles of quantum mechanics

Pedagogy tools: Blended learning, Case let, video lectures, self-reading

### UNIT – II: Properties of Matter Waves

(8 Hours)

Matter waves and wave amplitude; Schrodinger equation for non-relativistic particles; Momentum and Energy operators; stationary states; physical interpretation of a wave function, probabilities and normalization.

#### Learning Outcomes:

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

- understand the significance of Schrodinger's time independent wave equation.
- explain the operator formulation of quantum mechanics.
- learn the concept of wave function

Pedagogy tools: Blended learning, Case let, video lectures, self-reading

### UNIT – III: Quantum Tunneling

(8 Hours)

One dimensional infinitely rigid box-energy eigenvalues and eigenfunctions, normalization; Quantum dot as example; Quantum mechanical tunnelling in one dimensional rectangular potential barrier, 1D linear harmonic oscillator (no derivation required, only eigen function, eigen values and zero-point energy).



**Learning Outcomes:**

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

- Derive wave functions with reflection and transmission coefficients
- The concept of quantum mechanical tunneling
- solve time-independent Schrödinger equation for simple potentials

Pedagogy tools: Blended learning, Case let, video lectures, self-reading

**UNIT - IV                      Quantum Properties of Electrons                      (9 Hours)**

Electron angular momentum, angular momentum operator, Space quantization. Electron Spin and Spin Angular Momentum. Larmor's Theorem. Spin Magnetic Moment. Stern-Gerlach Experiment. Zeeman Effect, Stark Effect, Gyromagnetic Ratio and Bohr Magneton (qualitative)

**Learning Outcomes:**

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

- understand spin magnetic moment and total angular momentum
- relate the eigenvalue problems for energy, momentum and angular momentum explain the idea of spin
- explain the interaction between spin of electron and magnetic field
- understand the interaction between electron and electric field

Pedagogy tools: Blended learning, Case let, video lectures, self-reading

**UNIT – V: Qubits for Quantum Computing                      (10 Hours)**

Introduction to Dirac Bra-Ket notation, Introduction to Pauli spin matrices, Quantum Superposition, Interference, Quantum Measurement, Decoherence, Entanglement, Bloch sphere, Qubits, and multiple qubits, Qubits Vs classical bits, representation of a qubit probability.

**Learning Outcomes:**

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

- apply Bra-Ket notation in obtaining eigen values
- understand quantum entanglement
- describe the fundamentals of the quantum computing

Pedagogy tools: Blended learning, Case let, video lectures, self-reading

**Textbook(s):**

1. Quantum Mechanics, G. Aruldas, 2ndEdn. 2002, PHI Learning of India.
2. Quantum Mechanics, Satya Prakash, 2016, Pragati Prakashan.
3. Quantum Computing for Everyone, Chris Bernhardt, 2019, The MIT Press,

**Reference Book(s):**

1. Introduction to Quantum Mechanics, D.J. Griffith, 2ndEd. 2005, Pearson Education.
2. Quantum Computing: An Applied Approach, Jack D. Hidary, 2019,

**Springer Journal(s):**

1. <https://aapt.scitation.org/doi/full/10.1119/1.4897588>
2. <https://aapt.scitation.org/doi/full/10.1119/1.3639154>

**Websites:**

1. <https://www.intechopen.com/online-first/73811>
2. <https://www.quantum-inspire.com/kbase/what-is-a-qubit/>

## PHYS1021: PHYSICS OF SEMICONDUCTING DEVICES

L	T	P	C
3	1	0	4

This course is designed with fundamentals of electromagnetism and properties of materials for advanced courses in their respective engineering branches. It introduces electromagnetic theory with relevant mathematical tools, optical fibers and their propagation characteristics, properties of dielectric and magnetic materials. It also introduces principles of semiconductors and some widely used semiconductor devices for various applications.

### Course Objectives

- To introduce nature light and its properties.
- To familiarize students with different semiconductors and its energy band gaps.
- To introduce semiconductor physics and devices.
- To impart knowledge about the semiconducting optical devices.
- To demonstrate the properties of different semiconducting optical devices.

### UNIT I Elements of light

(8 hours)

Nature of light, Light sources, Black body, Colour temperature, Units of light, Radio metric and photometric units, Light propagation in media and waveguides, Electro-optic effects. Overview of luminescence: Photoluminescence, Cathodoluminescence, Electroluminescence, Injection-luminescence.

#### Learning Outcomes:

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

- Understanding the dual nature of light L2
- Understanding different law for energy spectrum emitted by black body. L3
- To explain the concepts of electro-optics effects L1
- To summarize the overview of different luminescence L2

### UNIT II: Semiconductor Materials

(10 hours)

Free electron theory of metals, Density of states in 1D, 2D, and 3D, Bloch's theorem for particles in a periodic potential, Energy band diagrams, Kronig-Penny model (to introduce origin of band gap), Energy bands in solids, E-k diagram, Direct and indirect bandgaps, Types of electronic materials: metals, semiconductors, and insulators, Occupation probability, Fermi level, Effective mass.

#### Learning Outcomes:

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

- Outline the properties of semiconductors L2
- Know the bands structure of metals and semiconductors L3
- Understand the electronic structure of interfaces between different types of materials L2
- To determine the different band gaps of direct and indirect band gap materials L5
- To explain the occupation probability and Fermi level variation in different electronic materials L1

**UNIT III: Light-semiconductor interaction****(10 hours)**

Optical transitions in bulk semiconductors: absorption, spontaneous emission, and stimulated emission; Einstein coefficients, Population inversion, application in semiconductor Lasers; Transition rates (Fermi's golden rule), Optical loss and gain; Photovoltaic effect.

**Learning Outcomes:**

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

- To summarize the optical transition in bulk semiconductors L2
- To explain the concepts of absorption, spontaneous emission and stimulated emission L1
- To outline the population inversion in semiconductor lasers L2
- To evaluate the transition rates and optical loss and gain in materials L5

**UNIT IV: Solar cells and Photovoltaic devices:****(9 hours)**

Charge carrier generation and recombination, p-n junction model and depletion capacitance, Current voltage characteristics in dark and Light, Device Physics of Solar Cells, Principle of solar energy conversion, Conversion efficiency, Type of solar cells in use: Dye Sensitized Solar Cells, Thin film solar cells.

**Learning Outcomes:**

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

- Outline the properties of semiconductors L2
- Know about the interaction of light with materials and its optical properties L3
- Illustrate and interpret the voltage and current characteristics of p-n junction diodes model L1
- Explain the conduction mechanism in semiconducting and optical devices. L5
- To describe the applications of p-n junction diodes in types of solar cells L3

**UNIT V: Semiconductor devices****(8 hours)**

Radiative recombination devices: Light-emitting diodes (LED), Organic Light Emitting Diodes (OLED) and its types, Photoelectric devices: Photodiodes. Photoconducting devices: Photodetectors and photoconductors, Photoresistors, Photo transistors, Stimulated emission devices: Injection laser diodes, Quantum cascade lasers.

**Learning Outcomes:**

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

- describe applications of light emitting diodes and its radiative recombination process L2
- explain the concepts of photoconductive devices and its applications in different devices L3
- to define the concepts of Photodetectors and photoconductors, Photoresistors, Photo transistors, L1
- to access the variation of stimulated emission in injection and quantum lasers L5

**Text Books:**

1. Schubert, E., Light-Emitting Diodes, 2/e, Cambridge: Cambridge University Press, 2006.
2. Physics of Solar Cells: From Basic Principles to Advanced Concepts, 3rd Edition Peter Würfel, Uli Würfel (2016) Wiley.
3. Solid State Physics, Neil W. Ashcroft, N. David Mermin (2003) Cengage Learning India

**Reference Books:**

1. Quantum Cascade Lasers by Vasilios N. Stavrou:  
<https://www.intechopen.com/books/5389>.
2. Optoelectronic materials and device concepts; Manijeh Razeghi, SPIE, 1991

3. Introduction to Organic Electronic and Optoelectronic Materials and Devices; Sun and Dalton, CRC Press, 2008.
4. Semiconductor Physics and Devices, 3ed, An Indian Adaptation, S. M. Sze, M. K. Lee, Wiley India.
5. Semiconductor optoelectronics; Jasprit Singh, McGraw-Hill, 1995.

### **Course Outcomes**

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

- Outline the properties of semiconductors L2
- explain the occupation probability and Fermi level variation in different electronic materials L1
- Know about the interaction of light with materials and its optical properties L3
- Explain the conduction mechanism in semiconducting and optical devices. L5

## PHYS1031: MECHANICS AND PROPERTIES OF MATTER

L	T	P	C
3	1	0	4

This course is designed for students of Aerospace, Civil and Mechanical Engineering. It introduces fundamentals of elasticity and thermal properties – the essentials for understanding the behaviour of materials. Mechanics of solids is taught to acquaint them with the behaviour of rigid objects. An introduction to sensors will be useful for all the branches as an application of modern technology.

### Course Objectives

- To acquaint the basic concepts of sound waves and principles in acoustic design.
- To introduce the concepts of elasticity, strain hardening and failure in materials and impart the relation between stress and strain.
- To impart the phenomenon of heat transfer so as to understand a wide variety of practical engineering problems.
- To demonstrate the use of Newton's laws of motion for understanding the mechanics of a particle.
- To explain the working principle and construction of different types of sensors.

### UNIT-I Mechanics:

**10 Hours**

Basic laws of vectors and scalars; Rotational frames; Conservative and non-conservative forces;  $F = - \text{grad } V$ ; Central forces; Elliptical, parabolic and hyperbolic orbits; Noninertial frames of reference; Centripetal acceleration; Harmonic oscillator; Damped harmonic motion; Forced oscillations and resonance. Degrees of freedom.

#### Learning Outcomes:

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

- Explain forces and moments in mechanical systems using scalar and vector techniques L2
- interpret the equation of motion of a rigid rotating body (torque on a rigid body) L3
- apply the Newton's second law for inertial and non inertial frame of reference L3
- summarize harmonic motion in undamped, damped and forced oscillations L2

Pedagogy tools: Blended learning, Case let, video lectures, self-reading

### UNIT-II Elasticity

**8 Hours**

Concepts of elasticity and plasticity, stress and strain, Hooke's law, different moduli of elasticity, Poisson's ratio, strain energy, stress-strain diagram, elastic behavior of a material, factors affecting elasticity, relation between different moduli of elasticity, determination of elastic moduli.

#### Learning Outcomes:

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

- explain the basic concepts of elasticity, plasticity, strain hardening and failure in materials L2
- determine graphically a material's mechanical properties in terms of its one dimensional stress-strain curve L2
- derive the generalized Hooke's law by recognizing the basic stress-strain response of isotropic materials L3
- Define several elastic constants and determine the relationship between them L1
- evaluate strain energy under different loadings L3

Pedagogy tools: Blended learning, Case let, video lectures, self-reading

### **UNIT - III Thermal Properties**

**10 Hours**

Transfer of heat energy; Thermal expansion of solids and liquids; Expansion joints -bimetallic strips; Thermal conduction, convection and radiation and their fundamental laws; Heat conduction in solids; Thermal conductivity - Forbes's and Lee's disc method: theory and experiment; Applications (qualitative only): heat exchangers, refrigerators, ovens and solar water heaters.

#### **Learning Outcomes:**

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

- explain the process of thermal expansion in solids and liquids L3
- distinguish fundamental laws related to conduction, convection and radiation of heat L1
- determine the thermal conductivity of a material by Forbes and Lee's disc method L4
- summarize the working of heat exchangers, refrigerators, ovens and solar water heaters L2

### **UNIT - IV Acoustics**

**8 Hours**

Characteristics of sound waves; Weber-Fechner Law; Absorption coefficient, determination of absorption coefficient; Reverberation time; Sabine's formula, derivation of Sabine's formula using growth and decay method; Intensity of sound; Acoustics of buildings, Acoustic requirements of a good auditorium.

#### **Learning Outcomes:**

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

- explain the basic concepts in acoustics and describe Weber-Fechner Law L2
- determine absorption coefficient and reverberation time L3
- derive Sabine's formula using growth and decay method L4
- solve problems involving the intensity of a sound wave L4
- summarize the principles of acoustics in designing an acoustically good auditorium L3

Pedagogy tools: Blended learning, Case let, video lectures, self-reading

### **UNIT- V: Sensors**

**9 Hours**

Sensors (qualitative description only); Different types of sensors and applications; Strain and pressure sensors- Piezoelectric, magnetostrictive sensors; Fibre optic methods of pressure sensing; Temperature sensor - bimetallic strip, pyroelectric detectors; Hall-effect sensor; Smoke and fire detectors.

#### **Learning Outcomes:**

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

- describe the principle of strain and pressure sensors L1
- explain the principle and working of magnetostrictive and piezoelectric sensors L3
- illustrate the fibre optic methods of pressure sensing L3
- infer the functioning of temperature sensors like bimetallic strip and pyroelectric detectors L2
- outline the principle and working of Hall-effect sensor, smoke and fire detectors L2

#### **Text Book(s)**

1. D.Kleppner and Robert Kolenkow "An Introduction to Mechanics- II" Cambridge University Press, 2015.
2. M.N. Avadhanulu & T.V.S. Arun Murthy, S Chand A Textbook of Engineering Physics, Volume-I 2018.
3. Ian R Sinclair, Sensor and Transducers 3/e, Elsevier (Newnes), 2001.

**Reference Book(s)**

1. M K Varma, "Introduction to Mechanics"-Universities Press, 2015
2. Prithwiraj Purkait, Budhaditya Biswas and Chiranjib Koley, Chapter 11 Sensors and Transducers, Electrical and Electronics Measurements and Instrumentation, 1/e., McGraw Hill Education (India) Private Limited, 2013.

**Course Outcomes:**

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

- describe the fundamental principles of acoustics with emphasis on physical mechanisms, law and relationships L1
- apply the concepts of strain, internal force, stress and equilibrium to deformation of solids L3
- explain the fundamental theory for the analysis of heat transfer processes in solids and liquids and to apply basic principles of heat transfer in design of refrigerators and heaters L4
- estimate forces and moments in mechanical systems using scalar and vector techniques L4
- outline the basic principle and operation of different types of sensors L2

## PHYS1041: MECHANICS AND MODERN PHYSICS

L	T	P	C
3	1	0	4

This course designed for students of Biotechnology to impart principles of Newtonian mechanics will help the students in understanding the oscillatory behavior of materials. It also introduces fundamentals of quantum mechanics – the essentials for understanding the behavior of properties of materials. Fundamentals of optics and electromagnetism in understanding the use in spectroscopy. An introduction to sensors will be useful for all the branches as an application of modern technology.

### Course Objectives

- To impart knowledge on damped and forced oscillations.
- To familiarize students with the concepts of quantum mechanics
- To impart knowledge concerning the wave properties of electromagnetic waves
- To familiarize the students about the Maxwell's equations and its propagation
- To outline the principles and working of few common sensing devices

### UNIT - I Fundamentals of Dynamics and Oscillations

10 Hours

Fundamentals of Dynamics: Reference frames. Inertial frames; Galilean transformations; Galilean invariance. Review of Newton's Laws of Motion.

Oscillations: SHM, Simple Harmonic Oscillations. Differential equation of SHM and its solution. Damped oscillation. Forced oscillations: Transient and steady states; Resonance, sharpness of resonance; power dissipation and Quality Factor

#### Learning Outcomes:

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

- Differentiate between inertial and non-inertial frames of reference
- Solve the differential equation of simple harmonic oscillator
- Distinguish between forced and damped oscillators
- Estimate the resonance and its properties
- Describe the Newton's laws of motion

Pedagogy tools: Blended learning, Case let, video lectures, self-reading

### UNIT - II Modern Physics (Quantum Physics)

8 Hours

Introduction, matter waves and its properties, Davisson-Germer experiment, GP Thomson experiment, Heisenberg's uncertainty principle, Schrodinger's time independent wave equation, physical significance of wave function, particle in a one-dimensional infinite well, rectangular potential barrier (transmission coefficient), band theory of solids (qualitative), distinction between metals, insulators and semiconductors, introduction to Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein statistics.

#### Learning Outcomes:

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

- Get a grasp on the elementary aspects of energy and momentum of a photon and de Broglie wavelength of a particle.
- Know about the uncertainty principle for position and momentum and for energy and time.
- Understand the significance of Schrodinger's time independent wave equation and apply it to a restricted particle.
- Derive wave functions with reflection and transmission coefficients.
- Differentiate between the Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein statistics

Pedagogy tools: Blended learning, Case let, video lectures, self-reading



**UNIT – III: Optics****10 Hours**

Interference: Introduction, interference in thin films due to reflected light: interference in parallel-sided film and wedge-shaped film, Newton's rings. Diffraction: Introduction; Fraunhofer diffraction at single slit (qualitative only), diffraction due to N-slits (diffraction grating) (qualitative only), determination of wavelength of light with a plane transmission grating. Polarisation: Introduction; Double refraction –double refraction in calcite crystal, negative and positive crystals, Nicol's prism, Retarders (quarter and half-wave plates).

**Learning Outcomes:**

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

- Develop the ability to determine the conditions for constructive and destructive interference
- Figure out the position and intensity variation of the dark fringes in single-slit diffraction (Fraunhofer Diffraction).
- Acquire a basic understanding of diffraction gratings with dispersive nature.
- Comprehend the concepts and meaning of Polarization.
- Know about polarization of light, polarizer and methods of producing polarized light.

Pedagogy tools: Blended learning, Case let, video lectures, self-reading

**UNIT – IV: Maxwell's equations and Electromagnetic wave propagation****8 Hours**

Maxwell's equations (both differential and integral forms) and its physical significance, Poynting vector, energy density in electromagnetic field, electromagnetic wave propagation through vacuum and isotropic dielectric medium, transverse nature of EM waves, polarization of EM waves.

**Learning Outcomes:**

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

- Relate the Maxwell's equation in differential and integral forms
- Interpret the behavior of plane electromagnetic waves in vacuum
- Summarize the significance of Maxwell's equations
- Evaluate the energy density of electromagnetic wave
- Describe the wave propagation in vacuum and medium

Pedagogy tools: Blended learning, Case let, video lectures, self-reading

**UNIT - V Sensors****9 Hours**

Sensors (qualitative description only); Different types of sensors and applications; Strain and pressure sensors -Piezoelectric, magnetostrictive sensors, ultrasonic sensors; Fibre optic methods of pressure sensing; Temperature sensor -bimetallic strip, pyroelectric detectors; Hall-effect sensor; Smoke and fire detectors

**Learning Outcomes:**

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

- Illustrate the principle of strain and pressure sensors
- explain the principle and working of magnetostrictive and piezoelectric sensors
- Evaluate the fibre optic methods of pressure sensing
- Infer the functioning of temperature sensors like bimetallic strip and pyroelectric detectors
- State the principle and working of Hall-effect sensor, smoke and fire detectors

Pedagogy tools: Blended learning, Case let, video lectures, self-reading

**Textbook(s):**

1. Mechanics, D.S. Mathur, S.Chand and Company Limited, 2000.
2. A Text Book of Optics, 25/e, Brij Lal, M N Avadhanulu & N Subrahmanyam, 2012, S. Chand Publishing.
3. Ian R Sinclair, Sensor and Transducers 3rd eds, 2001, Elsevier (Newnes)
4. David J. Griffiths, "Introduction to Electrodynamics"-4/e, Pearson Education, 2014
5. M.N. Avadhanulu, P.G. Kshirsagar, A Textbook of Engineering Physics, S.Chand, 2014.

**Reference Book(s):**

1. Optics, Ajoy Ghatak, 2008, Tata McGraw Hill
2. Prithwiraj Purkait, Budhaditya Biswas and Chiranjib Koley, Chapter 11 Sensors and Transducers, Electrical and Electronics Measurements and Instrumentation, 1st eds., 2013 McGraw Hill Education (India) Private Limited.
3. Elements of Properties of Matter, D. S. Mathur, S. Chand Publishing

**Journal(s):**

1. <https://aapt.scitation.org/doi/abs/10.1119/1.3317450>
2. <https://aapt.scitation.org/doi/full/10.1119/1.3639154>

## VEDC1001: VENTURE DEVELOPMENT

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

### Course Description

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

The course is divided into four sections:

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

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

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

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

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

### Course Objectives

Students will have the opportunity to:

- Discovery who you are – Values, Skills, and Contribution to Society
- Understand how creativity works and permeates the innovation process
- Learn the basic processes and frameworks for successful innovation.
- Gain experience in actually going through the innovation process.
- Conduct field research to test or validate innovation concepts with target customers.
- Understand innovation outcomes: issues around business models, financing for start-ups, intellectual property, technology licensing, corporate ventures, and product line or service extensions.

### Course Materials

- Meyer and Lee (2020), Personal Discovery through Entrepreneurship, The Institute for Enterprise Growth, LLC. Boston, MA., USA
- Additional readings
- Additional videos, including case studies and customer interviewing methods.

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

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

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

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

### **Group Project Overview**

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

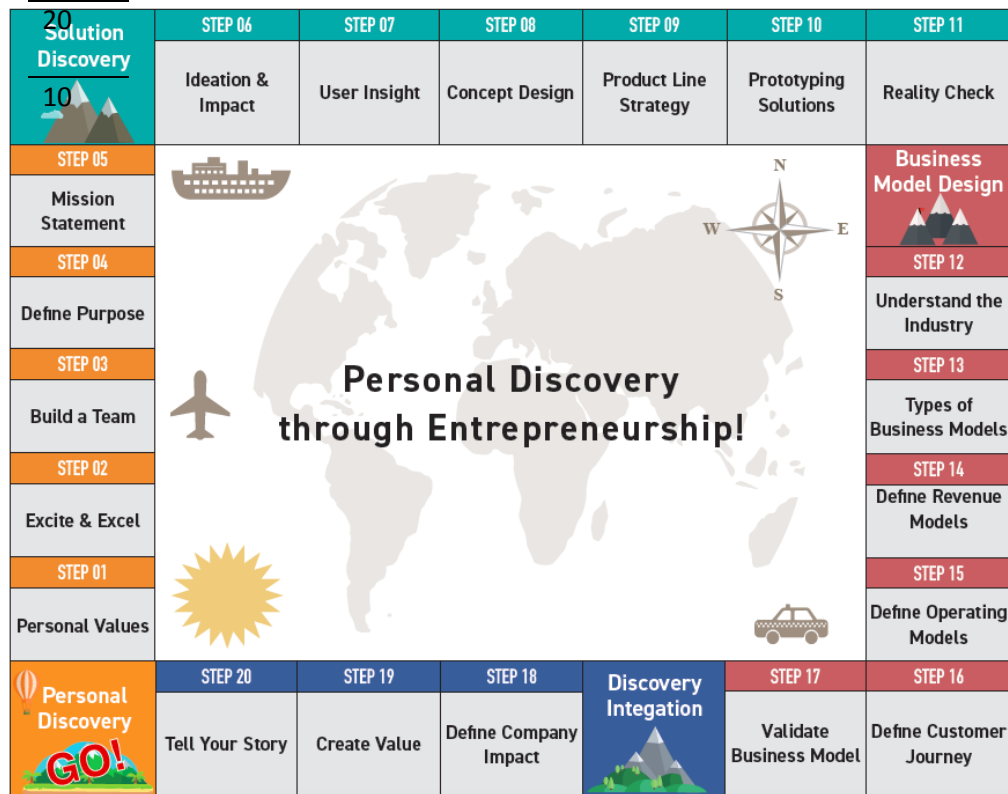
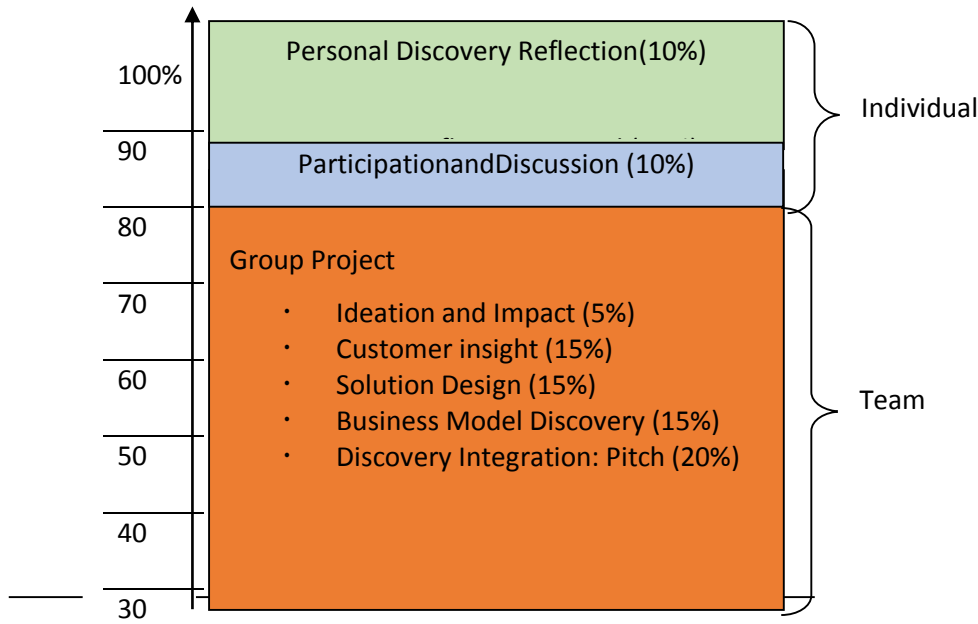
Talking to customers is one of the most important steps in investigating your business because your entrepreneurial vision must correspond to a true market opportunity. With your group, select 5-6 potential customers willing to be interviewed. They should represent a cross-section of our target market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

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

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

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

## Project Components and Grading



[20 Steps and activities in this course]

## Deliverables

There are a number of different deliverables for the course that follow the templates presented in the book, as applied to your own venture idea. Do your best to keep up with the timeline of the class; do not fall behind! Later templates build on the learnings from prior templates. Make the most of your team! Everyone needs to pitch in. In no case, should one person be taking the lead on all templates. Rather, different team members should take the lead on specific deliverables. Coordinate well. Let your teacher know if a team member is not carrying his or her load.

## Specific Deliverables

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

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

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

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

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

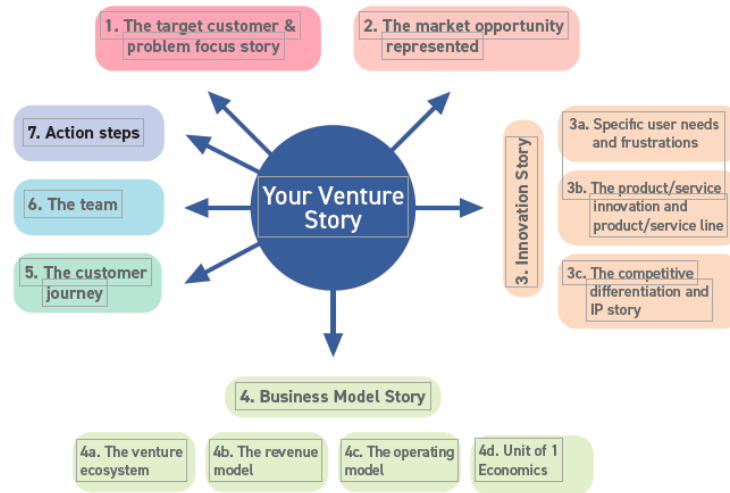
- Customer Value Proposition Template: Step 8, Page 107. This becomes the landing point for what you learned in your customer interviews.
- Competitive Analysis Template: Step 8, Page 109. (Use the Web or actual stores/dealers)
- Product Vision and Subsystem Design Templates: Step 10, Pages 121 and 126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

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

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

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

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



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

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

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

### **Individual Innovation Assignments**

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

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

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

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

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

## Course Schedule

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

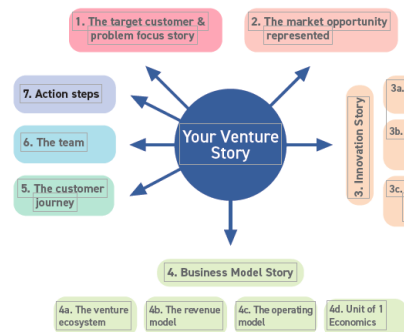


<b>We ek</b>	<b>Sess ion</b>	<b>Topics and Steps</b>	<b>Key CONCEPTS Introduced in Class</b>	<b>Class Focus Activity</b>
3	5	<b>Ideation &amp; Impact</b> (Step 06)	Ideation Methods • An in-class ideation exercise	Team: • Problem to Solve Templates, Step 4, Page 62, and 63
	6		Increasing the Impact of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

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

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

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

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

## BTEN1011: BIOTECHNOLOGY WORKSHOP

L	T	P	C
0	0	2	1

This laboratory course provides hands on training to the students in basic experiments of engineering biotechnology. The student will be familiarised with the usage of scientific calculator, calibration of pH meter & rotameter, concepts of rate and mass transfer, retrieving biological data, growth and division of cells.

### Course Objectives:

This workshop aims to

- provide fundamental concepts of microbiology, fermentation, bioinformatics, mass transfer and reaction engineering
  - demonstrate bioreactor and flow cytometer
  - understand and visualise different phases of mitosis
1. Applications of scientific calculator  
After completion of this experiment, the student will be able to use the calculator for all mathematical and scientific calculations.
  2. Determination of rate constant of a reaction by integral method  
After completion of this experiment, the student will be able to determine the rate constant for any chemical or biochemical reaction
  3. Measurement of oxygen diffused in water  
After completion of this experiment, the student will be able to measure the amount of oxygen present in water.
  4. Mitosis cell division in onion root tips  
After completion of this experiment, the student will be able to observe mitotic cell division in onion root tips.
  5. Estimation of sugar content by Brix meter  
After completion of this experiment, the student will be able to estimate the sugar content in any liquid sample.
  6. Calibration of pH meter and pH measurement.  
After completion of this experiment, the student will be able to calibrate the pH meter for measuring pH of any given liquid sample.
  7. Biological databases and information resources  
After completion of this experiment, the student will be able to retrieve the required data from biological databases and information resources.
  8. Batch growth of yeast cells  
After completion of this experiment, the student will be able to prepare the media and grow the yeast cells in a conical flask.
  9. Biological production of Wine  
After completion of this experiment, the student will be able to prepare wine using cells and raw materials.
  10. Calibration of rotameter and measurement of flow rate.  
After completion of this experiment, the student will be able to calibrate rotameter for flow measurement.
  11. Demonstration of bioreactor operation and its control

After completion of this experiment, the student will be able to understand the operation and control of Bioreactor.

12. Demonstration of flow cytometry for animal cell counting

After completion of this experiment, the student will be able to understand the principle of Flow cytometry and its usefulness in counting animal cells.

**Course Outcomes:**

The student will be able to:

- use the scientific calculator and microscope
- measure flow, pH, sugar content
- retrieve data
- observe cell division
- grow yeast cells
- produce and analyse wine
- explain the operation and control of bioreactors.

## BTEN1001: INTRODUCTION TO BIOTECHNOLOGY-I

L	T	P	C
2	0	0	2

This course introduces the student to the basics of biology such as classification, cell structure, biomolecular structure, metabolism, function and industrial applications

### Course Objectives:

- Introduce the cellular basis of life.
- Provide the basis for classification of living organisms.
- Describe the important biomolecules
- Describe the applications of biomaterials
- Describe the different metabolic pathways

### Unit- I

6 hrs

Introduction to Biology: Major discoveries in biology. Taxonomy- genera, species and strains  
Classification of living organisms: 3 domain and 6 kingdom classification. Classification based on Carbon and energy sources. Tools of molecular taxonomy

#### Learning Outcomes:

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

- summarize the basis of life. (L2)
- classify organisms. (L2)
- understand the molecular methods used in taxonomy(L2)

**Pedagogy tools:** Blended learning, Case let, video lectures, self-reading

8 hrs

### Unit- II

Cell as the basis of life. Ultrastructure of prokaryotic and Eukaryotic cell-Animal and plant cell.  
Commercially significant groups- bacteria, major crop plants and insects. Living Things as Models -Biomimetics -Architecture, Comparison of eye and camera, flying bird and aircraft.

#### Learning Outcomes:

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

- summarize the basis of life. (L2)
- distinguish prokaryotes from eukaryotes. (L3)
- compare biological organisms and manmade systems. (L2)

**Pedagogy tools:** Blended learning, Case let, video lectures, self-reading

10 hrs

### Unit- III

Water, Biomolecules- structure and functions: sugars, starch and cellulose, Amino acids and proteins, Lipids, Nucleotides -DNA/RNA. Structure and function of hemoglobin, antibodies and enzymes

#### Learning Outcomes:

After completing this unit, the student will be able to

- outline the importance of water. (L2)
- explain the relationship between monomeric units and polymeric units (L2)
- explain the relationship between the structure and function of proteins. (L2)
- interpret the relationship between the structure and function of nucleic acids. (L2)

**Pedagogy tools:** Blended learning, Case let, video lectures, self-reading



**6 hrs**

#### **Unit- IV**

Industrial applications of enzymes- Pharmaceutical, Biofuels and Food processing. Enzyme immobilization. Protein Engineering. Fermentation-types. Industrial applications -fermented foods, Antibiotics, Chemicals and enzymes.

##### **Learning Outcomes:**

After completing this unit, the student will be able to

- summarize the applications of enzymes in industry. (L2)
- explain the applications of fermentation in industry. (L2)

**Pedagogy tools:** Blended learning, Case let, video lectures, self-reading

**10 hrs**

#### **Unit- V**

Bioenergetics: Glycolysis and TCA cycle. Electron transport chain and oxidative phosphorylation. Mechanism of photosynthesis-Light and Dark reactions. Comparison of catabolism and anabolism.

##### **Learning Outcomes:**

After completing this unit, the student will be able to

- understand metabolic pathways in biological systems. (L2)
- explain the mechanism of respiration and photosynthesis. (L2)

**Pedagogy tools:** Blended learning, Case let, video lectures, self-reading

#### **Course Outcomes:**

After the completion of the course the student should be able to

- explain classification of living organisms. (L2)
- explain cell as the basis of life(L2)
- explain the importance of various biomolecules(L2)
- summarize application of enzymes and fermentation in industry. (L2)
- Analyze metabolic pathways(L5)

#### **Text Books:**

1. N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, "Biology: A global approach", Pearson Education Ltd, 2018.
2. Arthur T Johnson, Biology for Engineers, CRC press, 2011

#### **References:**

1. Alberts et. al. The molecular biology of the cell, 6/e, Garland Science, 2014
2. E. E. Conn, P. K. Stumpf, G. Bruening and R. H. Doi, "Outlines of Biochemistry", John Wiley and Sons, 2009.
3. John Enderle and Joseph Bronzino Introduction to Biomedical Engineering, 3/e, 2012.

## BTEN1021: INTRODUCTION TO BIOTECHNOLOGY-II

L	T	P	C
2	0	0	2

This course introduces the student to the basics of human physiology, molecular biology genetics and recombinant DNA technology.

### Course Objectives:

- Describe the concept of Central Dogma of Molecular Biology
- Describe the transfer of genetic information.
- Describe basics of human physiology
- Introduce recombinant DNA technology
- Introduce the techniques used for modification of living organisms

6 hrs

### Unit- I

Molecular Biology: Genetic code, Central Dogma, DNA replication, Transcription, Translation. Classification of human genetic disorders

#### Learning Outcomes:

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

- summarize the principles of information transfer and processing in humans. (L2)
- identify DNA as a genetic material in the molecular basis of information transfer. (L2)
- explain the medical importance of genetic disorders. (L2)

**Pedagogy tools:** Blended learning, Case let, video lectures, self-reading

8 hrs

### Unit- II

Genetics: Mendel's laws of inheritance. Gene interactions- Epistasis, Incomplete & Codominance, Multiple alleles, Additive, complementation, Pleiotropism. Linkage, Crossing over. Gene mapping. Cell cycle and regulation. Mitosis and Meiosis

#### Learning Outcomes:

After completing this unit, the student will be able to

- define Mendel's laws. (L1)
- demonstrate the mapping of genes. (L2)
- explain interactions among genes and their significance (L2)
- differentiate the mitosis and meiosis. (L3)

**Pedagogy tools:** Blended learning, Case let, video lectures, self-reading

10 hrs

### Unit- III

Human physiology – Membrane transport- Active and passive. Cell signaling and communication. Neurons – structure, function and types. Synapse-types, neurotransmitters, transmission of nerve impulse. Neuromuscular junctions. Muscle-structure, function and types.

#### Learning Outcomes:

After completing this unit, the student will be able to Genetics

- Understand the basics of human physiology (L3)
- Understand cell to cell communication (L3)
- Understand the functioning of neuromuscular system (L3)

**Pedagogy tools:** Blended learning, Case let, video lectures, self-reading

**Unit- IV****6 hrs**

Tools of Recombinant DNA Technology, Vectors. Techniques- PCR, Blotting Techniques. Transgenic microbes. Transgenic plants – improved characteristics, pest and herbicidal resistance.

**Learning Outcomes:**

After completing this unit, the student will be able to Genetics

- outline the principles of recombinant DNA technology. (L2)
- understand the techniques used in rDNA technology(L3)
- understand the applications of rDNA technology in plants.(L3)

**Pedagogy tools:** Blended learning, Case let, video lectures, self-reading

**10 hrs****Unit- V**

Transgenic animals- knockout mice, insects, livestock. Pharming, Growth enhancement and ornamental fish. Animal cloning - Dolly, applications of animal cloning. Biosensors, biochips. Recombinant vaccines.

**Learning Outcomes:**

After completing this unit, the student will be able to

- understand the applications of rDNA technology in animals(L3)
- understand the commercialization of rDNA technology (L3)
- appreciate the potential of rDNA technology in diagnostics(L2)

**Pedagogy tools:** Blended learning, Case let, video lectures, self-reading

**Course Outcomes:**

After the completion of the course the student should be able to

- identify DNA as a genetic material (L2)
- identify DNA as molecular basis of information transfer. (L2)
- Explain physiologic processes in humans (L2)
- Explain the concepts of recombinant DNA technology (L2)
- appreciate the potential of recombinant DNA technology (L2)

**Text Books:**

1. N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, "Biology: A global approach", Pearson Education Ltd, 2018.
2. Arthur T Johnson, Biology for Engineers, CRC press, 2011

**References:**

1. Alberts et. al. The molecular biology of the cell, 6/e, Garland Science, 2014
2. E. E. Conn, P. K. Stumpf, G. Bruening and R. H. Doi, "Outlines of Biochemistry", John Wiley and Sons, 2009.
3. John Enderle and Joseph Bronzino Introduction to Biomedical Engineering, 3/e, 2012.

## BTEN1031: PROCESS CALCULATIONS

L	T	P	C
2	0	0	2

Large scale production in biotechnology industry involves a wide range of processes. This course introduces the concepts, laws and physico-chemical properties that are useful for bioprocess calculations. These calculations also enable the students to estimate the amount of chemicals required/heat released or absorbed in a bioprocess.

### Course Objectives:

- To introduce the concepts of chemical calculations
- To provide the basis for chemical reactions
- To familiarize the concepts of material and energy balance
- To explain the material and energy balance calculations
- To expose the material and energy balance concepts to bioprocesses

### Unit- I

**Number of hours: 6**

Basic chemical calculations: Mole, atomic mass, molar mass, equivalent mass, stoichiometric and composition relationships for solids, liquids, solutions, gases: Weight percent, volume percent and mole percent, density and specific gravity, Behaviour of ideal gases, application of the ideal gas law, Dalton and Amagat laws of gaseous mixtures, Composition of gases on dry and wet basis.

#### Learning Outcomes:

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

- apply ideal gas, Dalton and Amagats laws. (L3)
- estimate chemical masses, volumes and percentages. (L3)
- explain the relationship between reactants and products. (L2)
- apply ideal gas law. (L3)

**Pedagogy tools:** Blended learning, Case let, video lectures, self-reading

### Unit- II

**Number of hours: 8**

Gases, Vapours and Liquids: Equations of state, Vapor pressure, effect of temperature on vapor pressure: Clausius-Clapeyron equation, Antoine equation. Reference substance vapor pressure plots: Cox chart and Duhring's plot, Vapor pressure of immiscible liquids, Ideal solutions and Raoult's law, non-volatile solutes, humidity, saturation, humid heat, humid volume, Dew point, humidity chart and its uses. Wet and dry bulb temperatures. Adiabatic vaporization and adiabatic saturation temperature.

#### Learning Outcomes:

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

- describe the factors affecting vapour pressure. (L2)
- explain the relationship between the temperature and vapour pressure. (L2)
- Outline the concept of adiabatic saturation and thermodynamic wet bulb temperature
- Interpret the humidity and dewpoint. (L2)
- predict the physico-chemical properties of air. (L2)

**Pedagogy tools:** Blended learning, Case let, video lectures, self-reading

**Unit- III****Number of hours: 8**

Material balances: Process flow sheet, Material balance without chemical reactions, Degrees of freedom, Tie element basis for calculations. Material balance calculations involving drying, dissolution and crystallization, continuous filtration, batch mixing, Recycling and bypassing operations, Material balance with chemical reactions, concept of excess reactant, limiting reactant, conversion, yield, degree of completion.

**Learning Outcomes:**

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

- explain process flow diagrams (L2)
- perform material balance for various unit operations. (L3)
- estimate product yield and reactant conversion. (L3)
- solve material balance for various unit processes with and without recycling. (L3)

**Pedagogy tools:** Blended learning, Case let, video lectures, self-reading

**Unit- IV****Number of hours: 10**

Energy balance: Components of energy balance equation, Concept of Enthalpy and heat capacity, Heat effects accompanying chemical reactions, standard heats of reaction, combustion and formation, Hess's law, effect of temperature on standard heats of reaction, steady state energy balance.

**Learning Outcomes:**

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

- identify various components of energy balance equation. (L1)
- interpret the heat effects in chemical reactions. (L2)
- predict the heat of combustion and heat of formation. (L3)
- explain the medical importance of gene disorders. (L2)
- apply Hess's law for energy calculations. (L2)

**Pedagogy tools:** Blended learning, Case let, video lectures, self-reading

**Unit- V****Number of hours: 6**

Stoichiometry of microbial growth and product formation: Elemental balances, degree of reduction, yield coefficients, biomass yield, product stoichiometry, Theoretical oxygen demand, Maximum possible yield, Thermodynamics of microbial growth, Heat of reaction with oxygen as electron acceptor and without oxygen, Energy balance equations for fermentation and cell culture.

**Learning Outcomes:**

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

- outline the stoichiometry of microbial growth and product formation. (L2)
- explain the importance of oxygen in energy balance calculations. (L2)
- apply the material and energy balance concepts to fermentation and cell culture. (L2)

**Pedagogy tools:** Blended learning, Case let, video lectures, self-reading

**Text Book(s):**

1. Himmelblau, D. M., Riggs, J. B. "Basic Principles and Calculations in Chemical Engineering", 8/e., Pearson, 2015.
2. Bhatt, B. I., Vora, S. M., "Stoichiometry", 4/e Tata McGraw Hill, 2004.

**Reference Book(s):**

1. Felder, R. M.; Rousseau, R. W., “Elementary Principles of Chemical Processes”, Third Edition, John Wiley & Sons, 2000
2. Hougen, O. A., Watson, K. M., Ragatz, R. A., “Chemical Process Principles, Part-I Material & Energy Balances”, Second Edition, CBS Publishers & Distributors, 2004
3. Venkataramani, V., Anantharaman, N., Begum, K. M. Meera Sheriffa, “Process Calculations”, Second Edition, Prentice Hall of India.
4. Sikdar, D. C., “Chemical Process Calculations”, Prentice Hall of India.
5. Pauline M.Doran, Bioprocess Engineering Principles, 1/e, Academic Press, 2009.

**CLAD1001: EMOTIONAL INTELLIGENCE & REASONING SKILLS  
(SOFT SKILLS 1)**

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

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

**Course Outcomes**

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

**CLAD1011: LEADERSHIP SKILLS & QUANTITATIVE APTITUDE  
(SOFT SKILLS 2)**

**L T P J C**

0 0 2 0 1

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	Presentation Skills: Seven Basic Rules for Effective Presentation: Be Passionate, Focus on Audience Needs, Focus on the Core Message, Use Body Language and Voice, Start Strongly, Organizing Ideas & Using Visual Aids: SPAM Model, Effective Opening and Closing Techniques, Guy Kawasaki's Rule (10-20-30 Rule), Overcoming Stage Fear, Story Telling	3
3	Problem Solving & Decision Making: Difference Between the Two, Steps in Rational Approach to Problem Solving: Defining the Problem, Identifying the Root Causes, Generating Alternative Solutions, Evaluating and Selecting Solutions, Implementing and Following-Up, Case Studies	3
4	Group Discussion: Understanding GD, Evaluation Criteria, Nine Essential Qualities for Success, Positive and Negative Roles, Mind Mapping, Structuring a Response, Methods of Generating Fresh Ideas	4
5	Number Theory: Number System, Divisibility rules, Remainders and LCM & HCF	3
6	Numerical Computation and Estimation - I : Chain Rule, Ratio Proportions, Partnerships & Averages, Percentages, Profit-Loss & Discounts, Mixtures, Problems on Numbers & ages	6
7	Data Interpretation: Interpretation and analysis of data in Tables, Caselets, Line-graphs, Pie-graphs, Box-plots, Scatter-plots and Data Sufficiency	3
8	Mental Ability: Series(Number, Letter and Alphanumeric), Analogy(Number, Letter and Alphanumeric) and Classifications	3
<b>Total Hours</b>		30

**Course Outcomes**

- Students will be able to communicate 'one-on-one' and 'one-on-many' confidently using both verbal and non-verbal messages and deliver impressive talks/ presentations to a group both with and without the use of PPTs and create posters, advertisements, etc.
- Students will be able to apply the the rational model of problem solving and decision making in their problem solving and decision making efforts.
- Students will be able to solve questions based on numbers and arithmetic given in various competitive examinations
- Students will be able to solve questions based on data interpretation, progressions and series.



## **DOSP1001: RACQUET SPORTS (Badminton + TT)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>2</b>	<b>15</b>	<b>2</b>

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

### **Course Objectives**

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

### **List of Topics**

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
9. Introduction to Table Tennis - History and development
10. Rules of the Game, Play Area & dimensions
11. Fundamental Skills - TT: Grips - Racket, ball
12. Stances and footwork
13. TT Gameplay- Forehand, Backhand, Side Spin, High Toss. Strokes-Push, Chop, Drive, Half Volley, Smash, Drop-shot, Balloon, Flick, Loop Drive.
14. Preparatory Drills and Fun Games
15. Game Variations: Singles/ Doubles/ Mixed

### **List of Activities**

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

### **References**

1. Handbook of the Badminton World Federation (BWF)
2. Handbook of the International Table Tennis Federation (ITTF)

**Course Outcomes**

- Learn to play two (2) sports - Badminton + Table Tennis
- Understanding of the fundamental concepts such as rules of play, game variations
- Understanding of the governing structure and administration of the sport
- Understand the event management of the sport
- Apply sport concepts into an active physical lifestyle

## **DOSP1011: RACQUET SPORTS (BADMINTON + TENNIS)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>2</b>	<b>15</b>	<b>2</b>

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

### **Course Objectives**

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

### **List of Topics**

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
9. Introduction to Tennis - History and development
10. Rules of the Game, Play Area & dimensions
11. Fundamental Skills - Tennis: Grips - Racket, ball
12. Stances and footwork
13. Gameplay- Forehand, Backhand, Service, volley, chops,
14. Preparatory Drills and Fun Games
15. Game Variations: Singles/ Doubles/ Mixed

### **List of Activities**

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

### **References**

1. Handbook of the Badminton World Federation (BWF)
2. Handbook of the International Table Tennis Federation (ITTF)

**Course Outcomes**

- Learn to play two (2) sports - Badminton + Tennis
- Understanding of the fundamental concepts such as rules of play, game variations
- Understanding of the governing structure and administration of the sport
- Understand the event management of the sport
- Apply sport concepts into an active physical lifestyle
- Apply sport concepts into an active physical lifestyle

## **DOSP1021: BOARD GAMES (CHESS + CARROM)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>2</b>	<b>15</b>	<b>2</b>

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

### **Course Objectives**

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

### **List of Topics**

1. Introduction to Chess - History and development
2. Rules of the Game, Board 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
8. Warmup drills (mental, preparatory gamework)
9. Introduction to Carrom - History and development
10. Rules of the Game, Board components & dimensions
11. Fundamental Skills - Carrom: - Striking
12. Gameplay - General
13. Preparatory Drills and Fun Games
14. Game Variations: Singles/ Doubles/ Mixed
15. Game Variations: Singles/ Doubles/ Mixed

### **List of Activities**

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

### **References**

1. International Chess Federation (FIDE) Handbook
2. Indian Carrom Federation Handbook - Laws

**Course Outcomes**

- Learn to play two (2) board games - Chess + Carrom
- Understanding of the fundamental concepts such as rules of play, game variations
- Understanding of the governing structure and administration of the sport
- Understand the event management of the sport
- Apply sport concepts into an active lifestyle

## **DOSP1031: TACTICAL SPORTS (HANDBALL + FOOTBALL)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>2</b>	<b>15</b>	<b>2</b>

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

### **Course Objectives**

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

### **List of Topics**

1. Introduction to Handball - History and development
2. Rules of the Game, Play Area & dimensions
3. Fundamental Skills - Handball: Throwing, Ball control, Movement
4. Sports Specific fitness and warmup drills
5. Stances and footwork: Jumps, dribbles, catching, throws
6. Gameplay: Shots, throws, movements, attack, defense
7. Preparatory Drills and Fun Games
8. Introduction to Football - History and development
9. Rules of the Game, Play Area & dimensions
10. Fundamental Skills: Kicking, heading, ball control, Keeping
11. Movement, throwins, tackling, defense, scoring, defense
12. Gameplay- Formations, passing, FKs, CKs, PK, tactics
13. Preparatory Drills and Fun Games
14. Game Variations: Small sided games, 7v7, 11v11

### **List of Activities**

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

### **References**

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

**Course Outcomes**

- Learn to play two (2) sports - Handball + Football
- Understanding of the fundamental concepts such as rules of play, game variations
- Understanding of the governing structure and administration of the sport
- Understand the event management of the sport
- Apply sport concepts into an active physical lifestyle



## **DOSP1041: TACTICAL SPORTS (BASKETBALL + FOOTBALL)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>2</b>	<b>15</b>	<b>2</b>

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

### **Course Objectives**

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

### **List of Topics**

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. Gameplay: Shots, throws, movements, attack, defense
7. Preparatory Drills and Fun Games
8. Introduction to Football - History and development
9. Rules of the Game, Play Area & dimensions
10. Fundamental Skills: Kicking, heading, ball control, Keeping
11. Movement, throwins, tackling, defense, scoring, defense
12. Gameplay- Formations, passing, FKs, CKs, PK, tactics
13. Preparatory Drills and Fun Games
14. Game Variations: Small sided games, 7v7, 11v11

### **List of Activities**

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

### **References**

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

**Course Outcomes**

- Learn to play two (2) sports - Basketball + Football
- Understanding of the fundamental concepts such as rules of play, game variations
- Understanding of the governing structure and administration of the sport
- Understand the event management of the sport
- Apply sport concepts into an active physical lifestyle

## **DOSP1051: TACTICAL SPORTS (HANDBALL + BASKETBALL)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>2</b>	<b>15</b>	<b>2</b>

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

### **Course Objectives**

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

### **List of Topics**

1. Introduction to Handball - History and development
2. Rules of the Game, Play Area & dimensions
3. Fundamental Skills - HB: Throwing, Ball control, Scoring, Movement
4. Sports Specific fitness and warmup drills
5. Stances and footwork: Jumps, dribbles, catching, throws
6. Gameplay: Shots, throws, movements, attack, defense
7. Preparatory Drills and Fun Games
8. Introduction to Basketball - History and development
9. Rules of the Game, Play Area & dimensions
10. Fundamental Skills: Passing, Receiving, Dribbling
11. Sports Specific fitness and warmup drills
12. Stances and footwork: Jumps, dribbles, catching, throws
13. Gameplay: Shots, throws, movements, attack, defense
14. Preparatory Drills and Fun Games

### **List of Activities**

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

### **References**

1. International Handball Federation - Rules of the Game & Regulations
2. FIBA Basketball Official Rules

**Course Outcomes**

- Learn to play two (2) sports - Handball + Basketball
- Understanding of the fundamental concepts such as rules of play, game variations
- Understanding of the governing structure and administration of the sport
- Understand the event management of the sport
- Apply sport concepts into an active physical lifestyle

## **DOSP1061: SPORTS (VOLLEYBALL + THROWBALL)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>2</b>	<b>15</b>	<b>2</b>

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

### **Course Objectives**

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

### **List of Topics**

1. Introduction to Volleyball - 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. Gameplay: Jumps, strikes, layoffs, attack, defense
7. Preparatory Drills and Fun Games
8. Introduction to Throwball - History and development
9. Rules of the Game, Play Area & dimensions
10. Fundamental Skills: Throwing, Receiving
11. Sports Specific fitness and warmup drills
12. Stances and footwork
13. Gameplay: Shots, throws, movements, control
14. Preparatory Drills and Fun Games

### **List of Activities**

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

### **References**

1. FIVB - Official Volleyball Rules
2. World Throwball Federation - Rules of the Game

**Course Outcomes**

- Learn to play two (2) sports - Volleyball + Throwball
- Understanding of the fundamental concepts such as rules of play, game variations
- Understanding of the governing structure and administration of the sport
- Understand the event management of the sport
- Apply sport concepts into an active physical lifestyle

## **DOSP1071: TRADITIONAL SPORTS (KABADDI + KHOKHO)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>2</b>	<b>15</b>	<b>2</b>

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

### **Course Objectives**

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

### **List of Topics**

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. Gameplay: Chain system movement
7. Preparatory Drills and Fun Games
8. Introduction to Kho Kho - History and development
9. Rules of the Game, Play Area & dimensions
10. Fundamental Skills: Siting, giving Kho, Pole dive
11. Sports Specific fitness and warmup drills
12. Stances and footwork: Running, sitting
13. Gameplay: Running strategies, ring method, chain method
14. Preparatory Drills and Fun Games

### **List of Activities**

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

### **References**

1. Amateur Kabaddi Federation of India (AKFI) - Official Rules
2. Rules of Kabaddi - International Kabaddi Federation
3. Khelo India Official Rulebook of Kho Kho

**Course Outcomes**

- Learn to play two (2) sports - Kabaddi + KhoKho
- Understanding of the fundamental concepts such as rules of play, game variations
- Understanding of the governing structure and administration of the sport
- Understand the event management of the sport
- Apply sport concepts into an active physical lifestyle



## DOSL1001: CLUB ACTIVITY - PARTICIPANT

L	T	P	C
0	1	2	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	C
0	1	2	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	C
0	1	2	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	C
0	1	2	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



## **DOSL1041: COMMUNITY SERVICES - VOLUNTEER**

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

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

### **Course Objectives**

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

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

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

### **List of Activities**

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

### **Text Books**

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

**References**

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

**Course Outcomes**

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

## DOSL1051: COMMUNITY SERVICES - MOBILIZER

L	T	P	C
0	1	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 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