Guru Nanak Institute of Technology
R25 [B.Tech., Food Technology]

Curriculum and Syllabus for B.Tech. Under Autonomy (NEP-2020 implemented)

Dept. of Food Technology

(Effective from 2025-26 admission batch)

Department: Food Technology (FT)

Curriculum Structure & Syllabus (Effective from 2025-26 admission batch)

1st Year 1st Semester									
Sl. No.	Broad Category	Category	Paper Code	Subject	Contact Hours/ Week				Credit Points
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	FT101	Chemistry of Food	3	0	0	3	3
2	SCI	Multidisciplinary	PH101	Engineering Physics	3	0	0	3	3
3	SCI	Multidisciplinary	M101	Engineering Mathematics- I	3	0	0	3	3
4	HUM	Value Added Course	HU101	Environmental Science	2	0	0	2	2
5	HUM	Value Added Courses	HU102	Indian Knowledge System	1	0	0	1	1
B. PRACTICAL									
1	ENGG	Major	FT191	Chemistry of Food Lab I	0	0	3	3	1.5
2	SCI	Skill Enhancement Course	PH191	Engineering Physics Lab	0	0	3	3	1.5
4	ENGG	Skill Enhancement Course	ME194	Engineering Graphics & Computer Aided Design Lab	0	0	3	3	1.5
5	HUM	Ability Enhancement Course	HU191	Communication & Presentation Skill	0	0	3	3	1.5
C. MANDATORY ACTIVITIES / COURSES									
1	MC	Mandatory Course	MC181	Induction Program	0	0	0	0	0
Total of Theory, Practical								**24**	**18**

**HUM: Humanities; ENGG: Engineering; SCI: Science; PRJ: Project*

1st Year 2nd Semester									
Sl. No.	**Broad Category**	**Category**	**Paper Code**	**Subject**	**Contact Hours/Week**				**Credit Points**
					L	**T**	**P**	**Total**	
A. THEORY									
1	ENGG	Major	FT201	Food Microbiology	3	0	0	3	3
2	ENGG	Major	FT202	Biochemistry and Nutrition	3	0	0	3	3
3	ENGG	Minor	CS202	Introduction to Artificial Intelligence	2	0	0	2	2
4	SCI	Multidisciplinary	CH201	Engineering Chemistry	2	0	0	2	2
5	SCI	Multidisciplinary	M201	Engineering Mathematics –II	3	0	0	3	3
6	HUM	Value Added Course	HU205	Constitution of India & Professional Ethics	1	0	0	1	1
7	HUM	Ability Enhancement Course	HU203	Design Thinking & Innovation	1	0	0	1	1
B. PRACTICAL									
1	ENGG	Major	FT291	Food Microbiology lab	0	0	3	3	1.5
2.	ENGG	Major	FT292	Biochemistry and Nutrition Lab	0	0	3	3	1.5
3	SCI	Skill Enhancement Course	CH291	Engineering Chemistry Lab	0	0	2	2	1
4	ENGG	Skill Enhancement Course	ME293	IDEA LAB Workshop	0	0	3	3	1.5
5	ENGG	Minor	CS292	Introduction to Artificial Intelligence Lab	0	0	3	3	1.5
C. MANDATORY ACTIVITIES / COURSES									
1	MC	Mandatory Course	MC281	NSS/ Physical Activities / Meditation & Yoga / Photography/ Nature Club	0	0	0	0	0
Total of Theory, Practical								**29**	**22**
Total Credit in 1st year									**40**

2nd Year 3rd Semester									
Sl. No.	**Broad Category**	**Category**	**Paper Code**	**Subject**	**Contact Hours/Week**				**Credit Points**
					L	**T**	**P**	**Total**	
A. THEORY									
1	ENGG	Major	FT301	Food Process Technology–I (Fish, Meat, Poultry)	3	0	0	3	3
2	ENGG	Major	FT302	Food Process Technology–II (Cereals, Fruits, Vegetables)	3	0	0	3	3
3	ENGG	Minor	CH(FT)301	Industrial stoichiometry	3	0	0	3	3
4	ENGG	Minor	CS(FT) 301A/B/C	A. Data Structure and Algorithms B. Data Base Management System C. Software Engineering	3	0	0	3	3
5	SCI	Minor	M(FT)301	Applied Statistics and Numerical Methods	2	0	0	2	2
B. PRACTICAL									
1	ENGG	Major	FT391	Chemistry of Food Lab II	0	0	3	3	1.5
2	ENGG	Minor	CS(FT) 391A/B/C	A. Data Structure and Algorithms Lab B. Data Base Management System Lab C. Software Engineering Lab	0	0	3	3	1.5
3	ENGG	Minor	M(FT)391	Applied Statistics and Numerical Methods Lab	0	0	3	3	1.5
4	HUM	Ability Enhancement Course	HU(FT)391	Technical Seminar Presentation & Group Discussion	0	0	3	3	1.5
C. MANDATORY ACTIVITIES / COURSES									
1	Mandatory Course	MC	MC381	NSS/NCC/ Physical Activities / Meditation & Yoga / Club Activities/Environmental Protection Initiatives		0	0	0	0
Total of Theory, Practical								26	20

2nd Year 4th Semester									
Sl. No.	**Broad Category**	**Category**	**Paper Code**	**Subject**	**Contact Hours/Week**				**Credit Points**
					L	**T**	**P**	**Total**	
A. THEORY									
1	ENGG	Major	FT401	Principles of Food Preservation	3	0	0	3	3
2	ENGG	Major	FT402A/B/C	A. Food Biotechnology B. Environmental Biotechnology C. Industrial Biotechnology	3	0	0	3	3
3	ENGG	Major	FT403A/B/C	A. Fluid Mechanics and Heat Transfer B. Mass Transfer I C. Mechanical Operation and Separation Process I	3	1	0	4	4
4	ENGG	Major	FT404	Bakery, Confectionery and Extruded Foods	3	0	0	3	3
5	ENGG	Major	FT405	Food Packaging Technology	3	0	0	3	3
6	ENGG	Minor	CH(FT)401	Chemical Engineering Thermodynamics and Kinetics	3	0	0	3	3
B. PRACTICAL									
1	ENGG	Major	FT491A/B/C	A. Food Biotechnology Lab B. Environmental Biotechnology Lab C. Industrial Biotechnology Lab	0	0	3	3	1.5
2	ENGG	Major	FT492A/B/C	A. Fluid Mechanics and Heat Transfer Lab B. Mass Transfer I Lab C. Mechanical Operation and Separation Process I Lab	0	0	3	3	1.5
3	PRJ	Project	FT481	Project-I	0	0	2	2	1
C. MANDATORY ACTIVITIES / COURSES									
1	Mandatory Course	MC	MC481	NSS/NCC/ Physical Activities / Meditation & Yoga / Club Activities/Environmental Protection Initiatives	0	0	0	0	0
Total of Theory, Practical								**27**	**23**
Total credit in 2nd year									**43**

3rd Year 5th Semester									
Sl. No.	Broad Category	Category	Paper Code	Subject	Contact Hours/Week				Credit Points
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	FT501	Food Process Technology–III (Milk and Milk Products)	3	0	0	3	3
2	ENGG	Major	FT502A/B/C	A. Mass Transfer II B. Mechanical Operation and Separation Process II C. Transport Phenomena	3	1	0	4	4
3	ENGG	Major	FT503	Applied Microbial Technology for Industry	4	0	0	4	4
4	ENGG	Major	FT504	Food Process Technology–IV (Edible Fats and Oils)	3	0	0	3	3
5	HUM	Value Added Course	HU501	Research Methodology and IPR	1	0	0	1	1
B. PRACTICAL									
1	ENGG	Major	FT591	Food Processing Lab I	0	0	3	3	1.5
2	ENGG	Major	FT592A/B/C	A. Mass Transfer Lab II lab B. Mechanical Operation and Separation Process II Lab C. Transport Phenomena Lab	0	0	3	3	1.5
3	ENGG	Major	FT593	Applied Microbial Technology for Industry Lab	0	0	3	3	1.5
4	ENGG	Major	FT594	Food Analysis and Quality Control Lab-1	0	0	4	4	2
5	PRJ	Project	FT581	Project-II	0	0	4	4	2
C. MANDATORY ACTIVITIES / COURSES									
1	Mandatory Course	MC	MC581	NSS/NCC/ Physical Activities / Meditation & Yoga / Club Activities/Environmental Protection Initiatives	0	0	0	0	0
Total of Theory, Practical								32	23.5

3rd Year 6th Semester									
Sl. No.	Broad Category	Category	Paper Code	Subject	Contact Hours/Week				Credit Points
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	FT601	Principles of Biochemical Engineering	3	1	0	4	4
2	ENGG	Major	FT602	Food Process Engineering	3	0	0	3	3
3	ENGG	Major	FT603A/B/C	A. National and Global Food Regulation B. Supply Chain Management and Food Marketing C. Food Security and Sustainability	3	0	0	3	3
4	ENGG	Major	FT604A/B/C	A. Functional Foods and Nutraceuticals B. Protein Technology C. Enzyme Technology	3	0	0	3	3
5	ENGG	Minor	ECS(FT)601A EE(FT)601B EC(FT)601C	Process Instrumentation and Control Renewable Energy Technology Introduction to Nanotechnology	3	0	0	3	3
6	ENGG	Minor	CS(FT)602A/ B/C	A. Digital Image Processing B. Introduction to Machine Learning C. Introduction to Internet of Things	3	0	0	3	3
B. PRACTICAL									
1	ENGG	Major	FT691	Food Processing Lab II	0	0	3	3	1.5
2	ENGG	Major	FT692	Food Analysis and Quality Control Lab-II	0	0	4	4	2
4	PRJ	Project	FT681	Project-III	0	0	6	6	3
C. MANDATORY ACTIVITIES / COURSES									
1	Mandatory Course	MC	MC681	NSS/NCC/ Physical Activities / Meditation & Yoga / Club Activities/Environmental Protection Initiatives	0	0	0	0	0
Total of Theory, Practical								32	25.5
Total Credit in 3rd Year									**49**

4th Year 7th Semester									
Sl. No.	Broad Category	Category	Paper Code	Subject	Contact Hours/Week				Credit Points
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	FT701	Waste Management of Food Industries	3	1	0	4	4
2	ENGG	Minor	HU(FT)701 A	Entrepreneurship Development and Start-Up Management	3	0	0	3	3
			HU(FT)701 B	Quality Management System					
			CS(FT)701 C	Smart Technologies					
4	ENGG	Minor	HU(FT)702 A	Consumer Behavior Research	3	0	0	3	3
			HU(FT)702 B	Product Design and Development					
			HU(FT)702 C	Business Research Method					
3	HUM	Skill Enhancement Course	HU(FT)703	Project Management and Finance	2	0	0	2	2
B. PRACTICAL									
1	ENGG	Skill Enhancement Course	FT791	Product Development and Quality Control Lab	0	0	0	4	2
1	PRJ	Project	FT781	Project-IV	0	0	0	12	6
Total of Theory, Practical								28	20

4th Year 8th Semester									
Sl. No.	Broad Category	Category	Paper Code	Subject	Contact Hours/Week				Credit Points
					L	T	P	Total	
B. PRACTICAL									
1	PRJ	Project	FT881	Grand Viva	0	0	0	0	4
2	PRJ	Project	FT882	Internship/ Entrepreneurship	0	0	0	0	4
Total of Theory, Practical									8
Total Credit in 4th Year									28

Total credit: 160

Credit Distribution

Sem	Major	Minor	Multidisciplinary	Ability enhancement course	Skill enhancement course	Value added course	Project	Internship	Total
1	4.5		6	1.5	3	3			**18**
2	9	3.5	5	1	2.5	1			**22**
3	7.5	11		1.5					**20**
4	19	3					1		**23**
5	20.5					1	2		**23.5**
6	16.5	6					3		**25.5**
7	4	6			4		6		**20**
8							4	4	**8**
	81	**30**	**11**		**9.5**		**16**	**4**	**160**

1st Year 1st Semester									
Sl. No.	Broad Category	Category	Paper Code	Subject	Contact Hours/ Week				Credit Points
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	FT101	Chemistry of Food	3	0	0	3	3
2	SCI	Multidisciplinary	PH101	Engineering Physics	3	0	0	3	3
3	SCI	Multidisciplinary	M101	Engineering Mathematics- I	3	0	0	3	3
4	HUM	Value Added Course	HU101	Environmental Science	2	0	0	2	2
5	HUM	Value Added Courses	HU102	Indian Knowledge System	1	0	0	1	1
B. PRACTICAL									
1	ENGG	Major	FT191	Chemistry of Food Lab I	0	0	3	3	1.5
2	SCI	Skill Enhancement Course	PH191	Engineering Physics Lab	0	0	3	3	1.5
4	ENGG	Skill Enhancement Course	ME194	Engineering Graphics & Computer Aided Design Lab	0	0	3	3	1.5
5	HUM	Ability Enhancement Course	HU191	Communication & Presentation Skill	0	0	3	3	1.5
C. MANDATORY ACTIVITIES / COURSES									
1	MC	Mandatory Course	MC181	Induction Program	0	0	0	0	0
Total of Theory, Practical								**24**	**18**

Course Name: Chemistry of Food

Course Code: FT101

Contact (L: T: P): 3 : 0 : 0

Total Contact Hours: 36

Credit: 3

Pre requisites: Engineering Chemistry

Course Objectives

The objective of the course is to make the students able to –

O1: Differentiate the types of chemical interactions and reactions among major food components such as carbohydrates, proteins, and lipids.

O2: Analyze the impact of these chemical reactions on the sensory, nutritional, and functional properties of foods.

O3: Evaluate how various food processing techniques influence the chemical properties and quality attributes of food components.

Course Outcome(s):

After completion of the course students will be able to:

CO1	**Apply** the principles of food chemistry to classify food groups and evaluate moisture content and water activity in various food matrices.
CO2	**Analyze** the structure-function relationships of carbohydrates and proteins in relation to their physico-chemical behavior in food systems.
CO3	**Evaluate** the quality and stability of fats and oils using physico-chemical parameters and recommend appropriate use of antioxidants.
CO4	**Assess** the impact of processing and storage on the nutritional quality of foods by interpreting changes in vitamins, minerals, and pigments.

CO-PO-PSO Mapping:

COs	**Program Outcomes (PO)**											**Program Specific Outcomes (PSO)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	-	-	-	2	1	-	-	-	-	3	2	2
CO2	3	3	3	2	1	2	1	1	2	1	2	3	3	2
CO3	3	3	3	3	2	2	2	1	2	2	1	3	3	3
CO4	3	3	2	2	2	2	2	2	2	2	1	3	3	3

Course Contents:

Module 1 (8L)

Importance of food chemistry; Food Groups; Water in foods and its properties: different types of moisture in food; Water activity, Determination of moisture content, water absorption isotherm.

Carbohydrate: Sources of food carbohydrates; Classifications; Structure, Physico-chemical and functional properties: Monosaccharides, Disaccharides, Oligosaccharides, Polysaccharides, homosachharides and heterosachharides; Starch: Structure, sources, properties (hydrolysis, gelatinization, retrodradation, dextrinisation, crystallization); Glycogen: definition, properties, Cellulose, pectin, gums: Occurrences, properties, uses.

Module 2 (8L)

Proteins: Sources, Basic structure and physico-chemical and functional properties: Amphoterism, hydration, binding of ions, precipitation with antibiotics, gel formation, Different types of food proteins. Purification of proteins (basic concepts): Electrophoresis, Gel filtration Spectrophotometric analysis, Chromatographic analysis. Amino acids: Essential and non-essential amino acids, their structures, deficiency diseases; Acidic and basic amino acids.

Module 3 (8L)

Fats: Sources; Classifications; Fatty acids: Classifications with examples and structure (SAFA, MUFA, PUFA); Omega 3 and Omega 6 fatty acids. Physico-chemical and functional properties; Rancidity: Definition, types of rancidity of fats and oils; Reversion of fats; Antioxidants: Definition, examples, roles; Saponification number, iodine value, Reichert-Meissl number, Polenske value; Lipids of biological importance like cholesterol and phospholipids.

Module 4 (8L)

Minerals and Vitamins: Sources and structures of minerals & vitamins; Effect of processing and storage of vitamins; Provitamins A&D; Vitamins as antioxidants. Food Pigments & Flavouring Agent: Importance, types and sources of pigments (Chlorophyll, Carotenoids, anthocyanin, and flavonoids)− their changes during processing and storages.

Revision: (4L)

Textbooks:

1. Food Chemistry by H. K. Chopra & P. S. Panesar, 2nd reprint 2015
2. Essentials of Food & Nutrition by Swaminathan, Vol. 1 &2, 2nd edition
3. Food Chemistry by L. H. Meyer, reprint 2004

Reference books:

1. Food Science by Norman N. Potter & Joseph H. Hotchkiss, 5th edition
2. Hand Book of Analysis of fruits & vegetables by S. Ranganna Chemical changes in food during processing by Richardson

Course Name: Engineering Physics

Course Code: PH101

Contact (L: T: P): 3 : 0 : 0

Total Contact Hours: 36

Credit: 3

Prerequisites: Knowledge of Physics up to 12^{th} standard.

Course Objectives:

The objective of the course is to make the students able to –

O1: **Provide foundational understanding** of core physical principles such as optics, quantum mechanics, solid-state physics, and statistical mechanics relevant to engineering disciplines.

O2: **Develop the ability** to apply theoretical knowledge of physical sciences in interpreting engineering phenomena and solving problems using scientific reasoning and quantitative analysis.

O3: **Expose students to the working principles** of modern devices and technologies like lasers, fiber optics, semiconductors, and nanomaterials used in engineering and industrial applications.O4: **Encourage scientific curiosity and innovation** by connecting physical theories with practical tools and techniques in emerging fields like nanotechnology and quantum systems.

O5: **Understand the role of physics** in interdisciplinary domains for the advancement of science, technology, and sustainable development through real-life engineering contexts.

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	*Explain* the principles of lasers, fibre optics, and holography and *apply* them in modern optical and communication systems.
CO2	*Identify* different crystal structures and *compute* structural parameters such as Miller indices and packing factors; *distinguish* between metals, semiconductors, and insulators using band theory.
CO3	*Utilize* the principles of quantum theory, wave-particle duality, and Schrödinger equation—to *interpret* fundamental quantum phenomena.
CO4	*Illustrate* the basic concepts of statistical mechanics and e*xamine* their implications on microscopic particle behaviour.
CO5	*Describe* the properties of nanomaterials and display/storage devices and *analyze* their applications in modern technology.

CO-PO Mapping:

CO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2	PSO 3
CO 1	3								2		2			
CO 2	3	3							2		2			
CO 3	3	3							2		2			
CO 4	3	3							2		2			
CO 5	3	3							2		2			

Course Content:

Module 1: Modern Optics (11L)

1.01- Laser: Concepts of various emission and absorption processes, Einstein A and B coefficients and

equations, working principle of laser, metastable state, population inversion, condition necessary for active laser action, optical resonator, illustrations of Ruby laser, He-Ne laser, Semiconductor laser, applications of laser, related numerical problems. 6L

1.02-Fibre Optics-Principle and propagation of light in optical fibers (Step index, Graded index, single and multiple modes) - Numerical aperture and Acceptance angle, Basic concept of losses in optical fiber, related numerical problems. 3L

1.03—Holography: Theory of holography (qualitative analysis), viewing of holography, applications.

2L

Module 2: Solid State Physics (5L)

2.01 Crystal Structure: Structure of solids, amorphous and crystalline solids (definition and examples), lattice, basis, unit cell, Fundamental types of lattices –Bravais lattice, simple cubic, fcc and bcc lattices, Miller indices and miller planes, co-ordination number and atomic packing factor, Bragg's equation, applications, numerical problems. 3L

2.02 Semiconductor: Physics of semiconductors, electrons and holes, metal, insulator and semiconductor, intrinsic and extrinsic semiconductor, p-n junction. 2L

Module 3: Quantum and Statistical Mechanics (14L)

3.01 Quantum Theory: Inadequacy of classical physics-concept of quantization of energy, particle concept of electromagnetic wave (example: Black body radiation, Photoelectric and Compton Effect: no derivation required), wave particle duality; phase velocity and group velocity; de Broglie hypothesis; Davisson and Germer experiment, related numerical problems. 5L

3.02 Quantum Mechanics 1: Concept of wave function, physical significance of wave function, probability interpretation; normalization of wave functions-Qualitative discussion; uncertainty principle, relevant numerical problems, Introduction of Schrödinger wave equation (only statement). 4L

3.03 Statistical Mechanics

Concept of energy levels and energy states, phase space, microstates, macrostates and thermodynamic probability, MB, BE, FD, statistics (Qualitative discussions)-physical significance, conception of bosons, fermions, classical limits of quantum statistics, Fermi distribution at zero & non-zero temperature, Concept of Fermi level-Qualitative discussion. 5L

Module 4: Physics of Nanomaterials (4L)

Reduction of dimensionality, properties of nanomaterials, Quantum wells (two dimensional), Quantum wires (one dimensional), Quantum dots (zero dimensional); Quantum size effect and Quantum confinement. Carbon allotropes. Application of nanomaterials (CNT, graphene, electronic, environment, medical).

Module 5: Storage and display devices (2L)

Different storage and display devices-Magnetic storage materials, Operation and application of CRT, CRO, LED and OLED.

Text book:

1. Concepts of Modern Engineering Physics- A. S. Vasudeva. (S. Chand Publishers)
2. Engineering Physics - Rakesh Dogra
3. Introduction to Nanoscience and Nanotechnology, An Indian Adaptation-Charles P. Poole, Jr., Frank J.
Owens.
4. Quantum Mechanics – S. N. Ghosal

5. Nanotechnology – K. K. Chattopadhyay

Reference Books:

1. Optics - Ajay Ghatak (TMH)

2. Solid state Physics - S. O. Pillai

3. Quantum mechanics -A.K. Ghatak and S Lokenathan

4. Fundamental of Statistical Mechanics: B. B. Laud

6. Perspective & Concept of Modern Physics—Arthur Beiser

Course Name: Engineering Mathematics - I

Course Code: M101

Contact (L: T: P): 3 : 0 : 0

Total Contact Hours: 36

Credit: 3

Prerequisites:

The students to whom this course will be offered must have the understanding of (10+2) standard algebraic operations, coordinate geometry, and elementary calculus concepts including limits, continuity, differentiation, and integration.

Course Objective(s):

The objective of the course is to make the students able to –

O1: Develop a strong foundation in both fundamental and advanced concepts of linear algebra and calculus essential for engineering applications.

O2: Build competency in applying integration techniques in multiple dimensions, including line, surface, and volume integrals, to solve problems relevant to engineering and applied sciences.

O3: Gain proficiency in analyzing multivariable functions using differentiation techniques such as partial and total derivatives, Jacobians, and methods for finding extrema.

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	Apply linear algebra methods to perform matrix operations, classify matrix structures, solve systems of linear equations, and compute eigenvalues and eigenvectors in engineering contexts.
CO2	Apply differential and integral calculus to evaluate and approximate the behavior of single-variable and multivariable real-valued functions relevant to engineering scenarios.
CO3	Analyze the properties of eigenvalues and eigenvectors to assess matrix diagonalizability and interpret linear transformations using the Cayley-Hamilton theorem in engineering systems.
CO4	Analyze single-variable and multivariable real-valued functions using differential and integral calculus to model and interpret complex behavior in engineering applications.

CO-PO Mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	2	-	-	-	-	-	-	-	-	1			
CO2	3	2	-	-	-	-	-	-	-	-	1			
CO3	3	3	1	1	-	-	-	-	-	-	2			
CO4	3	3	1	1	-	-	-	-	-	-	2			
M101	**3**	**2.5**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1.5**			

Course Content:

Module I: Liner Algebra (11L)

Echelon form and normal (canonical) form of a matrix; Inverse and rank of a matrix; Consistency and inconsistency of system of linear equations, Solution of system of linear equations; Eigenvalues and eigenvectors; Diagonalization of matrix, Cayley-Hamilton theorem.

Module II: Single Variable Calculus (5L)

Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Taylor's series.

Module III: Multivariable Calculus (Differentiation) (13L)

Function of several variables; Concept of limit, continuity and differentiability; Partial derivatives, Total derivative and its application; chain rules, Derivatives of implicit functions Euler's theorem on homogeneous function; Jacobian; Maxima and minima of functions of two variables.

Module IV: Multivariable Calculus (Integration) (7L)

Double Integral, Triple Integral; Change of order in multiple integrals; Line Integral, Surface Integral, Volume Integral. Change of variables in multiple integrals.

Text Books:

1. Higher Engineering Mathematics, Grewal, B.S., Khanna Publishers, 36th Edition, 2010.
2. Advanced Engineering Mathematics, 9th Edition, Kreyszig, E., John Wiley & Sons, 2006.

Reference Books:

1. A text book of Engineering Mathematics-I, Guruprasad, S., New age International Publishers.
2. Higher Engineering Mathematics, Ramana, B.V., Tata McGraw Hill New Delhi, 11th Reprint, 2010.
3. Engineering Mathematics for first year, Veerarajan, T., Tata McGraw-Hill, New Delhi, 2008.
4. A text book of Engineering Mathematics, Bali, N.P. and Goyal, M., Laxmi Publications, Reprint, 2008.
5. Calculus and Analytic geometry, 9th Edition, Thomas, G.B. and Finney, R.L., Pearson, Reprint, 2002.
6. Calculus, Volumes 1 and 2 (2nd Edition), Apostol, M., Wiley Eastern, 1980.
7. Linear Algebra - A Geometric approach, Kumaresan, S., Prentice Hall of India, 2000.
8. Linear Algebra: A Modern Introduction, 2nd Edition, Poole, D., Brooks/Cole, 2005.
9. Schaum's Outline of Matrix Operations, Bronson, R., 1988.
10. Differential and Integral Calculus, Vol. I & Vol. II, Piskunov, N., Mir Publishers, 1969.

Course Name: Environmental Science

Course Code: HU101

Contact (L: T: P): 2: 0 : 0

Total Contact Hours: 24

Credit: 2

Prerequisites: 10+2

Course Objective (s):

This course will enable the students to,

O1: Realize the importance of environment and its resources.

O2: Apply the fundamental knowledge of science and engineering to assess environmental and health risk.

O3: Know about environmental laws and regulations to develop guidelines and procedures for health and safety issues.

O4: Solve scientific problem-solving related to air, water, land and noise pollution.

Course Outcome (s):

CO1	Able to understand the natural environment and its relationships with human activities
CO2	The ability to apply the fundamental knowledge of science and engineering to assess environmental and health risk
CO3	Ability to understand environmental laws and regulations to develop guidelines and procedures for health and safety issues
CO4	Acquire skills for scientific problem-solving related to air, water, noise & land pollution

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	3	-	-	2	3	1	-	-	1
CO2	3	3	3	1	1	2	3	1	-	-	1
CO3	3	3	3	2	1	2	3	1	-	-	1
CO4	1	3	3	-	-	2	1	1	-	-	1
CO5	1	3	3	-	-	2	1	1	-	-	1

Course Content:

Module I - Resources and Ecosystem (6L)

1. Resources (4L)

Types of resources, Human resource, Population Growth models: Exponential Growth, Logistic growth curve with explanation. Maximum Sustainable Yield [Derivation]Alternative sources of Energy [Solar energy, tidal energy, geothermal energy, biomass energy]

2. Ecosystem (2L)

Components of ecosystem, types of ecosystem, Forest ecosystem, Grassland ecosystem, Desert ecosystem, Pond eco system, Food chain, Food web.

Module II – Environmental Degradation (10L)

1. Air Pollution and its impact on Environment (3L)

Air Pollutants, primary & secondary pollutants, Criteria pollutants, Smog, Photochemical smog and London smog, Greenhouse effect, Global Warming, Acid rain, Ozone Layer Depletion.

2. Water Pollution and its impact on Environment (4L)

Water Pollutants, Oxygen demanding wastes, heavy metals, BOD [Rate equation], COD, Eutrophication, Hardness, Alkalinity, TDS and Chloride, Heavy metal (As, Hg, Pb) poisoning and toxicity. Numerical on BOD, Hardness.

3. Land Pollution and its impact on Environment (1L)

Solid wastes, types of Solid Waste, Municipal Solid wastes, hazardous wastes, bio-medical wastes, E-wastes,

4. Noise Pollution and its impact on Environment (2L)

Types of noise, Noise frequency, Noise pressure, Measurement of noise level and decibel (dB) Noise intensity, Noise Threshold limit, Effect of noise pollution on human health. Numerical on Measurement of noise level and decibel (dB) and Noise Threshold limit.

Module III – Environmental Management (6L)

1. Environmental Impact Assessment (1L)

Environmental Auditing, Environmental laws and Protection Acts of India, carbon footprint, Green building practices. *(GRIHA norms)*

2. Pollution Control and Treatment (2L)

Air Pollution controlling devices, Catalytic Converter, Electrostatic Precipitator. WasteWater Treatment (Surface water treatment &Activated sludge process), Removal of hardness of water (Temporary &Permanent -Permutit process).

3. Waste Management (3L)

Solid waste management, Open dumping, Land filling, incineration, composting & Vermicomposting, E-waste management, and Biomedical Waste management.

Module IV – Disaster Management (2L)

1. Study of some important disasters (1L)

Natural and Man-made disasters, earthquakes, floods drought, landslide, cyclones, volcanic eruptions, tsunami, oil spills, forest fires.

2. Disaster Management Techniques (1L)

Basic principles of disaster management, Disaster Management cycle, Disaster management policy, Awareness generation program

Text Books:

1. Basic Environmental Engineering and Elementary Biology (For MAKAUT),

Gourkrishna Dasmohapatra, Vikas Publishing.

2. Basic Environmental Engineering and Elementary Biology, Dr. Monindra Nath Patra & Rahul Kumar Singha, Aryan Publishing House.

3. Textbook of Environmental Studies for Undergraduate Courses, Erach Barucha for UGC, Universities Press

Reference Books:

1. A Text Book of Environmental Studies, Dr. D.K. Asthana & Dr. Meera Asthana, S.Chand Publications.

2. Environmental Science (As per NEP 2020), Subrat Roy, Khanna Publisher

Course Name: Indian Knowledge System

Course Code: HU102

Contact (L: T: P): 1: 0 : 0

Total Contact Hours: 12

Credit: 1

Course Objectives:

The objective of this course is to make the students able to—

O1: understand the extent and aspects of ancient Indian cultural, philosophical and scientific heritage.

O2: explore the philosophical roots of Indian knowledge, the scientific temper and quest for advanced understanding of the universe and deeper knowledge of the self.

O3: identify and describe the Indian scientific and technological tools, techniques and discoveries and assess their significance and continuing relevance.

O4: develop a liberality and open-mindedness of outlook to foster lifelong learning.

O5: acquire the skills to apply traditional knowledge in their everyday lives.

Course outcome: After successful completion of the course, students will be able to

CO1	define, identify, describe and classify the philosophical, literary and socio-religious heritage of ancient India and the core concepts of the Vedic corpus and way of life.
CO 2	discover, enumerate, compare, contrast and categorize the importance of pioneering developments in science and mathematics and evaluate their continuing relevance.
CO 3	analyze, appraise, correlate and describe the ancient Indian heritage in science and technology and examine technological correlations with present-day technological applications.
CO4	discover, assess and describe traditional knowledge in health care, architecture, agriculture and other sectors and to explore the history of traditional Indian art forms.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	1	2	-	3	-	3
CO2	2	-	1	-	-	2	-	-	3	-	3
CO3	3	1	1	1	2	3	-	-	3	-	3
CO4	2	-	1	-	2	3	-	-	3	-	3

Course Content:

Module-1 An overview of Indian Knowledge System (IKS): (3L)

Importance of Ancient Knowledge - Definition of IKS - Classification framework of IKS - Unique aspects of IKS.

The Vedic corpus: Vedas and Vedangas - Distinctive features of Vedic life.

Indian philosophical systems: Different schools of philosophy (Orthodox and Unorthodox).

Module-2 Salient features of the Indian numeral system: (3L)

Developments in Indian Mathematics in ancient India - Importance of decimal representation - The discovery of zero and its importance - Unique approaches to represent numbers- Contribution of ancient Indian mathematicians

Highlights of Indian Astronomy: Historical development of astronomy in India- key contributions of ancient Indian astronomers.

Module-3 Indian science and technology heritage: (3L)

Metals and metalworking - Mining and ore extraction –Structural engineering and architecture in ancient India: planning, materials, construction and approaches- Dyes and painting; Shipbuilding.

Module-4 Traditional Knowledge in Different Sectors: (3L)

Traditional knowledge and engineering. Traditional Agricultural practices (resources, methods, technical aids); Traditional Medicine and Surgery; History of traditional Art forms and Culture.

Text Books:

1. Amit Jha . *Traditional Knowledge System in India*. New Delhi: Atlantic Publishers, 2024.

2. B. Mahadevan, Vinayak Rajat Bhat, Nagendra Pavana . *Introduction to Indian Knowledge System: Concepts and Applications*. New Delhi: PHI, 2022.

3. Angad Godbole. *Science and Technology in Ancient India*. New Delhi: Biblia Implex, 2023.

4. Pritilakshmi Swain. *Indian Knowledge System*. New Delhi: Redshine Publication, 2024.

5. Vishnudut Purohit. *Fundamentals of Indian Knowledge System*. New Delhi: ABD Publishers, 2024.

Reference Books:

1. A. L. Basham. *The Wonder that was India*. Vol. I. New Delhi: Picador, 2019.

2. Arun Kumar Jha and Seema Sahay ed. *Aspects of Science and Technology in Ancient India.* Oxford and New Delhi: Taylor and Francis, 2023.

3.Kapil Kapoor and Awadhesh Kumar Singh. *Indian Knowledge Systems*. Vols. 1 and 2. New Delhi: D. K. Printworld, 2005.

4. S. N. Sen and K. S. Shukla, *History of Astronomy in India*. New Delhi: Indian National Science Academy, 2nd edition, 2000.

5. Arpit Srivastava. *Indian Knowledge System*. Rewa: AKS University, 2024.

Course Name: Chemistry of Food Lab I

Course Code: FT191

Contact (L: T: P): 0 : 0 : 3

Credit: 1.5

Pre requisites: Engineering Chemistry

Course Objective:

The objective of the course is to make the students able to –

O1: Define food chemistry as the study of the composition, structure, and properties of food materials.

O2: Identify suitable methods and instruments used in the study of food chemistry for quality assessment.

O3: Prioritize and apply different quality-controlling parameters to improve shelf-life and prevent food adulteration.

Course Outcomes:

CO1	**Apply** standard analytical techniques to determine proximate composition (moisture, protein, ash, fat) in various food samples.
CO2	**Employ** instrumental and classical methods to assess quality parameters in milk and other beverages, including fat content, pH, and acidity.
CO3	**Analyze** food samples for nutritional components such as sugars and Vitamin C using appropriate chemical analysis techniques.
CO4	**Create** an innovative experiment related to food analysis, integrating scientific reasoning and practical skills.

CO-PO-PSO Mapping:

COs	**Program Outcomes (PO)**											**Program Specific Outcomes (PSO)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	1	–	–	2	2	2	1	3	2	3	2	2
CO2	3	2	2	1	–	3	2	1	2	3	2	3	3	2
CO3	3	2	2	2	2	2	2	2	2	3	1	3	3	2
CO4	3	3	2	2	1	–	–	–	–	2	2	3	3	3

List of Experiment:

1. Determination of Moisture in food sample
2. Determination of Protein in food sample
3. Determination of Ash in food sample
4. Determination of Crude Fat in food sample by Soxhlet apparatus.
5. Determination of fat present in liquid milk by Gerber centrifuge.
6. Determination of Acidity and pH in food sample/beverages
7. Determination of total, non-reducing and reducing sugars in food sample
8. Determination of Vitamin C in food sample
9. Innovative experiment

Text books:

1. Essentials of Food & Nutrition by Swaminathan, Vol. 1 &2, 2nd edition
2. Food Chemistry by L. H. Meyer, reprint 2004, 2nd reprint 2015

Reference books:

1. Food Science by Norman N. Potter & Joseph H. Hotchkiss, 5th edition
2. Food Chemistry by H. K. Chopra & P. S. Panesar,
3. Hand Book of Analysis of fruits & vegetables by S. Ranganna
4. Chemical changes in food during processing by Richardson

Course Name: Engineering Physics Lab

Course Code: PH191

Contact (L: T: P): 0 : 0 : 3

Credit: 1.5

Prerequisites: Knowledge of Physics up to 12^{th} standard.

Course Objective(s):

The objective of the course is to make the students able to –

O1: **Become familiar with scientific instruments and measurement techniques** used to determine various physical parameters of materials and systems.

O2: **Reinforce theoretical concepts learned in classroom physics** by performing related practical experiments and observing real-time outcomes.

O3: **Develop a systematic and analytical approach** to collecting, organizing, and interpreting experimental data for error analysis and validation of physical laws.

O4: **Engage in the experimental validation of physical laws** through laboratory activities involving classical mechanics, optics, electronics, and quantum phenomena.

O5: **Encourage innovation and problem-solving abilities** through hands-on investigation of advanced and application-oriented physics experiments, including specially designed extension activities.

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	*Determine* mechanical properties such as Young's modulus and rigidity modulus through hands-on experiments and *analyze* material behaviour under applied forces.
CO2	*Perform* optical experiments including Newton's Rings, laser diffraction, and optical fiber characterization, and *interpret* the results based on wave optics principles.
CO3	*Investigate* quantum effects such as the photoelectric effect and atomic transitions, and *relate* experimental outcomes to basic quantum principles.
CO4	*Study* the performance of semiconductor and electronic devices like solar cells, LEDs, and LCR circuits, and *investigate* their operational characteristics.
CO5	*Conduct* experiments such as Hall Effect, e/m determination, prism dispersion, or optical rotation to *demonstrate* the application of advanced physical principles in practical scenarios.

CO-PO Mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2	PSO 3
CO 1	3	3						3	2		2			
CO 2	3	3			3			3	2		2			
CO 3	3				3			3	2		2			
CO 4	3	3			3			3	2		2			
CO 5	3	3			3			3	2		2			

Course Content:

Module 1: General idea about Measurements and Errors (One Mandatory)

a) Error estimation using Slide callipers/ Screw-gauge/travelling microscope for one experiment.

Module 2: Experiments on Classical Physics (Any 4 to be performed from the following experiments)

1. Study of Torsional oscillation of Torsional pendulum & determination of time using various load of the oscillator.
2. Determination of Young's moduli of different materials.
3. Determination of Rigidity moduli of different materials.
4. Determination of wavelength of light by Newton's ring method.
5. Determination of wavelength of light by Laser diffraction method.
6. Optical Fibre-numerical aperture, power loss.

Module 3: Experiments on Quantum Physics (Any 2 to be performed from the following experiments)

7. Determination of Planck's constant using photoelectric cell.
8. Verification of Bohr's atomic orbital theory through Frank-Hertz experiment.
9. Determination of Stefan's Constant.
10.
    a) Study of characteristics of solar cell (illumination, areal, spectral)

b) Study of characteristics of solar cell (I-V characteristics, Power-load characteristics, Power-wavelength characteristics)

Module 4: Perform at least one of the following experiments

11. Determination of Q factor using LCR Circuit.
12. Study of I-V characteristics of a LED/LDR.
13. Determination of band gap of a semiconductor.

**In addition, it is recommended that each student should carry out at least one experiment beyond the syllabus/one experiment as Innovative experiment.

Module 5: Probable experiments beyond the syllabus

1. Determination of the specific charge of the electron (e/m) from the path of an electron beam by Thomson method.
2. Determination of Hall co-efficient of a semiconductor and measurement of Magnetoresistance of a given semiconductor3. Study of dispersive power of material of a prism.
3. Determination of thermal conductivity of a bad/good conductor using Lees-Charlton / Searle apparatus.
4. Determination of the angle of optical rotation of a polar solution using polarimeter.
5. Any other experiment related to the theory.

Text book:

1. Practical Physics by Chatterjee & Rakshit (Book & Allied Publisher)
2. Practical Physics by K.G. Mazumder (New Central Publishing) 3. Practical Physics by R. K. Kar (Book & Allied Publisher)

Course Name: Engineering Graphics & Computer Aided Design Lab

Course Code: ME194

Contact (L: T: P): 0 : 0 : 3

Credit: 1.5

Prerequisites: Basic knowledge of geometry

Course objectives:

The objective of the course is to teach detailed engineering drawing and modeling of a component or system for a given dimension or constraints through ample understanding of engineering views, projections and sections. It will help students to acquire the manual drawing techniques as well as computer aided graphics skills, using modern engineering tools to communicate their design effectively in industries.

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

CO1	Use common drafting tools with the knowledge of drafting standards
CO2	Understand the concepts of engineering scales, projections, sections.
CO3	Apply computer aided drafting techniques to represent line, surface or solid models in different Engineering viewpoints
CO4	Produce part models; carry out assembly operation and represent a design project work.

CO-PO Mapping:

COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**
CO1	-	-	3	-	2	1	-	2	-	1	-
CO2	-	-	3	-	2	1	-	2	-	1	-
CO3	-	-	3	-	3	1	-	2	-	2	-
CO4	-	-	3	-	3	1	-	2	-	2	-

Course Contents:

Basic Engineering Graphics: **3P**

Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Module 1: Introduction to Engineering Drawing **6P**

Principles of Engineering Graphics and their significance, Usage of Drawing instruments, lettering, Conic sections including Rectangular Hyperbola (General method only); Cycloid, Epicycloid and Involute; Scales – Plain, Diagonal and Vernier Scales.

Module 2: Orthographic & Isometric Projections **6P**

Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes on inclined Planes - Auxiliary Planes; Projection of Solids inclined to both the Planes- Auxiliary Views; Isometric Scale, Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice- versa.

Module 3: Sections and Sectional Views of Right Angular Solids **6P**

Drawing sectional views of solids for Prism, Cylinder, Pyramid, Cone and project the true shape of the sectioned surface, Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw sectional orthographic views of objects from industry and dwellings (foundation to slab only).

Computer Graphics: **3P**

Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modeling; Solid Modeling.

Module 4: Overview of Computer Graphics **3P**

Demonstration of CAD software [The Menu System, Toolbars (Standard, Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), Zooming methods, Select and erase objects].

Module 5: CAD Drawing, Customization, Annotations, layering 6P

Set up of drawing page including scale settings, ISO and ANSI standards for dimensioning and tolerance; Using various methods to draw straight lines, circles, applying dimensions and annotations to drawings; Setting up and use of Layers, changing line lengths (extend/lengthen); Drawing sectional views of solids; Drawing annotation, CAD modeling of parts and assemblies with animation, Parametric and nonparametric solid, surface and wireframe modeling, Part editing and printing documents.

Module 6: Demonstration of a simple team design project 3P

Illustrating Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; use of solid-modeling software for creating associative models at the component and assembly levels.

Text Books:

1. Bhatt N.D., Panchal V.M. & Ingle P.R, (2014), Engineering Drawing, Charotar Publishing House
2. K. Venugopal, Engineering Drawing + AutoCAD, New Age International publishers

Reference Books:

1. Pradeep Jain, Ankita Maheswari, A.P. Gautam, Engineering Graphics & Design, Khanna Publishing House
2. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication.
3. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.

Course Name: Communication & Presentation Skill

Course Code: HU191

Contact (L: T: P): 0 : 0 : 3

Credit: 1.5

Pre requisites: Basic knowledge of LSRW skills.

Course Objectives: The objectives of the course are to make the students able to-

O1: acquire interpersonal communication skills of listening comprehension and speaking in academic and professional situations.

O2: understand English pronunciation basics and remedy errors.

O3:operate with ease in reading and writing interface in global professional contexts.

O4:deliver professional presentations before a global audience.

O5:develop confidence as a competent communicator.

Course Outcome:

After successful completion of the course, the students will be able to:

CO1	Recognize, identify and express advanced skills of Technical Communication in English and Soft Skills through Language Laboratory.
CO2	Understand, categorize, differentiate and infer listening, speaking, reading and writing skills in societal and professional life.
CO3	Analyze, compare and adapt the skills necessary to be a competent interpersonal communicator in academic and global business environments.
CO4	Deconstruct, appraise and critique professional writing documents, models and templates.
CO5	Adapt, negotiate, facilitate and collaborate with communicative competence in presentations and work-specific conclaves and interactions in the professional context.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	-	-	1	2	3	-
CO2	-	2	-	-	-	2	-	-	-	3	-
CO3	-	-	-	-	-	2	-	-	3	3	-
CO4	-	2	-	-	-	-	-	3	-	3	-
CO5	-	-	-	-	-	3	-	-	3	3	-

Course Contents:

Module 1: Introduction Theories of Communication and Soft Skills

a. Communication and the Cyclic Process of Communication (Theory, benefits and application)

b. Introduction to Workplace Communication (Principles and Practice)

c. Non-Verbal communication and its application

c. Soft Skills Introduction: Soft-Skills Introduction

What is Soft Skills? Significance of Soft-Skills

Soft-Skills Vs. Hard Skills

Components of Soft Skills

Identifying and Exhibiting Soft-Skills (Through classroom activity)

Module 2: Active Listening

a. What is Active Listening?

b. Listening Sub-Skills—Predicting, Clarifying, Inferencing, Evaluating, Note-taking

c. Differences between Listening and Hearing, Critical Listening, Barriers to Active Listening, Improving Listening.

d. Listening in Business Telephony and Practice

Practical (Role plays, case studies)

Module 3: Speaking Skills

a. Effective Public Speaking: Public Speaking, Selecting the topic for public speaking, (Understanding the audience, Organizing the main ideas, Language and Style choice in the speech, delivering the speech, Voice Clarity). Practical (Extempore)

Self Learning Topics: Preparation, Attire, Posture and Delivery techniques

b. Pronunciation Guide—Basics of Sound Scripting, Stress and Intonation

c. Fluency-focused activities—JAM, Conversational Role Plays, Speaking using Picture/Audio

Visual inputs

d. Group Discussion: Principles, Do’s and Don’ts and Practice;

Module 4: Writing and Reading Comprehension

a. Reading and Writing a Book Review (classroom activity)

b. Writing a Film Review after watching a short film (classroom activity)

c. Reading Strategies: active reading, note-taking, summarizing, and using visual aids like diagrams and graphs

d. Solving Company-Specific Verbal Aptitude papers.(Synonyms, Antonyms, Error Correction and RC Passages)

Module 5: Presentation Skills

Kinds of Presentation. Presentation techniques, planning the presentation,

Structure of presentation: Preparation, Evidence and Research, Delivering the presentation, handling questions, Time management, Visual aids.

- Self Introduction, Creation of Video Resume`
- Need for expertise in oral presentation.•Assignment on Oral presentation.
- Rules of making micro presentation (power point). Assignment on micro presentation

Text Books:

1. Pushp Lata and Sanjay Kumar. *A Handbook of Group Discussions and Job Interviews*. New Delhi: PHI, 2009.

2. Jo Billingham. *Giving Presentations*. New Delhi: Oxford University Press, 2003.

3. B. Jean Naterop and Rod Revell. *Telephoning in English*. 3rd ed. Cambridge: Cambridge University Press, 2004.

4. Jeyaraj John Sekar. *English Pronunciation Skills: Theory and Praxis*. New Delhi: Authorspress, 2025.

5. Career Launcher. *IELTS Reading: A Step-by-Step Guide*. G. K. Publications. 2028

Reference Books:

1. Ann Baker. *Ship or Sheep? An Intermediate Pronunciation Course*. Cambridge: Cambridge University Press, 2006.

2. Barry Cusack and Sam McCarter. *Improve Your IELTS: Listening and Speaking Skills.* London: Macmillan, 2007.

3. Eric H. Glendinning and Beverly Holmström. *Study Reading.* Cambridge: Cambridge University Press, 2004.

4.Malcolm Goodale. *Professional Presentations*. New Delhi: Cambridge University Press, 2005.

5. Mark Hancock. *English Pronunciation in Use*. Cambridge: Cambridge University Press, 2003.

6. Tony Lynch, *Study Listening*. Cambridge: Cambridge University Press, 2004.

7. J. D. O'Connor. *Better English Pronunciation*. Cambridge: Cambridge University Press, 2005.

8. Peter Roach. *English Phonetics and Phonology: A Practical Course*. Cambridge: Cambridge University Press, 2000.

1st Year 2nd Semester									
Sl. No.	**Broad Category**	**Category**	**Paper Code**	**Subject**	**Contact Hours/Week**				**Credit Points**
					L	**T**	**P**	**Total**	
A. THEORY									
1	ENGG	Major	FT201	Food Microbiology	3	0	0	3	3
2	ENGG	Major	FT202	Biochemistry and Nutrition	3	0	0	3	3
3	ENGG	Minor	CS202	Introduction to Artificial Intelligence	2	0	0	2	2
4	SCI	Multidisciplinary	CH201	Engineering Chemistry	2	0	0	2	2
5	SCI	Multidisciplinary	M201	Engineering Mathematics –II	3	0	0	3	3
6	HUM	Value Added Course	HU205	Constitution of India & Professional Ethics	1	0	0	1	1
7	HUM	Ability Enhancement Course	HU203	Design Thinking & Innovation	1	0	0	1	1
B. PRACTICAL									
1	ENGG	Major	FT291	Food Microbiology lab	0	0	3	3	1.5
2.	ENGG	Major	FT292	Biochemistry and Nutrition Lab	0	0	3	3	1.5
3	SCI	Skill Enhancement Course	CH291	Engineering Chemistry Lab	0	0	2	2	1
4	ENGG	Skill Enhancement Course	ME293	IDEA LAB Workshop	0	0	3	3	1.5
5	ENGG	Minor	CS292	Introduction to Artificial Intelligence Lab	0	0	3	3	1.5
C. MANDATORY ACTIVITIES / COURSES									
1	MC	Mandatory Course	MC281	NSS/ Physical Activities / Meditation & Yoga / Photography/ Nature Club	0	0	0	0	0
Total of Theory, Practical								**29**	**22**
Total Credit in 1st year									**40**

Course Name: Food Microbiology

Course Code: FT201

Contact: 3:0:0

Total Contact Hours: 36

Credit: 3

Pre-requisites: Biology, Life Science

Course Objective:

The objective of the course is to make the students able -

O1: To familiarize students with procedures and techniques used to detect and enumerate microorganisms in foods.

O2: To develop an understanding of spoilage microorganisms and their effects on food.

O3: To integrate their basic knowledge of microbiology, chemistry, biochemistry, food processing.

Course outcome(s):

After the completion of the course, students will be able to:

CO1	Understand different types of microorganisms that are present in the environment with special reference to food.
CO2	Describe the internal and external factors and predict the growth of microorganisms, which can cause food spoilage.
CO3	Interpret the microbiology of various food materials and causes of foodborne diseases and their etiology.
CO4	Evaluate the measures required to control undesired microorganisms in food based on the knowledge about disinfection and disinfectants.

CO-PO-PSO Mapping:

COs	**Program Outcomes (PO)**											**Program Specific Outcomes (PSO)**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	2	2	2	-	-	2	-	-	1	3	3	3	3
CO2	3	2	2	2	2	1	-	2	-	-	3	3	3	2
CO3	3	2	3	3	2	2	2	1	-	1	3	3	2	1
CO4	2	2	3	3	-	1	-	-	2	1	3	3	2	3

Course Contents:

Module 1 (8L)

Introduction – definition, significance of food microbiology; Microscope; Classification & morphology of microbes, including pathogens and non-pathogens; Techniques of pure culture; Bacterial growth kinetics; Bacteriology of water, Microbial toxins, Biofilm formation.

Module 2 (8L)

Antimicrobial agents –physical & chemical–mechanism & action, Disinfection & disinfectants; Thermal inactivation of microbes; Concept, determination & importance of TDT, F, Z & D values; Factors affecting heat resistance; Control of biofilm; Pasteurization and sterilization.

Module 3 (8L)

Microbiology of milk & milk products like cheese, butter, Yoghurt; Prebiotics and probiotics, Probiotics in immunity and gut health, Concept of fermentation, bioconversion using microbes.

Module 4 (8L)

Basic microbiology and spoilage of meat, fish, poultry; Microbiology of fruits & vegetables and products like jam, jelly, juice; Microbiology of cereal and cereal products like bread, biscuits, confectionery.

Revision (4L)

Text Book:

1. Essentials of Microbiology; K. S. Bilgrami; CBS Publishers, Delhi, First Edition, 2019
2. Food Microbiology; WC Frazier; Tata McGraw Hill, Delhi, 5th Edition, 2017

Reference books:

1. Modern Food Microbiology; James M Jay; CBS Publishers, Delhi, 7th ed. 2004. Corr. 2nd printing2006
2. Microbiology; Pelczar, Chan and Krieg; Tata McGraw Hill, Delhi, 5th Edition, 2002
3. Food Microbiology; M. R.Adams , 2nd Edition, 2002
4. Hand Book of Microbiology; Bisen, 3rd Edition, 2003

Course Name: Biochemistry and Nutrition

Course Code: FT202

Contact: 3:0:0

Total Contact Hours: 36

Credit: 3

Pre-requisites: Biology, Chemistry

Course Objective:

The objective of the course is to make the students able-

O1: To introduce the students to the biological basis of nutrition and biomolecules

O2: To understand the mechanisms by which diet can influence health

O3: To develop laboratory skills required for modern biochemical and molecular studies of nutrition.

Course outcome(s):

After the completion of the course, students will be able to:

CO1	Understand the principles of biochemical processes and methods and be able to use them with appropriate application.
CO2	Describe the major metabolic pathways involved in the metabolism of nutrients in the human body.
CO3	Interpret the basis of reactivity of biologically relevant molecules and their interactions.
CO4	Evaluate the data for different biochemical and nutritional experimental procedures.

CO-PO-PSO Mapping:

COs	**Program Outcomes (PO)**											**Program Specific Outcomes (PSO)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	2	-	-	2	-	-	-	3	3	3	3
CO2	3	3	2	2	2	1	-	2	-	-	3	3	3	2
CO3	3	3	3	3	2	2	2	1	-	1	3	3	3	1
CO4	2	3	3	3	-	-	-	-	2	1	3	3	2	3

Course Contents:

Module 1 (8L)

Introduction to Biochemistry: Amino acids, Protein synthesis and protein structures; Trans amination; Metabolism of proteins (digestion and absorption); Nitrogen balance and nitrogen pool; Evaluation of quality of proteins: BV, PER, NPU, Chemical Score.

Module 2 (8L)

Enzymes; Definition, function, classification, nomenclature & structure; Co- enzymes and its function; Mechanism of enzyme action: Single, bi and multi substrate reactions; Lock and Key model, Induced fit model; Enzyme kinetics: MME, Significance of MM Constant, MME and Allosteric enzyme kintics; Enzyme inhibition: Reversible and Irreversible; LB Plot, Feedback inhibition, Substrate acts as inhibitor, Turn over number.

Module 3 (10L)

Carbohydrates; Photosynthetic pathway to produce glucose, Metabolic pathways for breakdown of carbohydrates: glycolytic pathway and its importance, energy yield; pentose phosphate pathway and its importance, energy yield; citric acid cycle and its importance, energy yield; Gluconeogenesis; Pathway, importance, energy yield, Cori cycle; Electron transport chain: Pathway, importance, Energy yield, Oxidative phosphorylation, ATP balance. Essential fatty acids, Metabolism of ketone bodies, alpha, beta and omega oxidation of fatty acids; Digestion & absorption of lipids.

Module 4 (6L)

Vitamins & minerals: Physiological function of vitamins and minerals. Introduction to human nutrition; Nutritive values of foods; Basal metabolic rate; Techniques for assessment of human nutrition, gastrointestinal absorption of nutrition, Dietary requirements and deficiency diseases of different nutrients, micronutrients, importance of nutraceuticals with some case studies.

Revision (4L)

Textbooks:

1. Lehninger, Nelson & Cox, Principle of Biochemistry, CBS Publication
2. Modern Experimental Biochemistry, Boyer, Pearson Education
3. Lubert stryer, Biochemistry, Freeman & Co, N.Y.

Reference books:

1. Voet & Voet, Fundamentals of Biochemistry, Jonh Willey &Sons
2. Instant Notes in Biochemistry by D. Hames & N. Hooper
3. Biochemistry by Debojyoti Das
4. Textbook of Biochemistry by E. S. West & W. R. Tod

Course Name: Introduction to Artificial Intelligence

Course Code: CS202

Contact: 2:0:0

Total Contact Hours: 24

Credit: 2

Course Objectives:

The objectives of this course are to enable students to

O1: Comprehend the fundamental concepts of Knowledge Representation and Inferencing in Artificial Intelligence and its utilitarian importance in current technological context.

O2: Formulate a problem as State-Space Exploration Framework or an Inferencing Framework of Artificial Intelligence.

O3: Use the strategies of AI-Heuristics to find acceptable solutions avoiding brute-force techniques.

O4: Design AI-Frameworks for Inferencing based on knowledge base.

O5: Analyze the effectiveness of AI-Inferencing Model in offering solutions to the respective problem.

Course Outcomes (COs):

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

CO1	Understand and explain the fundamental concepts of Knowledge Representation and Inferencing in Artificial Intelligence and its utilitarian importance in current technological context for further exploration leading towards lifelong learning.
CO2	Identify and formulate an engineering problem primarily to fit a State-Space Exploration Framework or an Inferencing Model/Agent Design Framework within the scope of Artificial Intelligence paradigm.
CO3	Explore relevant literature and apply the concept of Heuristic Techniques of Artificial Intelligence to solve problems.
CO4	Develop Inferencing Models for proposing solutions to the problems of Artificial Intelligence.
CO5	Implement Inferencing Models of Artificial Intelligence through developing feasible algorithms and investigate their effectiveness by analyzing their performances in solving the relevant problems.

CO-PO Mapping:

COs	Program Outcomes (PO)										
	PO 1	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	-	-	-	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-
CO3	2	2	3	2	-	-	-	-	-	-	-
CO4	2	2	2	3	-	-	-	-	-	-	2
CO5	2	2	3	3	2	-	-	-	-	-	2

Course Contents:

Module 1: Introduction to Artificial Intelligence (3 Lectures)

Why AI • Definition of AI • Goals of AI • History and evolution of AI • Types of AI: Narrow, General, Super • Human vs Artificial Intelligence • Applications of AI in various domains • AI for social good

Module 2: Intelligent Agents and Logic-Based Thinking (8 Lectures)

Intelligent systems • Agents and environments • Decision making using rules and logic • Symbolic AI concepts • Propositional Logic: Knowledge Representation and Inference using Propositional Logic • Predicate Logic: Knowledge Representation, Inference and Answer Extraction using First Order Predicate Logic

Module 3: Overview of AI Branches and Perception (8 Lectures)

Machine learning • Deep learning • Natural language processing • Computer vision • Expert systems • Fuzzy logic • Evolutionary algorithms • Reinforcement learning • Planning and scheduling • Human-AI collaboration

Module 4: Basics of Machine Learning (6 Lectures)

What is machine learning • AI vs ML • Types of learning: supervised, unsupervised • Concept of dataset, features, and labels • ML model and prediction flow • Common ML applications

• Introduction to decision trees (concept only) • ML pipeline overview.

Module 5: Applications and Ethics of AI (5 Lectures)

AI in robotics and automation • AI-enabled smart applications • Industry 4.0 and intelligent systems • AI in different sectors: healthcare, agriculture, transport, education, etc. • Human-AI teamwork • Basics of AI ethics: bias, fairness, privacy • Career opportunities and future scopes in AI.

Textbook:

1. Saptarsi Goswami , Amit Kumar Das , Amlan Chakrabarti - AI for Everyone: A Beginner's Handbook for Artificial Intelligence (AI), Pearson.
2. Rich, E., Knight, K and Shankar, B. 2009. Artificial Intelligence, 3rd edition, Tata McGraw Hill.
3. Russell , S. and Norvig , P. 2015. Artificial Intelligence - A Modern Approach, 3rd edition, Prentice
Hall.

Reference Books:

1. Reema Thareja, Artificial Intelligence: Beyond Classical AI, Pearson.
2. Patterson , Introduction to Artificial Intelligence and Expert Systems, Pearson.

Course Name: Engineering Chemistry

Course Code: CH201

Contact: 2:0:0

Total Contact Hours: 24

Credit: 2

Course Objective

O1: Understand the basic principles of atomic structures and periodic properties of elements, different engineering materials, advanced polymers.

O2: Apply the knowledge of free energy, energy storage device and semiconductors to design environment friendly and sustainable devices.

O3: Apply the concept of corrosion and fuel to improve its efficacy and application for industrial purpose.

O4: Analyze the organic reaction with the structure of organic molecules by applying the knowledge of different spectroscopic techniques.

O5: Evaluate the electrical, optical, and structural properties of semiconductors to analyze their potential applications in modern electronic and energy devices

Course Outcome

After successful completion of this course, students will be

CO1	Able to understand the basic principles of atomic structures and periodic properties of elements, different engineering materials, advanced polymers.
CO2	Able to apply the knowledge of free energy, energy storage device and semiconductors to design environment friendly and sustainable devices.
CO3	Able to apply the concept of corrosion and fuel to improve its efficacy and application for industrial purpose.
CO4	Able to analyze the organic reaction with the structure of organic molecules by applying the knowledge of different spectroscopic techniques.
CO5	Able to evaluate the electrical, optical, and structural properties of semiconductors to analyze their potential applications in modern electronic and energy devices.

CO-PO mapping

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	2	-	2
CO3	3	-	-	-	-	-	-	-	2	-	2
CO4	3	3	-	-	-	-	-	-	2	-	2
CO5	3	3	3	-	-	-	-	-	2	-	2

Course Content

Module 1

Quantum Properties of Atoms (4 L)

Schrodinger Wave Equation (time independent – basic principles only), de Broglie Equation, Heisenberg Uncertainty Principle, Quantum Numbers, Effective nuclear charge, Slater's rule, penetration of orbitals, variations of orbital energies in the periodic table, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, oxidation properties.

Chemistry of materials (2L)

Semiconductor-Based Memory Materials (Si & Ge) [Introduction, Properties and role of Si & Ge), Intensive & Extensive semiconductor,

Module II

Chemical Thermodynamics (5L)

1st & 2nd Law of Thermodynamics, Tendency for maximum randomness, Carnot Heat Engine [Derivation], Entropy characteristics, Mathematical explanation & physical significance of Entropy, Entropy change of ideal gas for isothermal reversible process, Gibbs free Energy Function, Standard free Energy, Criterion of spontaneity.

Electricity production through chemical reactions (2L)

Electrochemical Cell, writing of cell notation, free energy and EMF, Criterion of spontaneity in terms of Cell. Nernst equation (only expression, no derivation) and applications, calculation of EMF of a cell, calculation of single electrode potential, calculation of Kc, calculation of Kc from G0.

Working principle and applications of Lithium-ion batteries

Module III

Polymers for Engineering Applications (3L)

Polymers and their classifications (based on origin, chemical structure, polymeric structure, tacticity and molecular forces)

Commercially important polymers: Synthesis and applications of Bakelite, nylon 6,6, HDPE & LDPE

Conducting polymers –Types examples and applications.

Biodegradable polymers –definition, example and uses

Industrial Chemistry (3L)

Types of corrosion, Electrochemical theory of corrosion, rusting of iron, comparison of chemical & electrochemical corrosion. [Mechanism excluded]

Factors affecting the rate of corrosion; nature of metal (physical state, purity, position in Galvanic series) & environment.

Corrosion control: Cathodic protection, anodic protection, Inorganic coatings.

Classification of Fuel (LPG, CNG, BIOGAS), Calorific value, Octane number, Cetane number, HCV, LCV. [Definition only]

Module IV

Organic Reactions & synthesis of drugs (3L)

Acidity and basicity comparison of organic compounds(acids, alcohols & amines), Nucleophilic Substitution reaction and Electrophilic Addition reactions, Markonikov's rule, peroxide effect, Synthesis of Paracetamol & Aspirin and uses.(Name reactions are not in syllabus)

Spectroscopy (2L)

Electromagnetic spectrum, Lambert-Beer Law, Finding of λ max value & concentration of the unknown solution, Applications of UV-VIS spectroscopy, Chromophores & Auxochromes. Applications of IR spectroscopy, Fingerprint region

Text Books:

1. Chemistry –I, Gourkrishna Das Mohapatro
2. A text book of Engineering Chemistry, Dr. Rajshree Khare
3. Engineering Chemistry, U. N. Dhar
4. Physical Chemistry, P.C. Rakshit

Reference Books

1. Engineering Chemistry, Jain & Jain
2. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S.Krishna
3. Text book of Engineering Chemistry, Jaya Shree Ani reddy

Course Name: Engineering Mathematics –II

Course Code: M201

Contact: 3:0:0

Total Contact Hours: 36

Credit: 3

Prerequisites:

The students to whom this course will be offered must have the understanding of (10+2) standard algebraic operations, coordinate geometry, and elementary calculus concepts including limits, continuity, differentiation, and integration.

Course Objective(s):

The objective of the course is to make the students able to –

O1: Develop a thorough understanding of ordinary differential equations and their role in modeling real-world systems.

O2: Build competency in applying the Laplace transform as a tool for solving initial value problems and linear differential equations in engineering contexts.

O3: Gain proficiency in numerical techniques for solving mathematical problems where analytical methods are difficult or impossible.

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	Apply analytical methods to solve ordinary differential equations in engineering contexts.
CO2	Apply the properties and inverse of Laplace Transforms to compute improper integrals and determine solutions of linear ordinary differential equations with constant coefficients in engineering scenarios.
CO3	Apply numerical methods to interpolate data, perform numerical integration, and solve ordinary differential equations in engineering applications.
CO4	Analyze the behavior of solutions using analytical and numerical approaches, including Laplace transforms, to assess stability, convergence, and accuracy in engineering contexts.

CO-PO Mapping:

CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	2	-	-	-	-	-	-	-	-	1			
CO2	3	2	-	-	-	-	-	-	-	-	1			
CO3	3	2	-	-	-	-	-	-	-	-	1			
CO4	3	3	1	1	-	-	-	-	-	-	2			
M201	**3**	**2.25**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1.25**			

Course Content:

Module I: First Order Ordinary Differential Equations (ODE) (9L)

Solution of first order and first degree ODE: Exact ODE, Rules for finding Integrating factors, Linear ODE, Bernoulli's equation.

Solution of first order and higher degree ODE: solvable for$p$, solvable for y and solvable for $x$and Clairaut's equation.

Module II: Second Order Ordinary Differential Equations (ODE) (8L)

Solution of second order ODE with constant coefficients: Complementary Function and Particular Integral, Method of variation of parameters, Cauchy-Euler equations.

Module III: Laplace Transform (LT) (12L)

Concept of improper integrals; Definition and existence of LT, LT of elementary functions, First and second shifting properties, Change of scale property, LT of $tf(t)$, LT of $\frac{f(t)}{t}$, LT of derivatives of $f(t)$, LT of integral of $f(t)$, Evaluation of improperintegrals using LT, LT of periodic and step functions, Inverse LT: Definition and its properties,Convolution theorem (statement only) and its application to the evaluation of inverse LT, Solution oflinear ODE with constant coefficients (initial value problem) using LT.

Module IV: Numerical Methods (7L)

Introduction to error analysis, Calculus of finite difference. **Interpolation:** Newton forward and backward interpolation, Lagrange's interpolation. **Numerical integration:** Trapezoidal rule, Simpson's 1/3 Rule. **Numerical solution of ordinary differential equation:** Euler method, Fourth order Runge-Kutta method.

Text Books:

1. Higher Engineering Mathematics, Grewal, B.S., Khanna Publishers, 36th Edition, 2010.
2. Advanced Engineering Mathematics, 9th Edition, Kreyszig, E., John Wiley & Sons, 2006.

Reference Books:

1. A text book of Engineering Mathematics-I, Guruprasad, S. New age International Publishers.
2. Higher Engineering Mathematics, Ramana, B.V., Tata McGraw Hill New Delhi, 11th Reprint, 2010.
3. Engineering Mathematics for first year, Veerarajan, T., Tata McGraw-Hill, New Delhi, 2008.
4. A text book of Engineering Mathematics, Bali, N.P. and Goyal, M., Laxmi Publications, Reprint, 2008.
5. Calculus and Analytic geometry, 9th Edition, Thomas, G.B. and Finney, R.L., Pearson, Reprint, 2002.
6. Calculus, Volumes 1 and 2 (2nd Edition), Apostol, M., Wiley Eastern, 1980.
7. Linear Algebra - A Geometric approach, Kumaresan, S., Prentice Hall of India, 2000.
8. Linear Algebra: A Modern Introduction, 2nd Edition, Poole, D., Brooks/Cole, 2005.
9. Schaum's Outline of Matrix Operations, Bronson, R., 1988.
10. Differential and Integral Calculus, Vol. I & Vol. II, Piskunov, N., Mir Publishers, 1969.

Course Name: Constitution of India & Professional Ethics

Course Code: HU205

Contact: 1:0:0

Total Contact Hours: 12

Credit: 1

Prerequisites:

A basic knowledge (10+2 level) of the Indian Constitution and moral science.

Course Objectives: The objectives of this course are to make the student able to-

O1: Understand the salient features of the Indian constitution and form of government.

O2: Develop ethical awareness and responsible professional conduct.

understand ethical frameworks, guidelines and recognize ethical dilemmas.

O4: Understand professional responsibilities and applications of ethical principles in real-life scenarios.

O5: Develop an awareness of the social impact of the profession and act responsibly in the broader community.

Course outcome: After successful completion of this course, students will be able to

CO1	Identify, define and understand the significance of the Constitution of India, its spirit and values and the fundamental rights and duties as a responsible citizen.
CO2	define and discover core ethical concepts, the basic perception of profession, and professional ethics that shape the ethical behavior of an engineer.
CO3	identify, examine and apply codes of engineering ethics, engineers' social responsibilities and industrial standards and ethical dilemmas.
CO4	consider, correlate and appraise ethical leadership and principles in addressing gender issues, concerns of IPR and industrial responsibilities.

CO-PO Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO 1	-	-	-	-	-	-	-	2	-	-	2
CO 2	-	-	-	-	-	3	3	2	-	-	2
CO 3	-	-	-	-	-	2	3	2	-	-	2
CO 4	-	-	-	-	-	2	3	3	-	-	2

Course Contents:

Module 1: Introduction to the Constitution of India and Indian Government: (2L)

Preamble : Salient Features, Fundamental Rights, Fundamental Duties, Directive Principles of State Policy, Parliament -Powers and Functions –Executive- President -Governor - Council of Ministers.

Module 2: Professional Ethics and Human Values: (3L)

Introduction to Ethical Thinking; what is Ethics, Work ethics; Scope of Professional Ethics, Values and Characteristics, Types of values: Negative and positive values, Ethical values for Professional success.

Module 3: Codes of Professional Ethics, Violation and Safeguards: (4L)

Engineering Ethics, Ethical theories: a brief overview; utilitarianism, deontology, virtue ethics. Professional Codes, Codes of professional ethics-Moral dilemmas, and moral autonomy-Internal ethics of business: whistle blowing, conflicts of interest, Job discrimination, and Exploitation of Employees; Social and ethical responsibilities of technologists: Responsibilities towards Customers, shareholders, employees – Social Audit.

Case Studies: Bhopal Gas Tragedy, Chernobyl (linking ethics to real-world failures).

Module 4: Business Ethics and Workplace Issues: (3L)

Business ethics, ethical decision-making frameworks - Impact of ethics on business policies and strategies- Characteristics of ethical leaders; fostering integrity in teams; Addressing occupational crime, discrimination, and gender-based issues in workplaces-Intellectual property rights (IPR), Plagiarism and Academic Misconduct.

Text Books:

1.Durga Das Basu. *Introduction to the Constitution of India*. 27th ed. New Delhi: Lexis Nexis, 2024.

2. R.S Naagarazan. *A Textbook on Professional Ethics and Human Values*. New Age International (P) Limited, 2022.

3. N. Subramanian. *Professional Ethics.* New Delhi: Oxford University Press, 2017.

4. A N Tripathi, *Human Values*. New Delhi: New Age Publishers, 2019.

5. S. K. Chakraborty. *Values and Ethics for Organizations: Theory and Practices*. New Delhi: Oxford University Press, 1997.

Reference Books:

1.O. C. Ferrell, John Friaedrich and Linda Ferrell. *Business Ethics: Ethical Decision Making and Cases.* New Delhi: Cengage India, 2024.

2.Charles Fledderman. *Engineering Ethics*. 3rd ed. New Delhi: Pearson Education, 2007.

3.Dinesh G. Harkut and Gajendra R. Bamnote. *Professional Ethics for Engineers*. Chennai: Notion Press, 2023.

4.U.C.Mathur, *Corporate Governance and Business Ethics*: *Text and Cases*. Chennai: Macmillan, 2012.

5. Fernando. A. C., K. P. Muralidheeran and E. K. Satheesh. *Business Ethics – An Indian Perspective*. New Delhi: Pearson Education, 2019.

Course Name: Design Thinking & Innovation

Course Code: HU203

Contact: 1:0:0

Total Contact Hours: 15

Credit: 1

Prerequisites:

For a course on the Basics of Design Thinking, students should ideally possess basic computer skills, communication abilities, problem-solving aptitude, critical thinking, introductory knowledge of Sustainable Development Goals, curiosity, and openness to new ideas, as well as basic understanding of mathematics, technology, and manufacturing processes.

However, even if these prerequisites are not satisfied, the faculty will cover them in the first few classes.

An awareness of 21st-century skills, including creativity and collaboration, is also beneficial.

These prerequisites aim to provide a foundation, and any gaps in knowledge will be addressed by the instructor early in the course.

Course Objective:

The objective of this Course is to provide new ways of creative thinking and learn the innovation cycle of Design Thinking process for developing innovative products and services which are useful for a student in preparing for an engineering career.

Course Outcomes (COs): Upon completion of the course, students shall be able to

CO1	Analyze emotional experience and expressions to better understand stakeholders while designing innovative products through group brainstorming sessions.
CO2	Generate and develop design ideas through different technique
CO3	Develop new ways of creative thinking and learn the innovation cycle of Design Thinking process for developing any innovative products using facility in AICTE IDEA LAB

CO-PO Mapping:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	1	2	-	2	2	-	2	3	1	-	-
CO2	1	2	3	3	3	-	2	3	-	3	2
CO3	1	3	3	3	3	2	2	3	-	2	2

Course Content:

Module 1 (2L)

Basics of Design Thinking:
Definition of Design Thinking, Need for Design Thinking, history of Design Thinking, Concepts & Brainstorming, 2X2 matrix, 6-3-5 method, NABC method;

Module 2: (4L)

PROCESS OF DESIGN: Understanding Design thinking

Shared model in team-based design – Theory and practice in Design thinking – Explore presentation signers across globe – MVP or Prototyping.

Stages of Design Thinking Process (explain with examples) –

Empathize (Methods of Empathize Phase: Ask 5 Why / 5W+H questions, Stakeholder map, Empathy Map, Peer observation, Trend analysis).

Define (Methods of Define Phase: Storytelling, Critical items diagram, Define success).

Ideate (Brainstorming, 2X2 matrix, 6-3-5 method, NABC method).

Prototype (Types of prototypes - Methods of prototyping - Focused experiments, Exploration map, Minimum Viable Product).

Test (Methods of Testing: Feedback capture grid, A/B testing).

Module 3: (2L)

Tools for Design Thinking
Real-Time design interaction captures and analysis – Enabling efficient collaboration in digital space– Empathy for design – Collaboration in distributed Design

Module 4: (2L)

Design Thinking in IT

Design Thinking to Business Process modelling – Agile in Virtual collaboration environment – Scenariobased Prototyping

Module 5: (2L)

Design Thinking For strategic innovations
Growth – Story telling representation – Strategic Foresight - Change – Sense Making - Maintenance Relevance – Value redefinition - Extreme Competition – experience design - Standardization – Humanization - Creative Culture – Rapid prototyping, Strategy and Organization – Business Model

Module 6: (3L)

Problem Solving & Critical thinking

Introduction to TRIZ, SCAMPER, UI and UX,

Sustainable development goals (SDG)

Integrating and mapping 17 Sustainable development goals (SDG) during designing a product; goods or service. Introduction to 21st Century Skill Set

Case Study & Project Report Submission

Text Books :

1. Karmin Design Thinking by Dr. Bala Ramadurai, Mudranik Technology Private Ltd. ISBN 978-93-5419-0I0-0.
2. John.R.Karsnitz, Stephen O'Brien and John P. Hutchinson, "Engineering Design", Cengage learning (International edition) Second Edition, 2013.
3. Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press , 2009.
4. Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand – Improve – Apply", Springer, 2011
5. Idris Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", John Wiley & Sons 2013.

Reference Books:

1. Yousef Haik and Tamer M.Shahin, "Engineering Design Process", Cengage Learning, Second Edition, 2011.
2. Solving Problems with Design Thinking - Ten Stories of What Works (Columbia Business School Publishing) Hardcover – 20 Sep 2013 by Jeanne Liedtka (Author), Andrew King (Author), Kevin Bennett (Author).
3. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, HarperCollins e-books, 2009.
4. Michael Lewrick, Patrick Link, Larry Leifer, The Design Thinking Toolbox, John Wiley & Sons, 2020.
5. Michael Lewrick, Patrick Link, Larry Leifer, The Design Thinking Playbook, John Wiley & Sons, 2018.
6. Kristin Fontichiaro, Design Thinking, Cherry Lake Publishing, USA, 2015.
7. Walter Brenner, Falk Uebernickel, Design Thinking for Innovation - Research and Practice, Springer Series, 2016.
8. Gavin Ambrose, Paul Harris, Design Thinking, AVA Publishing, 2010.
9. Muhammad MashhoodAlam, Transforming an Idea into Business with Design Thinking, First Edition, Taylor and Francis Group, 2019.

10. S. Balaram, Thinking Design, Sage Publications, 2011.

WEB REFERENCES:

1. https://designthinking.ideo.com/

2. https://thinkibility.com/2018/12/01/engineering-vs-design-thinking/

3. https://www.coursera.org/learn/design-thinking-innovation

4. https://swayam.gov.in/nd1_noc20_mg38/preview

5.www.tutor2u.net/business/presentations/. /productlifecycle/default.html

6. https://docs.oracle.com/cd/E11108_02/otn/pdf/. /E11087_01.pdf

7. www.bizfilings.com › Home › Marketing › Product Developmen

8. https://www.mindtools.com/brainstm.html

9. https://www.quicksprout.com/. /how-to-reverse-engineer-your-competit

10.www.vertabelo.com/blog/documentation/reverse-engineering

https://support.microsoft.com/en-us/kb/273814

11. https://support.google.com/docs/answer/179740?hl=en

Course Name: Food Microbiology Lab

Course Code: FT291

Contact: 0:0:3

Credit: 1.5

Pre-requisites: Biology

Course Objective:

The objective of the course is to make the students able –

O1: To help the students understand various methods of isolation, characterization and screening of bacteria, fungi, and other related microorganisms

O2: To apply different preservation techniques relative to food safety and spoilage.

Course outcome(s):

After the completion of the course, students will be able to:

CO1	Understand various methods of isolation, characterization and screening of bacteria, fungi and other related organisms.
CO2	Describe the process to skills to monitor various microbial food processing operations in food industries.
CO3	Interpret different preservation techniques relative to food safety and spoilage.
CO4	Evaluate the growth requirements of common foodborne pathogens and spoilage microorganisms.

CO-PO-PSO Mapping

COs	**Program Outcomes (PO)**											**Program Specific Outcomes (PSO)**		
	PO 1	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	2	-	-	2	-	-	-	3	3	3	3
CO2	3	3	2	3	2	1	-	1	-	-	3	3	3	2
CO3	3	3	3	3	2	2	2	1	2	1	3	3	3	1
CO4	2	3	3	3	-	-	-	-	2	1	3	3	2	3

List of Experiments:

1. Gram Staining and the study of cellular morphology of bacteria.
2. Study of autoclave, preparation and sterilization of nutrient broth.
3. Sub-culturing of a bacterial strain in liquid and solid medium.
4. Study of the bacterial growth curve by spectrophotometer.
5. Study of microbial quality of milk by MBRT test.
6. Study the growth of yeast and molds.
7. Serial dilution and Plating by spread–plate and pour–plate techniques.
8. Isolation of a pure culture.
9. Preparation and characterization of fermented food products
10. Innovative Experiments

Text Books:

1. Food Microbiology; M. R.Adams , 2nd Edition, 2002

Reference Books:

1. Hand Book of Microbiology; Bisen, 3rd Edition, 2003

Course Name: Biochemistry and Nutrition Lab

Course Code: FT292

Contact: 0:0:3

Credit: 1.5

Pre-requisites: Biochemistry Theory

Course Objective:

The objective of the course is to make the students able-

O1: To assist the students, in developing skills to monitor various enzymatic reactions and

O2: To learn about the association of food protein structure

O3: To help the students point out the threat of possible danger to health from contamination in water from effluent.

Course outcome(s):

After the completion of the course, students will be able to:

CO1	Understand the separation of immiscible liquids and solids from liquids, including various methods of sugar and amino acid separation.
CO2	Describe the process to develop skills to monitor various enzymatic reactions.
CO3	Interpret the association of food protein structure with solubility, viscosity, gelation, texturization, emulsification and foaming.
CO4	Evaluate the threat of possible danger to health, or the very existence of certain species, for the determination of the quality of a water source before water is drawn off for consumption.

CO-PO-PSO Mapping

COs	**Program Outcomes (PO)**											**Program Specific Outcomes (PSO)**		
	PO 1	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	2	-	-	2	-	-	-	3	3	3	3
CO2	3	3	2	2	2	1	-	2	-	-	3	3	3	2
CO3	3	3	3	3	2	2	2	1	-	1	3	3	3	1
CO4	2	3	3	3	-	-	-	-	2	1	3	3	2	3

List of Experiments:

1. Separation of amino acids/sugars by Ascending Paper Chromatography.
2. Separation of sugars/amino acids by Thin Layer Chromatography.
3. Separation of sugars /amino acids by Radial Chromatography.
4. Separation of triglycerides and sterols of the oil sample by Thin Layer Chromatography.
5. Separation and isolation of proteins/amino acids by Electrophoresis.
6. Preparation of cell-free extract: Bacterial cells by sonication, and Chicken liver by homogenization.
7. Assay of enzyme activity (a) Phosphatase assay [Chicken liver] (b) Protease assay
8. Study on the presence of alkaline phosphatase enzyme in raw and pasteurized milk.
9. Determination of BOD5 of a sample of wastewater.
10. Innovative Experiments

Text Books:

1. Modern Experimental Biochemistry, Boyer, Pearson Education

Reference Books:

1. An Introduction to Practical Biochemistry, David T Plummer

Course Name: Engineering Chemistry Lab

Course Code: CH291

Contact: 0:0:2

Credit: 1

Prerequisites: 10+2

Course Objective

The objective of the course is to make the students able to –

O1: Study the basic principles of pH meter and conductivity meter for different applications

O2: Analysis of water for its various parameters in relation to public health, industries & environment

O3: Learn to synthesis Polymeric materials and drugs

O4: Study the various reactions in homogeneous and heterogeneous medium

O5: Designing of innovative experiments

Course Outcome

After Successful completion of the course, students will be able to

CO1	Able to operate different types of instruments for estimation of small quantities chemicals used in industries and scientific and technical fields.
CO2	Able to analyse and determine the composition and physical property of liquid and solid samples when working as an individual and also as a team member
CO3	Able to analyse different parameters of water considering environmental issues
CO4	Able to synthesize drug and sustainable polymer materials.
CO5	Capable to design innovative experiments applying the fundamentals of modern chemistry

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
1	3	1	3	1	-	2	3	-	-	-	-
2	2	2	1	1	-	1	-	-	-	1	-
3	-	-	-	-	-	-	-	-	3	3	2
4	2	1	2	2	-	-	1	-	-	-	-
5	3	3	3	3	1	1	1	1	-	-	2

Course Content

Any 10 experiments to be conducted preferably a combination of estimation, water quality analysis, instrumental analysis and synthesis

1. To determine strength of given sodium hydroxide solution by titrating against standard oxalic acid solution.
2. Estimation of amount of Fe^{2+} in Mohr's salt using permanganometry.
3. To determine the surface tension of a given liquid at room temperature using stalagmometer by drop number method.
4. To determine the viscosity of a given unknown liquid with respect to water at room temperature, by Ostwald's Viscometer.
5. Water quality analysis :
   i. Determination of total, permanent and temporary hardness of sample water by complexometric titration.
   ii. Determination of Cl^- ion of the sample water by Argentometric method
   iii. Determination of alkalinity of the sample water.
   iv. Determination of dissolved oxygen present in a given water sample.
6. Determination of the concentration of the electrolyte through pH measurement.
7. pH- metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
8. Determination of cell constant and conductance of solutions.
9. Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution.
10. Determination of Partition Coefficient of acetic acid between two immiscible liquids.
11. Drug design and synthesis
12. Synthesis of polymers (Bakelite) for electrical devices and PCBs.
13. Synthesis of Silver Nanoparticles doped organic thin film for organic transistors.
14. Determination of R_F of any amino acid by thin layer chromatography.
15. Saponification /acid value of any oil.
16. Isolation of graphene from dead dry batteries

Course Name: IDEA LAB Workshop

Course Code: ME293

Contact: 0:0:3

Credit: 1.5

Course Objectives:
The objective of the course is to make the students able to –

O1: Learn all the skills associated with the tools and inventory associated with the IDEA Lab.
O2: Learn useful mechanical and electronic fabrication processes.

O3: Learn necessary skills to build useful and standalone system/ project with enclosures.

O4: Learn necessary skills to create print and electronic documentation for the system/project

Course Contents*:*

Module	**Topics**	
1	Electronic component familiarisation, Understanding electronic system design flow. Schematic design and PCB layout and Gerber creation using EagleCAD. Documentation using Doxygen, Google Docs, Overleaf. Version control tools - GIT and GitHub. Basic 2D and 3D designing using CAD tools such as FreeCAD, Sketchup, Prusa Slicer, FlatCAM, Inkspace, OpenBSP and VeriCUT.	Introduction to basic hand tools - Tape measure, combination square, Vernier calliper, hammers, fasteners, wrenches, pliers, saws, tube cutter, chisels, vice and clamps, tapping and threading. Adhesives Introduction to Power tools: Power saws, band saw, jigsaw, angle grinder, belt sander, bench grinder, rotary tools. Various types of drill bits,

2	Familiarisation and use of basic measurement instruments - DSO including various triggering modes, DSO probes, DMM, LCR bridge, Signal and function generator. Logic analyzer and MSO. Bench power supply (with 4-wire output) Circuit prototyping using (a) breadboard, (b) Zero PCB (c) 'Manhattan' style and (d) custom PCB. Single, double and multilayer PCBs. Single and double-sided PCB prototype fabrication in the lab. Soldering using soldering iron/station. Soldering using a temperature controlled reflow oven. Automated circuit assembly and soldering using pick and place machines.	Mechanical cutting processes - 3-axis CNC routing, basic turning, milling, drilling and grinding operations, Laser cutting, Laser engraving etc. Basic welding and brazing and other joining techniques for assembly. Concept of Lab aboard a Box.
3	Electronic circuit building blocks including common sensors. Arduino and Raspberry Pi programming and use. Digital Input and output. Measuring time and events. PWM. Serial communication. Analog input. Interrupts programming. Power Supply design (Linear and Switching types), Wireless power supply, USB PD, Solar panels, Battery types and charging	3D printing and prototypingtechnology – 3D printing using FDM, SLS and SLA. Basics of 3D scanning, point cloud data generation for reverseengineering. Prototyping using subtractive cutting processes. 2D and 3D Structures for prototype building using Laser cutter and CNC routers. Basics of IPR and patents; Accessing and utilizing patent information in IDEA Lab
4	Discussion and implementation of a mini project.	
5	Documentation of the mini project (Report and video).	

Laboratory Activities:

S. No.	List of Lab activities and experiments
1.	Schematic and PCB layout design of a suitable circuit, fabrication and testiof the circuit.
2.	Machining of 3D geometry on soft material such as soft wood or modelling w

3.	3D scanning of computer mouse geometry surface. 3D printing of scanngeometry using FDM or SLA printer.
4.	2D profile cutting of press fit box/casing in acrylic (3 or 6 m thickness)/cardboard, MDF (2 mm) board using laser cutter & engraver.
5.	2D profile cutting on plywood /MDF (6-12 mm) for press fit designs.
6.	Familiarity and use of welding equipment.
7.	Familiarity and use of normal and wood lathe.
8.	Embedded programming using Arduino and/or Raspberry Pi.
9.	Design and implementation of a capstone project involving embedded hardwasoftware and machined or 3D printed enclosure.

Reference Books:

S. No.	Title
1.	AICTE's Prescribed Textbook: Workshop / Manufacturing Practices (with Lab Manual), Khanna Book Publishing, New Delhi.
2.	All-in-One Electronics Simplified, A.K. Maini; 2021. ISBN-13: 978-9386173393, Khanna Book Publishing Company, New Delhi.
3.	Simplified Q&A - Data Science with Artificial Intelligence, Machine Learning and Deep Learning, Rajiv Chopra, ISBN: 978-9355380821, Khanna Book Publishing Company, New Delhi.
4.	3D Printing & Design, Dr. Sabrie Soloman, ISBN: 978-9386173768, Khanna Book Publishing Company, New Delhi.

Course Name: Introduction to Artificial Intelligence Lab

Course Code: CS292

Contact: 0:0:3

Credit: 1.5

Course Objectives:

The objectives of this course are to enable students to

O1: Gain foundational knowledge of PROLOG to implement an Artificial Intelligent Agent as an executable computer program for Knowledge Representation and Inferencing

O2: Formulate a problem by analyzing its characteristics to fit a State-Space Exploration Framework or an Inferencing Framework of Artificial Intelligence.

O3: Apply the concepts of Artificial Intelligence to solve a problem by implementing well-known Artificial Intelligence strategies using proper techniques and tools of PROLOG.

04: Build expert systems offering solutions to the challenging problems of Artificial Intelligence.

05: Implement Artificial Intelligence based ideas as executable PROLOG programs through developing intelligent heuristic strategies

Course Outcomes (COs):

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

CO1	Acquire foundational knowledge of PROLOG to implement an Artificial Intelligent Agent as an executable computer program for Knowledge Representation and Inferencing and understand the working principle of the agent and assess its utilitarian importance in current technological context leading towards lifelong learning**.**
CO2	Identify and formulate an engineering problem by analyzing its characteristics to fit a State-Space Exploration Framework or an Inferencing Agent Formulation Framework of Artificial Intelligence.
CO3	Explore relevant literature and apply the concepts of Artificial Intelligence to solve a problem by implementing well-known Artificial Intelligence strategies using proper techniques and tools of PROLOG.
CO4	Develop ideas and propose an expert system offering solutions to the challenging problems of Artificial Intelligence.

CO5	Plan and Implement Artificial Intelligence based ideas as executable PROLOG programs through developing intelligent heuristic strategies or expert systems with adequate documentation in a collaborative environment for successfully carrying out projects on Artificial Intelligence Problems and investigate their effectiveness by analyzing the performances using proper techniques and tools.

CO–PO Mapping:

COs	**Program Outcomes (PO)**										
	PO 1	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	-	-	-	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-
CO3	2	2	3	2	-	-	-	-	-	-	-
CO4	2	2	2	3	-	-	-	-	-	-	2
CO5	2	2	3	3	2	2	2	2	2	2	2

Course Contents:

Module 1: Introduction to PROLOG Programming along with the IDE and its Basic Components

Assignments for understanding the Basic Components of Knowledge Representation and Inferencing in Artificial Intelligence using PROLOG Programming and its working strategy. Understanding facts, rules, queries, and syntax.

Module 2: Recursive definitions in Prolog

Fibonacci Series, Calculator, Factorial, summation, list length, etc. Using recursive rules.

Module 3: Defining facts and simple queries

Writing a knowledge base for family relationships, basic objects.

Module 4: Rules and inference in Prolog

Creating logical rules and testing inferences.

Module 5: List operations in Prolog

Checking membership, concatenation, reverse, max/min of list.

Module 6: Pattern matching and symbolic reasoning

Simple examples involving pattern recognition (e.g., shape or name matching, Family Tree design)

Module 7: Expert system simulation (Mini project)

Building a mini knowledge-based system (e.g., Animal Classification, Medical diagnosis, etc).

Textbook:

Ivan Bratko, Prolog Programming for Artificial Intelligence, 4th Edition, Addison-Wesley.