JHARKHAND Rai University RANCHI

B. TECH. in ARTIFICIAL INTELLIGENCE and MACHINE LEARNING

Syllabus

Academic Year: 2026-2030 onwards

Vision

To develop the Department of Computer Science & Information Technology as a Center for Excellence to produce leading Professionals who can serve the society with innovative skills, Computer Experts, Researchers to meet the needs of the software industry in national/global scenario responding to the challenges of ever-changing world.

Mission

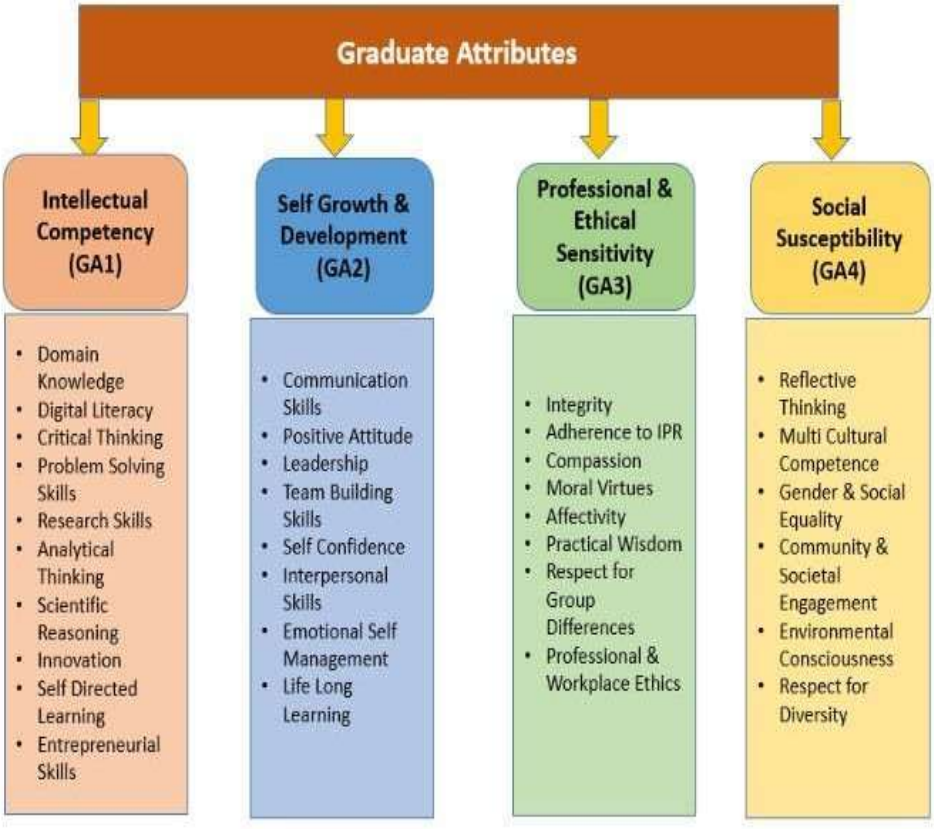
- We endeavor to provide the best possible learning environment to enhance innovations, research capabilities, problem solving skills, leadership qualities, team spirit and ethical responsibilities.
- To nurture the talent of the students to be successful, ethical and effective problem solvers who will contribute positively to the economic growth of the nation and prepare to respond to the challenges.

Graduate Attributes

Jharkhand Rai University is a mecca of transformative education which strongly believes in the holistic development of students. The university provides the cutting-edge of holistic learning to develop promising youngsters into leaders of tomorrow with globally relevant, future-ready and actionable intelligence. The objective of the Department is to make each student proficient in synthesizing/analysing information and be ethical, socially responsible, and just when making decisions. JRU ensures inclusive and equitable quality education and promote lifelong learning opportunities for all.

Every graduate of the Department will be developed to possess the following attributes:

1. Intellectual Competency
2. Self-Growth & Development
3. Professional & Ethical Sensitivity
4. Social Susceptibility



Program Educational Objectives (PEOs)

PEOs (Program Educational Objectives) relate to the career and professional accomplishments of passed out students after their graduation from the program. However, keeping the significanceof contribution of the curriculum and the assessment opportunities such as examination and evaluation results, placement data, employer feedback and higher education entrance performance etc. are taken as tools for supplementary evidence to assess PEOs.

The program educational objectives of the undergraduate program in Computer Science Engineering take into consideration the university mission and the constituents‟ needs by producing graduates who will be able to:

- **PEO1:** Develop foundational knowledge, technical skills and competency related to the various core and related areas of IT and ITeS in order to demonstrate good analytical, design and implementation skills.
- **PEO2:** Establish their career in Creativity & Design of Computer Support Systems and impart knowledge and skills with proficiency in analysis, design, coding, testing, deployment, maintenance of the system and application software.
- **PEO3:** Communicate effectively, recognize and incorporate societal needs and constraints in their professional endeavors, and practice their profession with high regard to ethical responsibilities.
- **PEO4:** Drive scientific and societal advancement through technological innovation and entrepreneurship.
- **PEO5:** Recognize the need for adapting to change & engage themselves in independent life-long learning.

Program Outcome (POs)

Engineering Graduates will be able to:

- **PO1: Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- **PO2: Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- **PO3: Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- **PO4: Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of theinformation to provide valid conclusions.
- **PO5: Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- **PO6: The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant tothe professional engineering practice.
- **PO7: Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and needfor sustainable development.
- **PO8: Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- **PO9: Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

- **PO10: Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- **PO11: Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- **PO12: Life-long learning**: Recognize the need for, and have the preparation and ability to engage inindependent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSOs)

The students shall have the:

- **PSO1: Professional Skills:** Ability to understand, analyze and develop computer programs/ application software in the areas related to Artificial Intelligence, Machine Learning and Data Engineering using industry-standard tools and technologies.
- **PSO2: Problem Solving Skills:** Ability to apply and implement standard practices, strategies, algorithms, and AI/ML techniques in software project development and undertake research in the fields of Machine Learning and Artificial Intelligence.
- **PSO3: Successful Career:** Ability to become employable in a variety of IT companies and government sectors and for the betterment of an individual and society at large.
- **PSO4**: **Entrepreneurship:** Preparedness to adopt new technology with unprecedented ideas to be a successful entrepreneur or pursue higher education in the rapidly evolving field of Artificial Intelligence and related domains.

Mapping between PEO and PSO

Program Specific Outcome (PSO)	Program Educational Objective (PEO)				
	PEO1	PEO2	PEO3	PEO4	PEO5
PSO1	3				
PSO2	3	2		1	1
PSO3			2		2
PSO4	2	1		2	

3- High, 2- Medium, 1- Low

Mapping of PEO and PO

Program Outcome (PO)	Program Educational Objective (PEO)				
	PEO1	PEO2	PEO3	PEO4	PEO5
PO1	3			2	1
PO2	2			1	2
PO3		3			
PO4		2			
PO5			1		
PO6		2	1		
PO7		2	2	1	
PO8			3		
PO9	2			1	2
PO10	1		3		
PO11			2	2	
PO12		2			3

3- High, 2- Medium, 1- Low

.

COURSE SCHEME

BATCH 2026-2030

B. TECH. IN ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

As per the guidelines of NEP 2020 with Multiple Entry and Exit option

SEMESTER I

S. No	NSQF/ NATIONAL CREDIT FRAMEWORK NCrF CREDIT LEVEL	BROAD CATEGORY	CATEGORY	CODE	COURSE TITLE	Periods			Evaluation Scheme				Subject Total	Credit
						L	T	P	Assignment	TA	Total	ESE		
1	4.5	Basic Science Course	Multidisciplinary Course (MDC)	3IBSC101	Chemistry	3	1	0	20	10	30	70	100	4
2		Basic Science Course	Core Course (CC)- Minor	3IBSC102	Mathematics I	3	1	0	20	10	30	70	100	4
3		Engineering Science Course	Core Course (CC)- Minor	3IESC101	Basic Electrical Engineering	3	1	0	20	10	30	70	100	4
4		Engineering Science Course	Core Course (CC)- Minor	3IESC102	Engineering Graphics & Design	2	0	0	20	10	30	70	100	2
5		Professional Core Course	Core Courses (CC)- Major	3IPCC101	Software Foundation Course-C	3	0	0	20	10	30	70	100	3
6		Humanities and Social Sciences	Ability Enhancement Courses (AEC)	3IHSS101	English	3	0	0	20	10	30	70	100	3
PRACTICAL /SESSIONAL														
1	4.5	Basic Science Course	Skill Enhancement Course (SEC)	3IBSC101P	Chemistry Lab	0	0	2			30	20	50	1
2		Engineering Science Course	Skill Enhancement Course (SEC)	3IESC101P	Basic Electrical Engineering Lab	0	0	2			30	20	50	1
3		Engineering Science Course	Core Course (CC)- Minor	3IESC102P	Engineering Graphics & Design Lab	0	0	2			30	20	50	1
4		Professional Core Course	Core Courses (CC)- Major	3IPCC101P	Software Foundation Course-C Lab	0	0	2			30	20	50	1
											TOTAL		**650**	**24**

JHARKHAND Rai University RANCHI

SEMESTER II														
S. No.	**NSQF/ NATIONAL CREDIT FRAMEWORK NCrF CREDIT LEVEL**	**BROAD CATEGORY**	**CATEGORY**	**CODE**	**COURSE TITLE**	**Periods**			**Evaluation Scheme**				**Subject Total**	**Credit**
						L	**T**	**P**	**Assignment**	**TA**	**Total**	**ESE**		
1	4.5	Basic Science Course	Multidisciplinary Course (MDC)	3IBSC103	Physics	3	1	0	20	10	30	70	100	4
2		Basic Science Course	Core Course (CC)-Minor	3IBSC104	Mathematics II	3	1	0	20	10	30	70	100	4
3		Basic Science Course	Core Course (CC)-Minor	3IBSC105	Biological Science for Engineers	3	0	0	20	10	30	70	100	3
4		Professional Core Course	Core Courses (CC)-Major	3IPCC102	Python	3	0	0	20	10	30	70	100	3
5		Engineering Science Course	Skill Enhancement Course (SEC)	3IESC103	Computer Assembly and Repair	1	0	0	20	10	30	70	100	1
6		Mandatory Course	Value Added Course (VAC)	3IMC101	Environmental Science	3	0	0	20	10	30	70	100	3
7		Value Added Course	Value Added Course (VAC)	3IVAC101	Character Building & Holistic Development of Personality -I (Spiritual & Mental Health)	2	0	0	20	10	30	70	100	2
PRACTICAL /SESSIONAL														
1	4.5	Basic Science Course	Skill Enhancement Course (SEC)	3IBSC103P	Physics Lab	0	0	2			30	20	50	1
2		Professional Core Course	Core Courses (CC)-Major	3IPCC102P	Python Lab	0	0	2			30	20	50	1
3		Engineering Science Course	Skill Enhancement Course (SEC)	3IESC103P	Computer Assembly and Repair Lab	0	0	2			30	20	50	1
											TOTAL		**650**	**23**

NOTE: Mandatory Vocational /Industrial Training(4Weeks) or any specialized course of minimum 4 credits offered by respective department for student opting for exit after first year with UG CERTIFICATE

SEMESTER III														
S. No	**NSQF/ NATIONAL CREDIT FRAMEWORK NCrF CREDIT LEVEL**	**BROAD CATEGORY**	**CATEGORY**	**CODE**	**COURSE TITLE**	**Periods**			**Evaluation Scheme**				**Subject Total**	**Credit**
						L	**T**	**P**	**Assignment**	**TA**	**Total**	**ESE**		
1	5	Basic Science Course	Core Courses (CC)-Major	3IBSC201	Mathematics III (Probability & Statistics)	2	0	0	20	10	30	70	100	2
2		Engineering Science Course	Core Course (CC)-Minor	3IESC201	Digital Electronics	3	0	0	20	10	30	70	100	3
3		Professional Core Course	Core Courses (CC)-Major	3IPCC201	Data Visualization	3	0	0	20	10	30	70	100	3
4		Professional Core Course	Core Courses (CC)-Major	3IPCC202	Data Structure And Algorithms	3	0	0	20	10	30	70	100	3
5		Professional Core Course	Core Courses (CC)-Major	3IPCC203	Computer Organization &Architecture	3	0	0	20	10	30	70	100	3
6		Humanities and Social Science	Ability Enhancement Course (AEC)	3IHSS201	Effective Technical Communication	2	0	0	20	10	30	70	100	2
7		**Mandatory Course**	**Value Added Course (VAC)**	**3IMC201**	**Community Engagement and Social Responsibility**	**1**	**0**	**2**	**40**	**10**	**50**	**50**	**100**	**2**
PRACTICAL /SESSIONAL														
1	5	Engineering Science Course	Core Course (CC)-Minor	3IESC201P	Digital Electronics Lab	0	0	2			30	20	50	1
2		Professional Core Course	Core Courses (CC)-Major	3IPCC201P	Data Visualization Lab	0	0	2			30	20	50	1
3		Professional core Course	Core Courses (CC)-Major	3IPCC202P	Data Structure And Algorithms Lab	0	0	2			30	20	50	1
4		Professional core Course	Core Courses (CC)-Major	3IPCC203P	Computer Organization & Architecture Lab	0	0	2			30	20	50	1

	TOTAL	**850**	**22**

SEMESTER IV															
S.No.	**NSQF/ NATIONAL CREDIT FRAMEWORK NCrF CREDIT LEVEL**	**BROAD CATEGORY**	**CATEGORY**	**CODE**	**COURSE TITLE**	**Periods**			**Evaluation Scheme**				**Subject Total**	**Credit**
						L	**T**	**P**	**Assignment**	**TA**	**Total**	**ESE**		
1	5	Professional Core Course	Core Courses (CC)-Major	3IPCC204	Database Management Systems	3	0	0	20	10	30	70	100	3
2		Professional Core Course	Core Courses (CC)-Major	3IPCC205	Machine Learning	3	0	0	20	10	30	70	100	3
3		Professional Core Course	Core Courses (CC)-Major	3IPCC206	Object Oriented Programming with JAVA	3	0	0	20	10	30	70	100	3
4		Professional Core Course	Core Courses (CC)-Major	3IPCC207	Discrete Mathematics	3	1	0	20	10	30	70	100	4
5		Professional Core Course	Core Courses (CC)-Major	3IPCC208	Operating Systems	3	0	0	20	10	30	70	100	3
6		Humanities and Social Sciences	Skill Enhancement Course (SEC)	3IHSS202	Entrepreneurship	3	0	0	20	10	30	70	100	3
7		Value Added Course	Value Added Course (VAC)	3IVAC201	Character Building & Holistic Development of Personality-II (Yoga and Physical Fitness)	2	0	0	20	10	30	70	100	2
PRACTICAL /SESSIONAL															
1	5	Professional Core Course	Core Courses (CC)-Major	3IPCC204P	Database Management Systems Lab	0	0	2			30	20	50	1
2		Professional Core Course	Core Courses (CC)-Major	3IPCC205P	Machine Learning Lab	0	0	2			30	20	50	1
3		Professional Core Course	Core Courses (CC)-Major	3IPCC208P	Operating Systems Lab	0	0	2			30	20	50	1

4		Professional Core Course	Core Courses (CC)-Major	3IPCC206P	Object Oriented Programming with JAVA Lab	0	0	2			30	20	50	1
											TOTAL		**850**	**25**
NOTE: Mandatory Vocational /Industrial Training(4Weeks) or any specialized course of minimum 4 credits offered by respective department for student opting for exit after second year with UG DIPLOMA														

SEMESTER V

S. No	NSQF/ NATIONAL CREDIT FRAMEWORK NCrF CREDIT LEVEL	BROAD CATEGORY	CATEGORY	CODE	COURSE TITLE	Periods			Evaluation Scheme				Subject Total	Credit
						L	T	P	Assignment	TA	Total	ESE		
1	5.5	Professional Core Course	Core Courses (CC)-Major	3IPCC301	Design & Analysis of Algorithms	3	0	0	20	10	30	70	100	3
2		Professional Core Course	Core Courses (CC)-Major	3IPCC302	Fundamentals of Software Engineering	3	0	0	20	10	30	70	100	3
3		Professional Core Course	Core Courses (CC)-Major	3IPCC303	Deep Learning	3	0	0	20	10	30	70	150	3
4		Departmental Elective			Departmental Elective I	3	0	0	20	10	30	70	100	3
5		Open Elective Course	Core Course (CC)-Minor		Open Elective I / MOOCs I	3	0	0	20	10	30	70	100	3
6		Value Added Course	Value Added Course (VAC)	3IVAC301	Character Building & Holistic Development of Personality- III (Universal Human Values and Ethics)	2	0	0	20	10	30	70	100	2
7		Internship	Internship		Internship	0	0	4				100	100	2
PRACTICAL /SESSIONAL														
1	5.5	Professional Core Course	Core Courses (CC)-Major	3IPCC301P	Design & Analysis of Algorithms Lab	0	0	2			30	20	50	1
2		Professional Core Course	Core Courses (CC)-Major	3IPCC302P	Fundamentals of Software Engineering Lab	0	0	2			30	20	50	1

3		Professional Core Course	Core Courses (CC)-Major	3IPCC303P	Deep Learning Lab	0	0	2			30	20	50	1
											TOTAL		**900**	**22**

SEMESTER VI														
S. No.	**NSQF/ NATIONAL CREDIT FRAMEWORK NCrF CREDIT LEVEL**	**BROAD CATEGORY**	**CATEGORY**	**CODE**	**COURSE TITLE**	**Periods**			**Evaluation Scheme**				**Subject Total**	**Credit**
						L	**T**	**P**	**Assignment**	**TA**	**Total**	**ESE**		
1	5.5	Professional Core Course	Core Courses (CC)-Major	3IPCC304	Computer Networks	3	0	0	20	10	30	70	100	3
2		Professional Core Course	Core Courses (CC)-Major	3IPCC305	Introduction to Cyber Security	3	0	0	20	10	30	70	100	3
3		Professional Core Course	Core Courses (CC)-Major	3IPCC306	Natural Language Processing	3	0	0	20	10	30	70	100	3
4		Departmental Elective	Core Courses (CC)-Major		Departmental Elective II	3	0	0	20	10	30	70	100	3
5		Departmental Elective	Core Courses (CC)-Major		Departmental Elective III	3	0	0	20	10	30	70	100	3
6		Open Elective Course	Multidisciplinary Course (MDC)		Open Elective II / MOOCs II	3	0	0	20	10	30	70	100	3
PRACTICAL /SESSIONAL														
1	5.5	Professional Core Course	Core Courses (CC)-Major	3IPCC304P	Computer Networks Lab	0	0	2			30	20	50	1
2		Professional Core Course	Core Courses (CC)-Major	3IPCC306P	Natural Language Processing Lab	0	0	2			30	20	50	1
3		Departmental Elective	Core Courses (CC)-Major		Departmental Elective II Lab	0	0	2			30	20	50	1

4		Project	Project	3IPROJ301	Project-I	0	0	6	20	10	50	50	100	3
											TOTAL		**800**	**24**

SEMESTER VII														
S. No	**NSQF/ NATIONAL CREDIT FRAMEWORK NCrF CREDIT LEVEL**	**BROAD CATEGORY**	**CATEGORY**	**CODE**	**COURSE TITLE**	**Periods**			**Evaluation Scheme**				**Subject Total**	**Credit**
						L	**T**	**P**	**Assignment**	**TA**	**Total**	**ESE**		
1	6	Professional Core Course	Core Courses (CC)-Major	3IPCC401	Artificial Intelligence Analyst	3	0	0	20	10	30	70	100	3
2		Departmental Elective	Core Courses (CC)-Major		Departmental Elective IV	3	0	0	20	10	30	70	150	3
3		Departmental Elective	Core Courses (CC)-Major		Departmental Elective V	3	0	0	20	10	30	70	100	3
4		Open Elective Course	Multidisciplinary Course (MDC)		Open Elective III / MOOCs III	3	0	0	20	10	30	70	100	3
PRACTICAL /SESSIONAL														
1	6	Professional Core Course	Core Courses (CC)-Major	3IPCC401P	Artificial Intelligence Analyst Lab	0	0	2			30	20	50	1
2		Departmental Elective	Core Courses (CC)-Major		Departmental Elective IV Lab	0	0	2			30	20	50	1
3		Project	Project	3IPROJ401	Project-II	0	0	8			100	100	200	4
											TOTAL		**650**	**18**

SEMESTER VIII														
S.No.	**NSQF/ NATIONAL CREDIT FRAMEWORK NCrF CREDIT LEVEL**	**BROAD CATEGORY**	**CATEGORY**	**CODE**	**COURSE TITLE**	**Periods**			**Evaluation Scheme**				**Subject Total**	**Credit**
						L	**T**	**P**	**Assignment**	**TA**	**Total**	**ESE**		
1					Managing Personal Finance##	2	0	0			50	0	50	0

PRACTICAL /SESSIONAL														
1	6	Project	Project	3IPROJ 402	Project-III	0	0	16			100	100	200	8
											TOTAL		**450**	**8**

Semester	Total Credit (Without Vocational Course)	Total Credit (With Vocational Course)
1	24	24
2	23	22
Year 1 (Certificate)	47	51
3	22	22
4	25	25
Year 2 (Diploma)	94	98
5	22	
6	24	
	140	NA
7	18	
8	8	
Year 4 (B. Tech. Regular)	166	NA

Departmental Elective- B. Tech. in Artificial Intelligence and Machine Learning						
SEMESTER	**CODE**	**COURSE TITLE**	**L**	**T**	**P**	**C**
SEM V	3IDE301	Formal Language & Automata Theory	3	0	0	3
	3IDE302	Introduction to Robotics	3	0	0	3
	3IDE303	Pattern Recognition	3	0	0	3
SEM VI	3IDE304	Compiler Design	3	0	2	4
	3IDE305	Web Technology	3	0	2	4
	3IDE306	AI for games	3	0	2	4
	3IDE307	Fundamentals of Data Science	3	0	0	3
	3IDE308	Intelligent systems	3	0	0	3
	3IDE309	Data Mining	3	0	0	3
SEM VII	3IDE401	Internet -of-Things	3	0	0	3
	3IDE402	Knowledge Representation	3	0	0	3
	3IDE403	Computer Vision	3	0	0	3
	3IDE404	Statistics for Artificial Intelligence	3	0	0	3
	3IDE405	Embedded Systems	3	0	2	4
	3IDE406	Image Processing	3	0	2	4
	3IDE407	Computer Graphics	3	0	2	4

Open Electives (Select any one in V, VI, VII semester)					
Code	**Course Title**	**L**	**T**	**P**	**Credits**
3IOEC101	Indian Knowledge System	3	0	0	3
3IOEC102	Cyber Law and Ethics	3	0	0	3
3IOEC103	Cryptography and Network Security	3	0	0	3

Open Elective can also be opted by MOOCs
The students of B. Tech. AI and ML can opt any of the courses offered by the other Departments / Programs in the same semester

Detailed Assessment Scheme

Assessment Scheme				
CIA- Continuous Internal Assessment (50 Marks)				
Assessment Parameters	**Assessment Tools**	**Marks**	Bloom's Taxonomy Category	Bloom's Taxonomy Level LOT/HOT
Assignment 1	Assignment consisting of minimum 5 Questions	10	Remember, Understand, Apply	LOT
Assignment 2	Assignment consisting of minimum 2 Questions	10	Analyze, Evaluate, Create	HOT
Teacher Assessment/ Class Participation				
Teacher Assessment 1	Quiz, Case Studies, Presentations, Group Discussion, Lab work, Project or any other	10	Remember, Understand, Apply	LOT
Teacher Assessment 2	Quiz, Case Studies, Presentations, Group Discussion, Lab work, Project or any other activity	10	Analyze, Evaluate, Create	HOT
Class Participation	Brainstorming, Discussion, Attendance, Extempore or any other activity	10		

(LOT: Low Order Thinking, HOT: High Order Thinking)

'ESE- End Semester Examination (70 Marks)		
Bloom's Taxonomy Category	**ESE Question Paper Section**	**Bloom's Taxonomy Level LOT/HOT**
Remember	A	LOT
Understand	A	
Apply	B	LOT/ HOT
Analyze	B	
Evaluate & Create	C	HOT

Semester I

SEMESTER I														
S. No	**NSQF/ NATIONAL CREDIT FRAMEWORK NCrF CREDIT LEVEL**	**BROAD CATEGORY**	**CATEGORY**	**CODE**	**COURSE TITLE**	**Periods**			**Evaluation Scheme**				**Subject Total**	**Credit**
						L	**T**	**P**	**Assignment**	**TA**	**Total**	**ESE**		
1	4.5	Basic Science Course	Multidisciplinary Course (MDC)	3IBSC101	Chemistry	3	1	0	20	10	30	70	100	4
2		Basic Science Course	Core Course (CC)- Minor	3IBSC102	Mathematics I	3	1	0	20	10	30	70	100	4
3		Engineering Science Course	Core Course (CC)- Minor	3IESC101	Basic Electrical Engineering	3	1	0	20	10	30	70	100	4
4		Engineering Science Course	Core Course (CC)- Minor	3IESC102	Engineering Graphics & Design	2	0	0	20	10	30	70	100	2
5		Professional Core Course	Core Courses (CC)- Major	3IPCC101	Software Foundation Course-C	3	0	0	20	10	30	70	100	3
6		Humanities and Social Sciences	Ability Enhancement Courses (AEC)	3IHSS101	English	3	0	0	20	10	30	70	100	3
PRACTICAL /SESSIONAL														
1	4.5	Basic Science Course	Skill Enhancement Course (SEC)	3IBSC101P	Chemistry Lab	0	0	2			30	20	50	1
2		Engineering Science Course	Skill Enhancement Course (SEC)	3IESC101P	Basic Electrical Engineering Lab	0	0	2			30	20	50	1
3		Engineering Science Course	Core Course (CC)- Minor	3IESC102P	Engineering Graphics & Design Lab	0	0	2			30	20	50	1
4		Professional Core Course	Core Courses (CC)- Major	3IPCC101P	Software Foundation Course-C Lab	0	0	2			30	20	50	1
											TOTAL		**800**	**24**

Program: B. Tech. in AI and ML

Semester: First

Course: Chemistry

Course Code: 3IBSC101

L	T	P	C
3	1	0	4

Course Objective:

The objectives of the course are:

- To bring adaptability to new developments in Engineering Chemistry and to acquire the skills required to become a perfect engineer.
- The knowledge gained on spectroscopy; stereochemistry will provide a strong platform to understand the concepts on these subjects for further learning.
- To acquire knowledge of the basic 3D structure in organic chemistry including stereochemistry, aromaticity and reaction mechanism.
- To develop knowledge on the physical state and electrochemistry of molecules and significance of corrosion.

Course Outcome:

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

CO1: Learn about the bonding in a molecular structure of simple and complex molecule, magnetism and isomerism in complex molecule.

CO2: Learn about limitations of classical mechanics and solution in terms of quantum mechanics for atomic/molecular systems. Gain insight into the basic principles of UV, IR and NMR spectroscopic techniques. Use spectroscopic techniques to determine structure and stereochemistry of known and unknown compounds.

CO3: Learn about aromaticity of organic compound identify and differentiate prochirality and chirality at centres, axis and determine the absolute configuration. Evaluate the stability of various conformers of acyclic and cyclic systems

CO4: Learn about the rate of reaction, order and molecularity of reaction, mechanism of a simple as well as catalytic reaction.

CO5: Learn about the phases and the electrochemical behavior of the molecules, EMF of cell and it's application.

Course Content:

Topics	Hours
Unit I	8
Chemical Bonding: Ionic bond: Radius ratio rule, Metallic Bond: valence bond and band theories, defects in solids, Werner's Theory, Bonding in Transition metal complexes, Ligands, coordination complexes, Crystal Field Theory, Octahedral and Tetrahedral complexes, CFSE, Jahn Teller theorem, magnetism, and isomerization in coordination compounds.	
Ionic bond: Radius ratio rule, Metallic Bond: valence bond and band theories, defects in solids, Werner's Theory, Bonding in Transition metal complexes, Ligands, coordination complexes, Crystal Field Theory, Octahedral and Tetrahedral complexes, CFSE, Jahn Teller theorem, magnetism, and isomerization in coordination compounds.	
Unit II	7
Spectroscopic techniques and applications:	
Principles of spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging.	
Unit III	4
Organic Structure and Stereochemistry:	
Covalent bond: Lewis's structure, Valence Bond theory, Molecular orbital theory, Molecular orbital of diatomic and polyatomic system, hybridization, conjugated molecules, Huckel molecular orbital theory of conjugated systems. Isomerism, Geometrical isomerism: cis–trans and syn-anti isomerism; Optical isomerism & Chirality; Wedge, Fischer, Newmann and Sawhorse Projection formulae and interconversions; Conformational studies of ethane, n-butane, Cyclohexane	
Unit IV	6
Kinetics and Catalysis:	
Order & molecularity of reactions, kinetics of zero, first & second order reaction Characteristics of catalyst, types of catalysis, theories of catalysis; Acid base catalysis, Enzyme catalysis, Important catalysts in industrial processes; Hydrogenation using Wilkinson's catalyst,	
Unit V	6
Phase and Chemical equilibrium:	
Phase Rule: Terms Involved, Phase diagram of one component (Water) their applications. Law of chemical equilibrium, equilibrium constants and their significance, Weak and strong electrolytes, Standard electrode potential and its application, EMF and its measurement and application, the Nernst equation, Chemical and Electrochemical corrosion, Factors affecting the rate of corrosion.	

Suggested Reading:

1. University chemistry, by B. H. Mahan
2. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
3. Fundamentals of Molecular Spectroscopy, by C. N. Banwell
4. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
5. Physical Chemistry, by P. W. Atkins
6. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore.
7. Engineering Chemistry by Jain & Jain.
8. Engineering Chemistry by O P Agarwal.

Program: B.Tech. in AI and ML

Semester: First

Course: Chemistry Lab

Course Code: 3IBSC101P

L	T	P	C
0	0	2	1

List of Laboratory Experiments/Demonstrations:

1. Know your lab

Volumetric Analysis:

2. Determine the Strength of NaOH Solution (Standard Hydrochloric acid Solution Supplied).
3. Determination of chloride content of water sample by argentometric method
4. Determination of DO content of water sample by Winkler's methods.
5. Determination of acidity of water sample
6. To draw pH-titration curve of strong acid vs strong base

pH meter:

7. Determination of pH of a given sample using pH meter:

Preparations:

8. Preparation of N/10 solution
9. Synthesis of Aspirin

Additional experiments

10. Determination of surface tension and Viscosity
11. Determination of the rate constant of a reaction
12. Adsorption of acetic acid by charcoal
13. Saponification/acid value of an oil

Program: B.Tech. in AI and ML

Semester: First

Course: Mathematics I

Course Code: 3IBSC102

L	T	P	C
3	1	0	4

Course Objective:

The objective of this course is

- To develop an understanding of matrix theory and its applications in solving linear systems and transformations.
- To equip students with the concepts of single-variable calculus including theorems, series expansion, and evaluation of integrals.
- To introduce multivariable calculus for functions of several variables and optimization techniques.
- To provide knowledge on multiple integrals and their applications in geometry and physics.
- To familiarize students with infinite sequences, series, and Fourier series representations of functions.

Course Outcome:

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

CO1: Apply matrix operations, eigenvalues, eigenvectors, diagonalization, and the Cayley Hamilton Theorem to solve linear algebra problems and systems of equations.

CO2: Use theorems of calculus such as Rolle's and Mean Value Theorems, Taylor/Maclaurin expansions, and evaluate definite and improper integrals using special functions like Beta and Gamma.

CO3: Compute partial derivatives, directional derivatives, and use the method of Lagrange multipliers for optimization in multivariable functions.

CO4: Evaluate double and triple integrals using Cartesian and polar coordinates and apply them to calculate areas and volumes in different coordinate systems.

CO5: Analyze the convergence of sequences and series, apply various tests, and represent functions.

Course Content:

Topics	Hours
Unit I	10
Matrices: System of linear equations; rank of a matrix, rank-nullity theorem; Symmetric, skew symmetric and orthogonal matrices; Eigen values and eigenvectors; Diagonalization of matrices; Cayley- Hamilton Theorem, and Orthogonal transformation; Cramer's rule.	
Unit II	7
Calculus: Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; indeterminate forms and Hospital's rule, Evaluation of definite and improper integrals; Beta and Gamma functions and their properties.	
Unit III	8
Multivariable Calculus (Differentiation): Partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points, Method of Lagrange multipliers.	
Unit IV	8
Multivariable Calculus (Integration): Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, change of variables (Cartesian to polar), Applications: areas and volumes, Triple integrals (Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes and sphere.	
Unit V	7
Sequences and series: Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and Logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.	

Suggested Reading:

1. H.K. Dass, "Advance Engineering Mathematics''; S.Chand &Co., 9th Revised Ed., 2001.
2. B.S. Grewal, "Higher Engineering Mathematics''.
3. E. Kreyszig, "Advance Engineering

Program: B. Tech. in AI and ML

Semester: First

Course: Basic Electrical Engineering

Course Code: 3IESC101

L	T	P	C
3	1	0	4

Course Objective:

The objective of this course is

- To study the electrical circuit network with DC Excitation.
- To understand phasor diagram of different electrical circuit for AC Excitation.
- To Understand different types of transformers with single phase & three phase connection.
- To study the construction & working principles of different types Electrical Machine.
- To understand the power converters with switch gear protection for electrical equipment's, Earthing & types of battery.

Course Outcome:

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

CO1: Demonstrate and apply basics of electrical circuit theorems on D.C Supply & A.C waveform with the Phasor diagram & power measurement.

CO2: Apply fundamentals of electromagnetism and basic concept of single-phase & three phase transformer with their regulation, efficiency and estimation of losses.

CO3: Realize the concept and working of different types of DC and AC machines and will be able to select right machine to meet desired needs for implementing engineering solutions.

CO4: Understand the basic circuits converters, inverters, Switchgear protection, earthing & types of battery.

Course Content:

Topics	Hours
Unit I	8
D.C. Circuits Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.	
Unit II	8
A.C. Circuits Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three-phase balanced circuits, voltage and current relations in star and delta connections.	
Unit III	6
Transformers Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.	
Unit IV	8
Electrical Machines Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.	
Unit V	6
Power Converters DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.	
Unit VI	6
Electrical Installations Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.	

Suggested Reading:

1. Basic Electrical Engineering - D.P. Kothari and I.J. Nagrath, 3rd edition 2010, Tata McGraw Hill.
2. Basic Electrical Engineering - D.C. Kulshreshtha, 2009, Tata McGraw Hill.
3. Fundamentals of Electrical Engineering, L.S. Bobrow, Oxford University Press, 2011
4. Electrical and Electronics Technology, E. Hughes, 10th Edition, Pearson, 2010
5. Electrical Engineering Fundamentals, Vincent Deltoro, Second Edition, Prentice Hall India, 1989

Program: B.Tech. in AI and ML

Semester: First

Course: Basic Electrical Engineering Lab

Course Code: 3IESC101P

L	T	P	C
0	0	2	1

List of Laboratory Experiments/Demonstrations:

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope). Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
3. Transformers: Observation of the no-load current waveform on an oscilloscope (non-sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
4. Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.
5. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.
6. Torque Speed Characteristic of separately excited dc motor.
7. Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections. Torque-Slip Characteristic of an induction motor. Generator operation of an induction machine driven at super-synchronous speed.

8. Synchronous Machine operating as a generator: stand-alone operation with a load. Control of voltage through field excitation.
9. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switchgear.

Program: B.Tech. CSE

Semester: First

Course: Engineering Graphics & Design

Course Code: 3IESC102

L	T	P	C
2	0	0	2

Course Objective:

The objective of this course is

- To introduction to engineering design and its place in society
- To exposure to the visual aspects of engineering design
- To exposure to engineering graphics standards
- To exposure to solid modeling
- To exposure to computer-aided geometric design
- To exposure to creating working drawings
- To exposure to engineering communication

Course Outcome:

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

CO1: Know and understand the conventions and the method of engineering drawing.

CO2: Interpret engineering drawings using fundamental technical mathematics.

CO3: Construct basic and intermediate geometry.

CO4: To improve their visualization skills so that they can apply this skill in developing new products.

CO5: To improve their technical communication skill in the form of communicative drawings.

CO6: Comprehend the theory of projection.

Course Content:

Traditional Engineering Graphics: 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.

Computer Graphics: Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modelling; Solid Modelling; Introduction to Building Information Modelling (BIM)

Topics	Hours
Unit I	7
Introduction to Engineering Drawing covering, Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Scales – Plain, Diagonal and Vernier Scales, Study symmetry in traditional Indian art (Mandala), design principles from Vastu Shastra, and ancient systems of measurement from Shilpa Shastra.	
Unit II	4
Orthographic Projections covering, Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes.	
Unit III	4
Projections of Regular Solids covering, those inclined to both the Planes-Auxiliary Views; Draw simple annotation, dimensioning and scale.	
Unit IV	4
Sections and Sectional Views of Right Angular Solids covering, Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone.	
Unit V	4
Isometric Projections covering, Principles of Isometric projection – Isometric Scale, Isometric Views; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions	
Unit VI	4
Overview of Computer Graphics covering, demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System, The Status Bar.	
Unit VII	4
Customization & CAD Drawing consisting of set up of the drawing page and the printer, including scale settings, setting up of units and drawing limits.	
Unit VIII	5
Annotations, layering & other functions covering applying dimensions to objects, Changing line lengths through modifying existing lines (extend/lengthen); Drawing sectional views of	

composite right regular geometric solids and project the true shape of the sectioned surface. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling.	
Unit IX	4
Creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; Introduction to Building Information Modelling (BIM).	

Suggested Reading:

1. Engineering Drawing textbook Intro By : N D Bhatt
2. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, CharotarPublishing House
3. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
4. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
5. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, ScitechPublishers
6. (Corresponding set of) CAD Software Theory and User Manuals By: R K Dhavan
7. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, CharotarPublishing House
8. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
9. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
10. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, ScitechPublishers
11. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
12. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication

Program: B.Tech. CSE

Semester: First

Course: Engineering Graphics & Design Lab

Course Code: 3IESC102P

L	T	P	C
0	0	2	1

Laboratory Experiments/Demonstrations is to be conducted as per module content.

Program: B.Tech. in AI and ML

Semester: First

Course: Software Foundation Course-C

Course Code: 3IPCC101

L	T	P	C
3	0	0	3

Course Objective:

1. Understand the basic concepts of programming, including algorithms, flowcharts, and pseudocode.
2. Learn about the history and evolution of the C programming language.
3. Understand the concept of functions and their importance in code reusability and modularity.
4. Learn how to declare, define, and call functions.
5. Explore the scope and lifetime of variables.

Course Outcome:

After completing the course, the students should be able to:

1. Understanding and describe concept related to Software Development using C.
2. Implement different programming constructs and decomposition of problems into functions
3. Use and implement data structures like arrays and structures to obtain solutions
4. Define and use of pointers with simple applications.

5. Analyzing the expected to have learnt programming concepts and technical aspects of C programming.

Course Contents

Unit No.	Unit Title	Contents	No. of Hours
UNIT -I	Introduction to C Programming	Introduction to Computing: Algorithms and Flowcharts. Overview of C: History, importance, structure, execution. Constants, Variables & Data Types: Tokens, Keywords, Identifiers, Data Types, Declaration, Assignments, Symbolic Constants. Input/Output: Character I/O, Formatted I/O. Operators & Expressions: Types, Precedence, Associativity, Type Conversion.	**10**
UNIT -II	Control Structures	Decision Making: IF, IF-ELSE, Nested IF, ELSE-IF Ladder, Switch, Conditional Operator, goto. Looping: while, do-while, for loops, Jump statements (break, continue).	**9**
UNIT -III	Arrays and Strings	Arrays: 1D & 2D Arrays, Declaration, Initialization. Programs: Sorting (Bubble, Selection), Searching (Linear, Binary), Matrix Operations. Strings: Declaration, Input/Output, String Operations, Built-in Functions, Programs.	**9**
UNIT -IV	Functions and Pointers	Functions: Definition, Types, Calls, Parameters, Return Values, Recursion, Scope & Lifetime. Pointers: Basics, Declaration, Initialization, Accessing Variables, Pointer Arithmetic.	**9**

UNIT -V	Structures and File Management	Structures: Definition, Declaration, Initialization, Array of Structures. File Management: File Handling Operations, I/O, Error Handling. Introduction to Linux: Open Source, IBM & Linux Basics.	**8**

Program: B.Tech. in AI and ML

Semester: First

Course: Software Foundation Course-C Lab

Course Code: 3IPCC101P

L	T	P	C
0	0	2	1

Lab Experiments

1. Write a program to perform arithmetic operations (addition, subtraction, multiplication, division, modulo).
2. Write a program to check whether a given year is a leap year.
3. Write a program to swap two numbers using a third variable.
4. Write a program to swap two numbers without using a third variable.
5. Write programs using decision-making statements: if, if-else, nested if, and switch-case.
6. Write programs using looping constructs (for, while, do-while).
7. Write a program to print even and odd numbers between 1 and 100.
8. Write a program to demonstrate the use of break and continue statements.
9. Write a program to demonstrate local and global variables.
10. Write programs on arrays to insert and delete elements and to find maximum and minimum values.
11. Write programs to implement linear search and bubble sort.

12. Write programs on two-dimensional arrays to perform matrix addition and matrix multiplication.
13. Write programs using functions with arguments and return values, and implement recursive functions (factorial or Fibonacci).
14. Write programs to demonstrate pointer operations and swapping using pointers.
15. Write programs using structures and file handling to store student records and perform file operations (create, read, write, append).

Text/Reference Books

1. The C Programming Language" by Brian W. Kernighan and Dennis M. Ritchie
2. "C Programming: A Modern Approach" by K.N. King
3. Programming in C" by Stephen G. Kochan

Program: B.Tech. in AI and ML
Semester: First
Course: English
Course Code: 3IHSS101

L	T	P	C
3	0	0	3

Course Objective:

The objectives of the course are:

- To enhance Professional competence in reading, writing, listening and speaking.
- Switch the approach from providing information about the language to use the language.
- To use English effectively for study purpose across the curriculum and to revise and reinforce structure already learnt.
- Introduce Communicative Method of ELT and focusing the teaching pedagogy on the student-centered learning rather than on the teacher-centered learning.
- Ability to master three major forms of communications which are vital in academic and professional settings namely professional presentations, interviews and group communications respectively.

- Providing a deep insight into the techniques for delivering effective presentations, winning job interviews, and actively participating in various forms of group communication.

Course Outcome:

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

CO1: Design language components or processes that meet specific needs within realistic constraints.

CO2: Analyze the contextual usage of English words.

CO3: Develop strong comprehension of technical and academic articles.

CO4: Confidently present themselves in multinational settings, adapting to different English standards.

CO5: Evaluate and produce correct, error-free writing, applying appropriate communication and presentation styles for both professional and academic contexts.

CO6: Apply practical presentation skills and voice dynamics in oral presentations.

Course Content:

Topics	Hours
Unit I	3
Vocabulary Building: The concept of Word Formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives, Synonyms, antonyms, and standard abbreviations.	
Unit II	4
Basic Writing Skills: Sentence Structures, Use of phrases and clauses in sentences, Importance of proper punctuation, Creating coherence, Organizing principles of paragraphs in documents, Techniques for writing precisely	
Unit III	3
Identifying Common Errors in Writing: Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies, Clichés	
Unit IV	4
Nature and Style of sensible Writing: Describing, Defining, Classifying, providing examples or evidence, writing introduction and conclusion	
Unit V	4

Writing Practices: Comprehension, Précis Writing, Essay Writing	
Unit VI	6
Oral Communication: (This unit involves interactive practice sessions in Language Lab) - Listening Comprehension, Pronunciation, Intonation, Stress and Rhythm, Common Everyday Situations: Conversations and Dialogues, Communication at Workplace, Interviews, Formal Presentations	

Suggested Readings:

1. Practical English Usage. Michael Swan. OUP. 1995.
2. Remedial English Grammar. F.T. Wood. Macmillan.2007
3. On Writing Well. William Zinsser. Harper Resource Book. 2001
4. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
5. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
6. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

Semester II

SEMESTER II														
S.No.		**BROAD CATEGORY**	**CATEGORY**	**CODE**	**COURSE TITLE**	**Periods**			**Evaluation Scheme**				**Subject Total**	**Credit**
						L	**T**	**P**	**Assignment**	**TA**	**Total**	**ESE**		
1	4.5	Basic Science Course	Multidisciplinary Course (MDC)	3IBSC103	Physics	3	1	0	20	10	30	70	100	4
2		Basic Science Course	Core Course (CC)- Minor	3IBSC104	Mathematics II	3	1	0	20	10	30	70	100	4
3		Engineering Science Course	Core Courses (CC)- Major	3IPCC102	Python	3	0	0	20	10	30	70	100	3
4		Engineering Science Course	Skill Enhancement Course (SEC)	3IESC105	Computer Assembly and Repair	1	0	0	20	10	30	70	100	1
5		Mandatory Course	Value Added Course (VAC)	3IMC101	Environmental Science	3	0	0	20	10	30	70	100	3

6		Value Added Course	Value Added Course (VAC)	3IVAC101	Character Building & Holistic Development of Personality-I (Spiritual & Mental Health)	2	0	0	20	10	30	70	100	2
PRACTICAL /SESSIONAL														
1	4.5	Basic ScienceCourse	Skill Enhancement Course (SEC)	3IBSC103P	Physics Lab	0	0	2			30	20	50	1
2		Engineering Science Course	Core Courses (CC)- Major	3IPCC102P	Python Lab	0	0	2			30	20	50	1
3		Engineering ScienceCourse	Skill Enhancement Course (SEC)	3IESC103P	Computer Assembly and Repair Lab	0	0	2			30	20	50	1
											TOTAL		**650**	**20**
NOTE: Mandatory Vocational /Industrial Training(4Weeks) or any specialized course of minimum 4 credits offered by respective department for student opting for exit after first year with UG CERTIFICATE														

Program: B.Tech. in AI and ML

Semester: Second

Course: Physics

Course Code: 3IBSC103

L	T	P	C
3	1	0	4

Course Objective:

The objective of this course is

- To equip the students with standard concepts of Physics and applications of Physics.
- To understand the concept of various types of Electromagnetic Theory.
- Detail study of Quantum Mechanics.
- To understand Laws and different Phenomena of Wave Optics.
- Detail study of Laser, types of Laser and applications of Laser.
- To understand the concept of Semiconductor Physics and Semiconductor devices.

Course Outcome:

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

CO1: Know the basic concepts of electromagnetic theory and their application.

CO2: Know about the dual nature of matter and wave equation.

CO3: Demonstrate the types of motion and different types of forces.

CO4: Design the concept of wave optics, types of lasers, classification of laser and their application.

CO5: Know about the different types of diodes and their characteristics.

Course Content:

Topics	Hours
Unit I	10
Laplace's and Poisson's equations for electrostatic potential and. Boundary conditions of electric field and electrostatic Potential. Energy of a charge distribution and its expression in terms of electric field. Solving simple electrostatics problems in presence of dielectrics – Point charge at the centre of a dielectric sphere, Bio-Savart law, Divergence and curl of static magnetic field; Magnetization magnetic susceptibility and ferromagnetic, paramagnetic and diamagnetic materials. Faraday's law in terms of EMF produced by changing magnetic flux, Lenz's law. Differential form of Faraday's law Displacement current and Maxwell's equations.	
Unit II	7
Introduction to Quantum mechanics, Wave nature of Particles, Time-dependent and time independent Schrodinger equation for wave function, Uncertainty principle. Solution of stationary-state Schrodinger equation for one dimensional problem– particle in a box, particle in three-dimensional box.	
Unit III	8
Scalars and vectors Forces in Nature; Newton's laws and its completeness in describing particle motion; Form invariance of Newton's Second Law; Solving Newton's equations of motion in polar coordinates; F = - Grad V; Definition and motion of a rigid body in the plane; Rotation in he plane; Kinematics in a coordinate system rotating and translating in the plane; Angular momentum about a point of a rigid body in planar motion; Euler's laws of motion, their independence from Newton's laws, and their necessity in describing rigid body motion; Examples.	
Unit IV	8
Mechanical and electrical simple harmonic oscillators. Brewster's Law, total internal reflection, Mirrors & lenses and optical instruments based on them. Amplification of light	

by population inversion, different types of lasers: gas lasers (He-Ne), solid-state lasers (ruby Laser).Properties of laser beams, applications of lasers in science, engineering and medicine.	
Unit V	
P-N junction, Metal-semiconductor junction (Ohmic and Schottky); Carrier transport, generation, and recombination; Semiconductor materials of interest for optoelectronic devices. Rates of optical transitions LED: device structure, materials, characteristics, and figures of merit. Types of semiconductor photodetectors -p-n junction, PIN, and Avalanche.	7

Suggested Reading:

1. Engineering Physics: R.K.Gaur & S.L. Gupta
2. Engineering Physics: G.S. Raghuvanshi
3. Modern Engineering Physics: A.S.Vasudeva
4. David Griffiths, Introduction to Electrodynamics
5. Halliday and Resnick, Physics
6. D. J. Griffiths, Quantum
7. Engineering Mechanics, 2nd ed. — MK Harbola
8. D. J. Griffiths, "Quantum mechanics", Pearson Education.
9. S. M. Sze, Semiconductor Devices: Physics and Technology.

Program: B.Tech. in AI and ML

Semester: Second

Course: Physics Lab

Course Code: 3IBSC103P

L	T	P	C
0	0	2	1

List of Laboratory Experiments/Demonstrations:

1. Find the acceleration due to gravity using Kater's pendulum.
2. Find the resistance of a given wire using Meter Bridge.
3. To establish the current voltage relationship for a metallic conductor and find itsresistance.
4. To determine the unknown resistance of given wire using Potentiometer.
5. Find the acceleration due to gravity using Simple pendulum.
6. To determine Young' modulus of the material of a given wire using Searle's Apparatus
7. To determine the unknown resistance of given wire using Potentiometer.
8. To determine the wavelength of sodium light by Newton's ring method.
9. To measure the wavelength of Mercury spectrum using Spectrometer grating.

10. To study the variation of magnetic field with distances using Helmholtz Galvanometer.

Program: B.Tech. in AI and ML

Semester: Second

Course: Mathematics II

Course Code: 3IBSC104

L	T	P	C
3	1	0	4

Course Objective:

The objectives of the course are:

- To solve first-order differential equations using standard methods.
- To analyze and solve higher-order linear differential equations.
- To apply power series solutions to differential equations and study special functions.
- To formulate and solve partial differential equations with boundary and initial conditions.
- To apply vector calculus operations and theorems in solving engineering problems.

Course Outcome:

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

CO1: Solve various types of first-order differential equations and understand their applications in

modeling physical systems.

CO2: Apply methods like variation of parameters and Cauchy-Euler technique to solve second-order and higher-order differential equations.

CO3: Use power series methods to find solutions to differential equations and explain the properties of Legendre and Bessel functions.

CO4: Classify and solve partial differential equations of first and second order using standard methods like separation of variables and D'Alembert's solution.

CO5: Evaluate scalar and vector line and surface integrals, and apply Green's, Gauss's, and Stokes's theorems to solve problems in vector calculus.

Course Content:

Topics	Hours
Unit I	10
First order ordinary differential equations: Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.	
Unit II	10
Ordinary differential equations of higher orders: Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation.	
Unit III	10
Power series: Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.	
Unit IV	10
Partial Differential Equations: Definition of Partial Differential Equations, First order partial differential equations, solutions of first order linear PDEs; Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method. Second-order linear equations and their classification, Initial and boundary conditions, D'Alembert's solution of the wave equation; Heat diffusion and vibration problems, Separation of variables method to simple problems in Cartesian coordinates.	

Unit V	
Vector calculus: Gradient, curl and divergence; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.	5

Suggested Readings:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.
4. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
5. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
6. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
7. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc- Graw Hill, 2004.
8. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
9. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Program: B.Tech. in AI and ML

Semester: Second

Course: Python

Course Code: 3IPCC102

L	T	P	C
3	0	0	3

Course Objective:

- Understand and apply Python's built-in functions, operators, and statements effectively.
- Work with Python data structures such as lists, tuples, and dictionaries, and identify object types.
- Implement control flow and decision-making statements to solve problems using Python.
- Develop reusable code by writing functions, handling files, and building Python modules.
- Analyze data patterns and create visual representations using Python libraries like matplotlib.

Course Outcome:

After completing the course, the students should be able to:

CO1: Gain a global perspective on Python and its applications.

CO2: Learn to implement loops, decision-making statements, and functions with arguments in Python.

CO3: Work with core data structures such as lists, tuples, and dictionaries, and identify Python object types.

CO4: Perform file handling operations, create and manipulate Pandas Data Frames, calculate aggregates, and merge datasets.

CO5: Utilize Python libraries for tasks such as data visualization with **matplotlib** and pattern matching with regular expressions.

Course Contents

Unit No.	Unit Title	Contents	No. of Hours
UNIT-I	Introduction to Python	Definition with real-world use cases, history of Python, installation and execution of Python programs, character set, tokens, core data types, variables, input (), eval() & print() functions, string formatting, operators and expressions.	**10**
UNIT-II	Control Structures	Decision making statements, conditional expressions, Boolean data type and operators, string operators, while loop, for loop, nested loops, break & continue statements, range() function.	**9**
UNIT-III	Data Structures, Functions & OOPs	Functions (syntax, parameters & arguments, local & global scope, return statement, recursion), strings (class, traversal, operations, built-in functions), data structures (lists, tuples, dictionaries, sets, operations), OOP concepts (classes, objects, methods, inheritance, super(), method overriding, operator overloading).	**9**
UNIT-IV	File Handling & Data Analysis	File handling (need, modes, reading/writing text and numbers, directories), introduction to Pandas, Series, DataFrames, basic data analysis using Pandas.	**9**

UNIT-V	Data Handling & Visualization	Regular expressions, pattern matching, parsing data, introduction to regression and its types, use cases, exploratory data analysis, correlation matrix, visualization using Matplotlib, implementation of linear regression.	**8**

Program: B.Tech. in AI and ML

Semester: Second

Course: Python Lab

Course Code: 3IPCC102P

L	T	P	C
0	0	2	1

Lab Experiments

1. Write a Python program to demonstrate basic input/output operations, variables, data types, and operators.
2. Write a Python program to perform arithmetic operations and string formatting.
3. Write a Python program using decision-making statements (if, if-else, nested if, elif ladder).
4. Write a Python program to implement looping constructs (for loop, while loop) and generate series (factorial, Fibonacci).
5. Write a Python program demonstrating the use of break and continue statements.
6. Write a Python program to perform operations on strings (slicing, traversal, and built-in functions).
7. Write a Python program to work with lists (creation, insertion, deletion, sorting, searching).
8. Write a Python program to demonstrate tuples, sets, and dictionaries with basic operations.
9. Write a Python program using functions (with arguments, return values, recursion, and scope of variables).
10. Write a Python program to implement basic OOP concepts (class, object, inheritance, method overriding).
11. Write a Python program to perform file handling operations (create, read, write, append files).
12. Write a Python program using Pandas to create Series and DataFrames and perform basic data analysis.
13. Write a Python program using regular expressions for pattern matching and data validation.
14. Write a Python program to perform exploratory data analysis (EDA) including summary statistics and correlation matrix.
15. Write a Python program to visualize data using Matplotlib and implement simple linear regression.

Text/Reference Books

1. Ashok Namdev Kamthane, Programming and Problem Solving with Python, Mc Graw Hill Education Publication, ISBN(13):978-93-87067-57-8.
2. Allen B. Downey, Think Python, O'Reilly Media
3. Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2011, Cengage Learning

Program: B.Tech. in AI and ML

Semester: Second

Course: Computer Assembly and Repair

Course Code: 3IESC103

L	T	P	C
1	0	0	1

Course Objectives:

The objectives of the course are:

- To introduce and familiarize students with internal and external computer hardware components.
- To develop the ability to perform system assembly/disassembly and basic hardware troubleshooting.
- To enable learners to recover data and connect peripheral devices effectively.
- To impart knowledge on operating system and application software installation and configuration.

Course Outcomes:

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

CO1: Identify, describe, and demonstrate key computer hardware components and ports with their functions.

CO2: Assemble and disassemble a desktop system and troubleshoot common hardware issues such as RAM faults, SMPS failures, and BIOS settings.

CO3: Perform data recovery from USB drives and hard disks, and configure peripheral devices like projectors and audio systems.

CO4: Install and configure different operating systems and application software, including antivirus programs, and observe their performance impacts.

Course Content:

Topics	Hours
Unit I	**5**
Introduction to Computer Hardware Components: • Demonstration of Hardware peripherals: CPU, RAM, SMPS, Motherboard, NIC card, Processor, Processor cooling fan, PCI card, HDD • Demonstration of various ports: CPU, VGA port, PS/2 (keyboard, mouse), USB, LAN, Speaker, Audio • Identify the Computer Name and Hardware Specification (RAM capacity, Processor type, HDD, 32 bit/ 64 bit) • Assemble and Disassemble Desktop System	
Unit II	**5**
Troubleshooting and BIOS Configuration: • Configure BIOS settings – disable and enable USB and LAN • Identify and troubleshoot the problems of RAM (beep sound with blue screen), SMPS and motherboard (CPU is not switched ON) • Adding additional RAM to the system (expanding RAM size) • Graphic Card insertion	
Unit III	**5**
Data Recovery and Device Connectivity: • Identify how to recover hidden files from corrupted pen drive using command • Recover contents from crashed Hard Disk using Disk Drill software • Add new Hardware device (keyboard, mouse, Speaker, Microphone) • Connect the LCD Projector with Laptop / CPU	
Unit 4:	**5**
Operating System and Software Installation: • Install Operating System – Windows family (Windows 7 / Windows 10) and make partitions • Install Operating System – Unix family (Linux / UBUNTU) • Install Application software – Python 3.8, MS Office 2010/2013, MySQL, TOAD, OpenOffice, etc. • Install any one antivirus software (Avast, Kaspersky, etc.) and observe the variations before and after installation	

References:

1. Dan Gookin, Troubleshooting & Maintaining Your PC ALL-IN-ONE, 3rd Edition,2017, John Wiley & Sons.
2. Mike Meyers, Scott Jernigan, Dan Lachance, ”CompTIA Fundamentals + Exam Guide (All-in-One), 2nd Edition, 2019, Mc Graw Hill Education.

Web References:

1. https://www.youtube.com/watch?v=ItxwyMR0SnY&list=PLeH4ngtDM7eE-1_mdWuXWyZrI_FMHnyJ0&index=5
2. https://www.cleverfiles.com/howto/crashed-hard-drive-recovery.html

Program: B.Tech. in AI and ML

Semester: Second

Course: Computer Assembly and Repair Lab

Course Code: 3IESC103P

L	T	P	C
0	0	2	1

Lab Experiments:

1. Demonstration of Hardware peripherals: CPU, RAM, SMPS, Motherboard, NIC card, Processor, Processor cooling fan, PCI card, HDD.
2. Demonstration of various ports: CPU, VGA port, PS/2 (keyboard, mouse), USB, LAN, Speaker, Audio.
3. Identify the Computer Name and Hardware Specification (RAM capacity, Processor type, HDD, 32 bit/ 64 bit)
4. Identify and troubleshoot the problems of RAM (beep sound with blue screen), SMPS and motherboard (CPU is not switched ON)
5. Configure BIOS settings- disable and enable USB and LAN.
6. Identify, how to recover the hidden files from corrupted pen drive using command.
7. Recover the contents from crashed Hard Disk using Disk Drill software.
8. Install Operating System – Windows family (Windows 7/ Windows 10) and also make partitions.
9. Install Operating System - Unix family (Linux/UBUNTU)
10. Install Application software – python 3.8, MS- Office 2010/2013, MySQL, TOAD, Open office, etc.,
11. Install any one of the antivirus software (Avast, Kaspersky, etc.,) and observe the variations before and after installation.
12. Add new Hardware device (keyboard, mouse, Speaker, Microphone)
13. Connect the LCD Projector with Laptop / CPU.
14. Adding additional RAM to the system. (Expanding RAM size).
15. Graphic Card insertion.
16. Assemble and Disassemble Desktop System.

Program: B.Tech. in AI and ML

Semester: Second

Course: Environmental Science

Course Code: 3IMC101

L	T	P	C
3	0	0	3

Course Objective:

The objectives of the course are:

- To understand key concepts from economic, political, and social analysis as they pertain to the design and evaluation of environmental policies and institutions.
- To appreciate concepts and methods from ecological and physical sciences and their application in environmental problem solving.
- To reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.
- To develop a strong understanding of core concepts and methods from ecological and physical sciences, and apply them effectively to solve environmental problems."
- To appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.
- To apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.

Course Outcome:

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

CO1: Understand the environmental impacts of engineering solutions in the context of society and sustainability.

CO2: Analyze environmental issues caused by various developmental activities and propose appropriate mitigation strategies.

CO3: Identify natural resources and apply suitable conservation methods for sustainable development.

CO4: Recognize the importance of ecosystems and biodiversity in maintaining ecological balance.

CO5: Identify major environmental pollutants and suggest suitable pollution control and

abatement techniques.

Course Content:

Topics	Hours
Unit I	**8**
Multidisciplinary nature of environmental studies, Natural Resources: Definition, scope and importance need for public awareness. Renewable and non-renewable resources:-Natural resources and associated problems :- a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, Case studies. f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. • Role of an individual in conservation of natural resources. • Equitable use of resources for sustainable lifestyles.	
Unit II	**8**
Ecosystems, Biodiversity and its conservation :• Concept of an ecosystem.• Structure and function of an ecosystem.• Producers, consumers and decomposers.• Energy flow in the ecosystem.• Ecological succession.• Food chains, food webs and ecological pyramids.• Introduction, types, characteristic features, **structure and function of the following ecosystem:** -(a. Forest ecosystem. Grassland ecosystem. Desert ecosystem, d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries),• Introduction – Definition: genetic, species and ecosystem diversity.• Bio geographical classification of India,• **Value of biodiversity:** consumptive use, productive use, social, ethical, aesthetic and option values ,• Biodiversity at global, National and local levels.• India as a mega-diversity nation• Hot-sports of biodiversity.• **Threats to biodiversity:** habitat loss, poaching of wildlife, man-wildlife conflicts.• Endangered and endemic species of India, • Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.	
Unit III:	**7**
Environmental Pollution: Social Issues and the Environment Definition, Cause, effects and control measures of: -(a. Air pollution, b. Water pollution, b. Soil pollution, c. Marine pollution, d.Noise pollution, e. Thermal pollution, f. Nuclear hazards)• **Solid waste Management:** Causes, effects and control measures of urban and industrial wastes. • Role	

of an individual in prevention of pollution.• Pollution case studies.• **Disaster management:** floods, earthquake, cyclone and landslides.• From Unsustainable to Sustainable development.• Urban problems related to energy.• Water conservation, rain water harvesting, watershed management.• Resettlement and rehabilitation of people; its problems and concerns. Case Studies.• **Environmental ethics:** Issues and possible solutions. • Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust Case Studies.• Wasteland reclamation.• Consumerism and waste products. • Environment Protection Act.• Air (Prevention and Control of Pollution) Act. • Water (Prevention and control of Pollution) Act.• Wildlife Protection Act.• Forest Conservation Act.• Issues involved in enforcement of environmental legislation.• Public awareness.	

Unit IV	
Human Population and the Environment, Field work : • Population growth, variation among nations.• Population explosion – Family Welfare Programme.• Environment and human health.• Human Rights.• Value Education.• HIV/AIDS.• Women and Child Welfare.• Role of Information Technology in Environment and human health.• Case Studies.• Visit to a local area to document environmental assets-river/forest/grassland/hill/mountain.• Visit to a local polluted site-Urban/Rural/Industrial/Agricultural.• Study of common plants, insects, birds.• Study of simple ecosystems-pond, river, hill slopes, etc.	7

Suggested Reading:

1. G. Kiely, Environmental Engineering, Irwin/ McGraw Hill International Edition, 1997
2. M. L. Davisand S. J. Masen, Principles of Environmental Engineering and Science, McGraw Hill International Edition 2004
3. D. D. Mishra, Fundamental Concepts in Environmental Studies, S. Chand and company PVT. LTD., 2014

Program: B.Tech. in AI and ML

Semester: Second

Course: Character Building & Holistic Development of Personality-I (Spiritual & Mental Health)

Course Code: 3IVAC101

L	T	P	C
2	0	0	2

Course Objective:

The objectives of the course are:

- To prepare the student to develop Manomaya Kosha (Development of mind).
- To enable the students to develop Vijnanamaya Kosha (Intellectual Development).
- To develop an understanding of Anandamaya Kosha (Spiritual Development).
- To help the students in understanding the virtue of Vasudhaiva-Kutumbakam (the whole world is one family) and also to transform students into ideal personalities by inculcating sanskaaras.

Course Outcome:

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

CO1: Students will **develop a strong understanding of Manomaya Kosha**.

CO2: Students will be able to **apply the concept of constructive roles**.

CO3: Students will be able to **analyze the principles of spiritual development**.

CO4: Students will be able to **correlate the importance of global unity** ("world as a family") and **develop their Manomaya Kosha, Vijnanamaya Kosha, and Anandmaya Kosha.**

Course Content:

Topics	Hours
Unit I	4
Cognitive Intellectual Development (Manomaya Kosha): Character Building: - Meaning, Concept, Constituent elements of character and means/ways of character building. **Manomaya Kosha:** General Introduction, Meaning and Concept. **Manomaya Kosha:** Objectives, Characteristics and Significance. Benefits of developed Manomaya Kosha and deficiencies due to underdeveloped Manomaya Kosha. Means, Activities and Programmes to develop Manomaya Kosha.	
Unit II	4
Cognitive Intellectual Development (Vijnanamaya Kosha): Vijnanamaya Kosha : General Introduction, Meaning and Concept. Objectives, Characteristics and Significance. Benefits of developed Vijnanamaya Kosha and deficiencies due to underdeveloped Vijnanamaya Kosha. Means, Activities and Programmes to develop Vijnanamaya Kosha.	
Unit III	8
Cognitive Intellectual Development (Anandamaya Kosha):Anandamaya Kosha : General Introduction, Meaning and Concept. Objectives, Characteristics and Significance. Benefits of developed Anandamaya Kosha and deficiencies due to underdeveloped Anandamaya Kosha. Means, Activities and Programmes to develop Anandamaya Kosha.	
Unit IV	8
Moral Spiritual Development: (To draw inspiration from important events of the lives of great men of India to serve the society and nation). **Social and National Awakening :** Chanakya, Birsa Munda, Lala Lajpat Rai, Jyotiba Phule, Adi Shankaracharya, Veer Savarkar, **Women from other countries dedicated to India :** Annie Besant, Emily Shankle Bose, Mary Reed. **Leading Scientists:** Acharya Sushruta, Acharya Charak, Aryabhatta, Jagdish Chandra Basu, Homi Jahangir Bhabha, A.P.J Abdul Kalam. **Women's Awakening:** Lakshmi Bai, Rani Durgavati, Rani Chenamma, Rani Ahilya Bai Holkar . **Those who sacrificed all:** Bhagat Singh, Khudiram Bose, Chandrashekhar Azad, Mahatma Gandhi. Seekers of Self-reliant India: Vinoba Bhave, Jai Prakash Narayan, Verghese Kurian, M.S.Swaminathan. **Unique Personality of India :** Dr.Rajendra Prasad, Sardar Ballabh Bhai Patel.	

Suggested Reading:

1. My Idea of Education, Swami Vivekanand, Advaita Ashram, Kolkata
2. Rabindranath Tagore : An Interpretation, Sabyasachi Bhattacharya, Penguin Delhi
3. Women Who Created History, NCERT, New Delhi