SCHEME OF EXAMINATION

1 TO 4TH YEAR

AND

DETAILED SYLLABUS - 2ND YEAR

FOR

B.TECH PROGRAMME - ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

(AI & DS) INCLUDING MINOR SPECIALIZATION

OFFERED AT AFFILIATED INSTITUTIONS OF GGSIPU FROM A.S. 2022-23 ONWARDS

Guru Gobind Singh Indraprastha University

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VISION, MISSION AND QUALITY POLICY OF THE GGSIP UNIVERSITY

VISION

"The University will stimulate both the hearts and minds of scholars, empower them to contribute to the welfare of society at large; train them to adopt themselves to the changing needs of the economy; advocate them for cultural leadership to ensure peace, harmony and prosperity for all."

MISSION

"Guru Gobind Singh Indraprastha University shall strive hard to provide a market oriented professional education to the student community of India in general and of Delhi in particular, with a view to serving the cause of higher education as well as to meet the needs of the Indian industries by promoting establishment of colleges and Schools of Studies as Centres of Excellence in emerging areas of education with focus on professional education in disciplines of engineering, technology, medicine, education, pharmacy, nursing, law, etc."

QUALITY POLICY

"Guru Gobind Singh Indraprastha University is committed to providing professional education with thrust on creativity, innovation, continuous change and motivating environment for knowledge creation and dissemination through its effective quality management system."

PREAMBLE

Recent advancements in engineering and technology have changed the way in which higher education needs to be delivered. Keeping in view the global requirements, higher education is being transformed by adopting innovative teaching – learning pedagogies, experiential learning, providing research environment, Industry exposure and entrepreneurial mindset. The approach is now student- centric rather than teacher-centric and is based on measuring learning outcomes of the students. The education programs are now designed and delivered in a way that makes best use of the available technologies to improve learning experience, thus, enhancing quality and employability of the students. The scheme and syllabi must cater to

- Increased Flexibility
- Personalized Learning Experience
- Learning Through MOOC's
- Experiential Learning
- Courses on Universal Human Values
- Interdisciplinary and Multidisciplinary
- Futuristic Approach in Both Design and Delivery
- Building Both Technical and Life Skills
- Understanding Entrepreneurship, Innovation and Startups in Computing
- Knowing Constitution of India
- Interaction with Industry Experts
- Industry exposure Through Trainings, Internship and Projects
- Enhancing Comprehension through Selected Reads
- Improve Communication and Technical Writing Skills
- Focus on Innovation
- Minor Specialization along with Major Specialization
- Provision for B.Tech with Honours degree

Further, increasing presence of technology in education and Industry demands awareness regarding several inter- disciplinary practical applications of concepts/principles such as, Artificial Intelligence, Data Science, Machine Learning, Computer Vision, Cloud Computing, Internet of Things, Robotics, Automation, etc. Accordingly, new B.Tech Programmes in the emerging areas are being offered by GGSIPU. Some Philosophies behind proposing the new scheme and syllabi for B.Tech Programmes, salient features, programme structure discussed below.

PHILOSOPHY OF THE NEW SCHEME AND SYLLABI FOR B.TECH IN EMERGING AREAS

The following important aspects have to be considered while designing the proposed scheme and syllabi

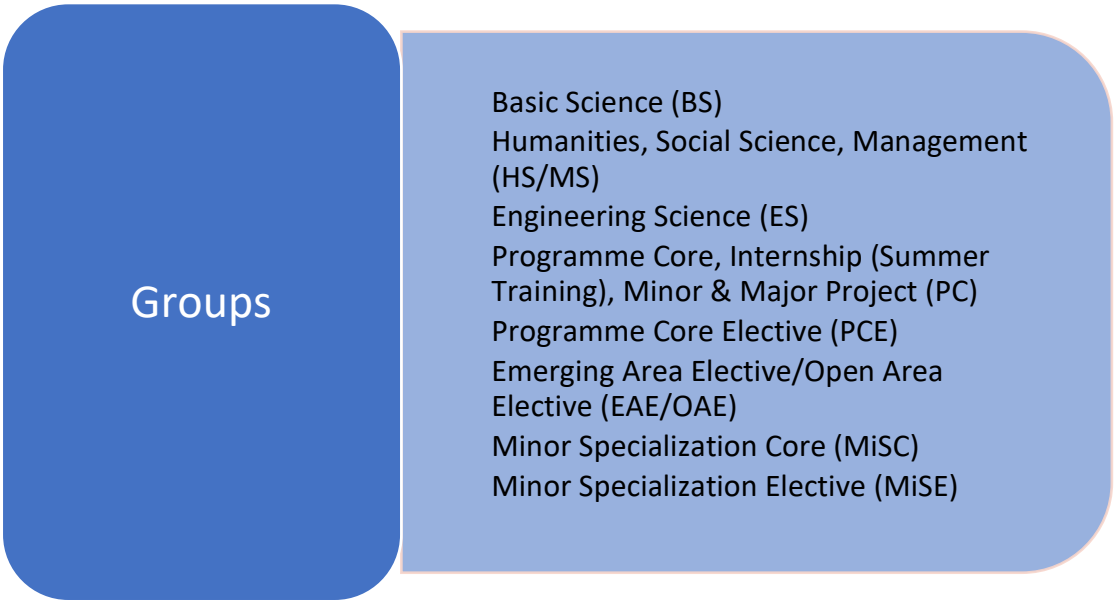
- Philosophy of regulatory bodies (AICTE Model Curriculum – 2018 and National Education Policy - 2020)
- Use of available technologies and resources in a more efficient manner through a combination of different learning - teaching methodologies, such as, Blended, Flip, Experiential, Focussed listing Skill based, Project based, Activity based, Use of Smart Classroom, etc.
- Interdisciplinary and futuristic program scheme and syllabi with emphasis on Artificial Intelligence, Data Science, Machine Learning, Robotics, Automation, IoT etc.
- Since Technology is changing rapidly the platforms to be taught will change accordingly. Hands on need to be given more credit in these futuristic technologies. Practicals shall be linked to live /filed challenges/ problems.

SOME SALIENT FEATURES OF THE PROPOSED SCHEME AND SYLLABI

- Variety of subjects offered through different groups to enable holistic learning and personal development opportunities (Course group wise credit distribution is mentioned in the draft proposal)
- Different categories of subjects out of which one group is NUES (Non-University Exam System) where No End-term Examination is held
- Scope for teaching and learning through various modes, such as, Classroom teaching, MOOCs, Industry Engagement, Projects, Practicums, Summer Internships
- Option for Minor Specialization along with Major Specialization
- Programme Core Electives
- Open electives of OAE group may be taken through NPTEL/SWAYAM MOOCs/ any other MOOCs Education portals of the Government of India.
- Internships to enable relevant Industry exposure and practical hands-on experience in core areas of interest to additionally provide students with career direction,
- Subjects on Critical Reasoning, Systems Thinking, Understanding Entrepreneurship, Innovation, and Startups in Computing to enhance perspective, motivation and understanding of various subjects.
- Provision of Honors degree by earning 20 or more additional credits through NPTEL/SWAYAM MOOCs/ any other Education portals of the Government of India.
- Provision of Optional Online Courses through NPTEL/SWAYAM MOOCs/ any other MOOCs Education portals of Government of India.
- Credits for engagement with Experts from Industry and Academia on Emerging Trends in Technological Industries
- Credits for developing Comprehension through Selected Reads
- Credits for seminar on Case Study of Emerging reas of Technology
- Credits for developing Effective Technical Writing Skills
- Credits for integrated Project referred to as Practicum

GROUPS

The B.Tech. Programme Scheme consists of the underlying groups of study:



1. Basic Science (BS)

The BS consist of 4 theory papers. BS subjects will also be covered in I,II, III and IV semesters.

2. Humanities, Social Science and Management (HS/MS)

The HS/MS consist of 10 theory paper from I to VI semester. III semester onwards, there is HS/MS paper in each semester till VI semester.

3. Engineering Science (ES)

The ES consist of 2 theory papers with practical Labs in semester I and II.

4. Programme Core (PC)

The PC consists of core theory papers, Practicum, Internship and Project work.

4a. Programme Core (PC)

The PC consist of 23 papers out of which 16 papers comprise Labs. All the PC subjects will be covered in III, IV & V, VI, VII semester.

4b. Seminar on Case Study of Emerging Areas of Technology

In V semester, the student will be required to select several research papers of good quality and study them in detail and outline the literature review. The student should then prepare and give a presentation on the summary of his/her learnings from those research papers.

4c. Practicum (PM)

This is a semester Integrated Project work included in IV and VI semesters. The practical course constitutes an integrated Project work based on the concurrently studied theory in that semester or in previous semesters.

4d. Internship (IN) Summer Training Report

After completion of IV and VI semesters, the students are given the opportunity to experience the industrial setting through an Internship. Internship may be carried out in industries and premier academic institutions in this semester. The student shall be allocated a faculty mentor to keep track of the progress of training along with Industry mentor. The Evaluation will be done in V and VII semesters respectively. The faculty mentors should take the report from students after two weeks of commencement of training and 1-2 weeks before the end of training. Faculty mentor will also prepare a report and submit the same after completion of the training.

4e. Minor & Major Project Work (PW)

The student shall be allocated a supervisor/guide for Project work at the end of 6th semester by the department/institution, the Project shall continue into the 8th semester. The conceptualization of the Project work would include the back-ground study/literature survey and identification of objectives and methodology to be followed for Project. The faculty mentors should take the report from students after two weeks of commencement of project and 1-2 weeks before the end of project. Faculty mentor will also prepare a report and submit the same after completion of the project.

5. Programme Core Elective (PCE)

The total number of 4 Programme Core Electives will be offered in VI and VII semesters. Student will have to choose out of the given list of subjects. Each of these program electives will have 1 credit for experiential/practical component (out of 4 credits).

6. Emerging Area/Open Area Electives (EAE/OAE)

The total number of 6 EAE/OAE will be offered in VI and VII semesters. Student will have to choose out of the given list of subjects. Each of these Emerging Area/Open Area

7. Selected Reads

In III semester under Selected Reads, the students will be required to select a book (non-technical book that is not related to engineering & technology) that they want to read in the semester and explore their content critically thereby get inspired to use the assimilated knowledge from the books to shape their personalities and to enhance their life skills. Selected reads will have 1 credit.

8. Honours Courses (HC) and Optional Online Courses

To earn an Honours degree, along with B.Tech Programme, the student may enroll for 20 credits or more through NPTEL/SWAYAM MOOCs/ any other MOOCs Education portals of Government of India. The conditions and detailed information are given in point no. **10 on page no. 33**

- **Honours Courses**
  To obtain Honours in the Programme, the student must apply to the institution about the same before the commencement of the V semester. The specific courses through MOOCs shall be registered by the student only after approval by the Academic Programme Committee (APC) of the Institution.

- **Optional Online Courses**
  This course is optional for students who opt for B.Tech (Optional). Students who don't fulfill the eligibility criteria for Honours can opt for Optional Course. The students can choose online courses from NPTEL/SWAYAM MOOCs/ any other MOOCs Education portals of the Government of India. The specific courses through MOOCs shall be registered by the student only after approval by the Academic Programme Committee (APC) of the Institution.

9. Minor specialization

The Scheme also supports Bachelor of Technology with Minor Specialization. The students shall be awarded minor specializations through EAE/OAE route. The specific subjects shall be opted by the student only after approval by the Academic Programme Committee (APC) of the Institution. The conditions and detailed information are given in Evaluation Scheme **on page no. 31.**

10. L-P-C Notation

L-P-C => Lecture-Practical/Practicum/Project-Credits (Total).

11. Grading Criteria

Grading System shall be as per Ordinance 11 of the University.

NUMBER OF CREDITS IN EACH GROUP

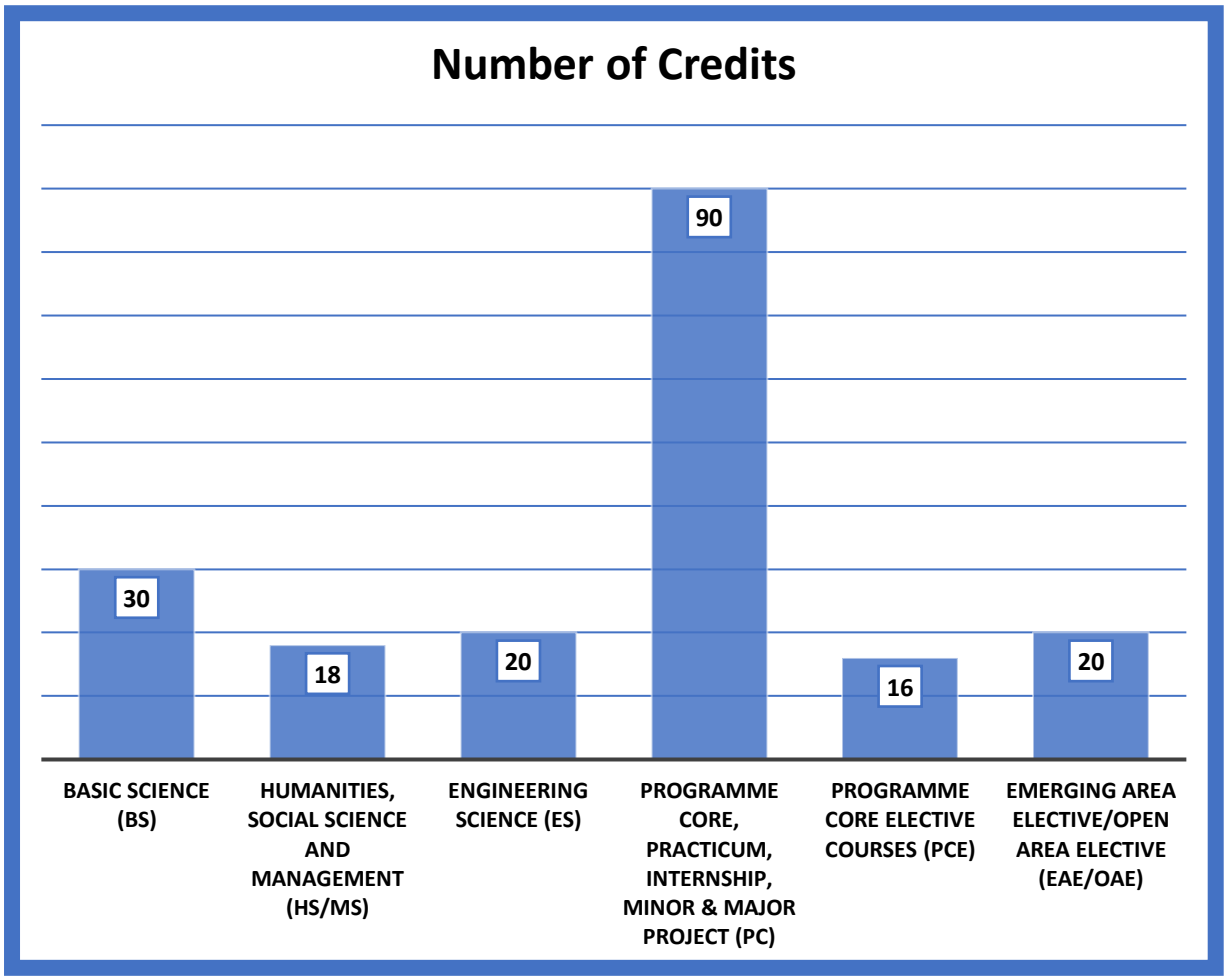
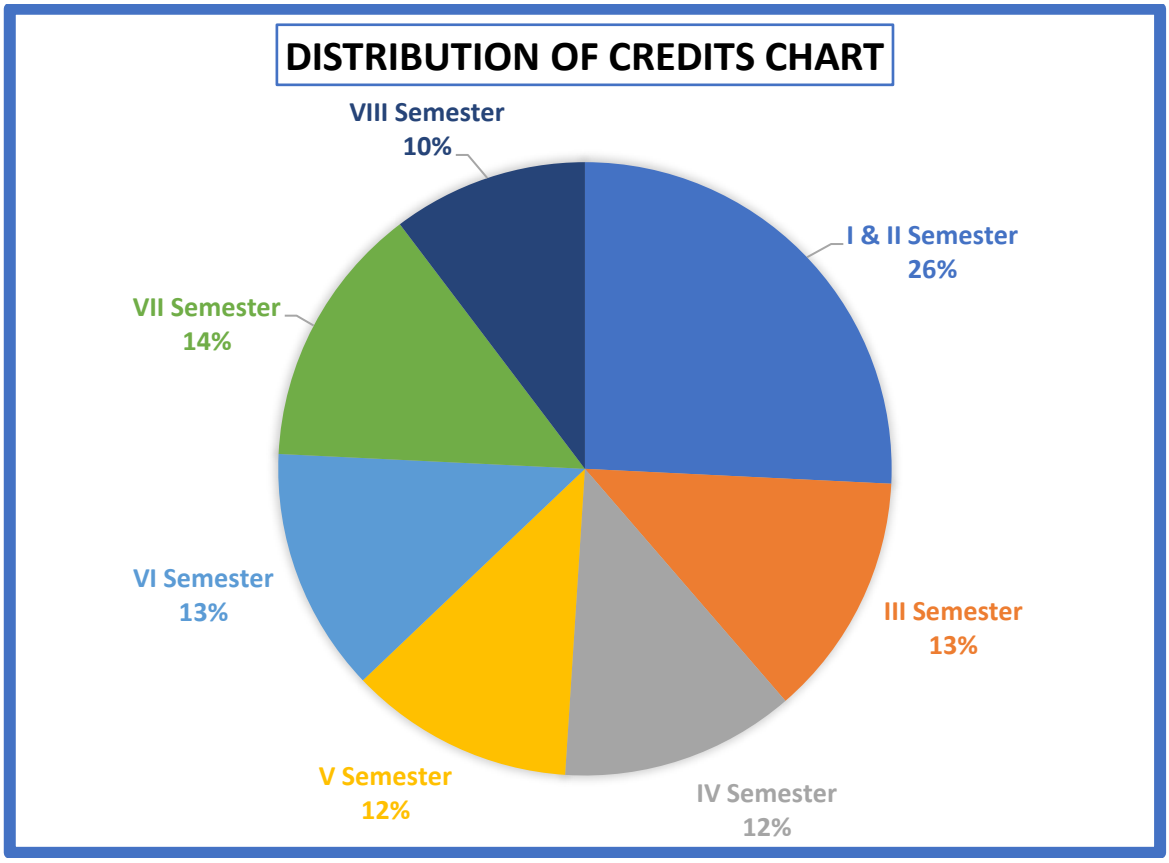


TABLE 1 – DETAILED CREDIT DISTRIBUTION AMONG VARIOUS GROUPS IN THE PROPOSED SCHEME

Group	Semester (Credits)							Total Group Credits	Mandatory Group Credits
	I & II	III	IV	V	VI	VII	VIII		
Basic Science (BS)	24	3	3					30	26
Humanities, Social Science and Management (HS/MS)	6	6	2	2	2			18	9
Engineering Science (ES)	20							20	12
Programme Core, Practicum, Internship, Minor Project & Major Project (PC)		16	19	21	5	9	20	90	80
Programme Core Elective Courses (PCE)					8	8		16	12
Emerging Area Elective/Open Area Elective (EAE/OAE)					10	10		20	13
Total Semester Credits	**50**	**25**	**24**	**23**	**25**	**27**	**20**	**194**	**152**



Abbreviations used in the Tables below

$^{\alpha}$	Includes Lab
$^{\Omega}$	Includes GATE Subject
$^{\pi}$	Non-University Examination Subject
β	NPTEL/SWAYAM MOOCs/ any other MOOCs Education portals Government of India.

Basic Science (BS)

S. No.	Subjects	Semester	Credits	
			L (Hours)	P (Hours)
1.	Applied Mathematics – I$^{\Omega}$	I	4	-
2.	Applied Mathematics – II$^{\Omega}$	II	4	-
3.	Applied Physics$^{\alpha}$ – I	I	3	1
4.	Applied Physics$^{\alpha}$ – II	II	3	1
5.	Applied Chemistry$^{\alpha}$ - I	I	3	1
6.	Applied Chemistry$^{\alpha}$ - II	II	3	1
7.	Probability, Statistics and Linear Algebra$^{\alpha}$	III	3	-
8.	Computational Methods $^{\alpha}$	IV	3	-

Humanities, Social Science and Management (HS/MS)

S. No.	Subjects	Semester	Credits	
			L (Hours)	P (Hours)
1.	Communication Skills$^{\pi}$	I & II	3	-
2.	Indian Constitution $^{\pi}$	I & II	2	-
3.	Universal Human Values & Ethics $^{\pi}$	I & II	1	-
4.	Universal Human Values – II $^{\pi}$	III	3	-
5.	Critical Reasoning and Systems Thinking	III	2	-
6.	Selected Reads	III	1	-
7.	Effective Technical Writing Skills $^{\pi}$	IV	1	-
8.	Emerging Trends in Technological Industries $^{\pi}$	IV	1	-
9.	Entrepreneurship, Innovation and Start-ups in Computing	IV	2	-
10.	Technical Clubs/Sports/Cultural/Yoga/NCC/NSS $^{\pi}$	VI	2	-

Engineering Science (ES)

S. No.	Subjects	Semester	Credits	
			L (Hours)	P (Hours)
1.	Environmental Studies$^{\alpha}$	I & II	3	1
2.	Electrical Science$^{\alpha}$	I & II	3	1
3.	Programming in C$^{\alpha\,\Omega}$	I & II	3	1
4.	Engineering Graphics – I$^{\alpha}$	I	1	1
5.	Engineering Graphics – II$^{\alpha}$	II	1	1
6.	Manufacturing Process	I	4	-
7.	Engineering Mechanics	II	3	-
8.	Workshop Practice$^{\alpha}$	II	-	2

Programme Core (PC)

S. No.	Subjects	Semester	Credits	
			L (Hours)	P (Hours)
1.	Data Structures$^{\alpha\,\Omega}$	III	3	1
2.	Foundations of Data Science $^{\alpha}$	III	3	1
3.	Digital Logic Design$^{\alpha\,\Omega}$	III	3	1
4.	Principles of Artificial Intelligence	III	3	-
5.	Web Programming Lab	III	-	1
6.	Object-Oriented Programming $^{\alpha\,\Omega}$	IV	3	1
7.	Database Management Systems$^{\alpha\,\Omega}$	IV	3	1
8.	Software Engineering	IV	3	-
9.	Computer Networks and Internet Protocol $^{\Omega}$	IV	3	-
10.	Fundamentals of Machine Learning$^{\alpha}$	IV	3	1
11.	Operating Systems $^{\Omega}$	V	3	-
12.	Design and Analysis of Algorithms$^{\alpha\,\Omega}$	V	3	1
13.	Data Mining $^{\alpha}$	V	3	1
14.	Computer Organization and Architecture $^{\Omega}$	V	3	-
15.	Internet of Things $^{\alpha}$	V	3	1
16.	Mobile Applications Development Lab $^{\alpha}$	V	1	-
17.	Digital Image Processing$^{\alpha}$	VI	3	1
18.	Natural Language Processing $^{\alpha}$	VII	3	1
19.	Internship (after 4th semester) Summer Training Report$^{\pi}$	V (Evaluation semester)	1	-
20.	Internship (after 6th semester) Summer Training Report$^{\pi}$	VII (Evaluation semester)	1	-
21.	Practicum	IV	-	1
22.	Practicum	VI	-	1
23.	Technical Clubs/Sports/Cultural/Yoga/NCC/NSS	VI	-	2
24.	Minor Project Work	VII	-	4
25.	Major Project Work	VIII	-	20

*Programme Core Electives (PCE)

S. No.	Subjects	Semester	Credits	
			L (Hours)	P (Hours)
1.	PCE	VI	3	1
2.	PCE	VI	3	1
3.	PCE	VII	3	1
4.	PCE	VII	3	1

*Emerging Area Electives (EAE)/Open Area Electives (OAE)

S. No.	Subjects	Semester	Credits	
			L (Hours)	P (Hours)
1.	EAE/OAE	VI	3	1
2.	EAE/OAE	VI	3	-
3.	EAE/OAE	VI	3	-
4.	EAE/OAE	VII	3	1
5.	EAE/OAE	VII	3	-
6.	EAE/OAE	VII	3	-

(1 EAE/OAE in VI and VII Semester consists of Practical Lab)

Non-University Examination Scheme (NUES)

S. No.	Subjects	Semester	Credits	
			L (Hours)	P (Hours)
1.	Communication Skills$^{\pi}$	I or II	3	-
2.	Indian Constitution $^{\pi}$	I or II	2	-
3.	Human Values & Ethics $^{\pi}$	I or II	1	-
4.	Selected Reads$^{\pi}$	III	1	-
5.	Emerging Trends in Technological Industries $^{\pi}$	IV	1	-
6.	Seminar on Case Study of Emerging Areas of Technology $^{\pi}$	V	1	-

Honors and Optional Online Courses (OC)

S. No.	Honours and Online Optional Courses $^{\beta}$	Credits
1.	Honours Courses	20
2.	Optional Online Courses	0-12
$^{\beta}$ Based on number of courses and credits audited.		

Programme Outcomes (PO)

1. **Engineering Knowledge (PO01):** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem Analysis (PO02**): Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
3. **Design/Development of Solutions (PO03):** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate considerationfor the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct Investigations of Complex Problems (PO04):** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of theinformation to provide valid conclusions for complex problems:
   a) that cannot be solved by straightforward application of knowledge, theories and techniques applicable to the engineering discipline as against problems given at the end of chapters in a typical textbook that can be solved using simple engineering theories and techniques;
   b) that may not have a unique solution. For example, a design problem can be solved in many waysand lead to multiple possible solutions.
   c) that require consideration of appropriate constraints / requirements not explicitly given in the problem statement such as cost, power requirement, durability, product life, etc.;
   d) which need to be defined (modeled) within appropriate mathematical framework; and
   e) that often require use of modern computational concepts and tools, for example, in the design of an antenna or a DSP filter
5. **Modern Tool Usage (PO05):** Create, select, and apply appropriate techniques, resources, and modernengineering and IT tools including prediction and modelling to complex engineering activities withan understanding of the limitations.
6. **The Engineer and Society (PO06):** Apply reasoning informed by the contextual knowledge to assesssocietal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability (PO07):** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics (PO08):** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work (PO09):** Function effectively as an individual, and as a member or leaderin diverse teams, and in multidisciplinary settings.
10. **Communication (PO10):** 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.
11. **Project Management and Finance (PO11):** 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.
12. **Life-long Learning (PO12):** Recognize the need for, and have the preparation and ability to engagein independent and lifelong learning in the broadest context of technological change.

Programme Specific Outcomes (PSO)

1. **PSO1:** Comprehend the role of artificial intelligence and data science in various domains like businesses, healthcare, expert systems, etc. for efficient data storage, analysis and visualization.

2. **PSO2:** Gain the ability to independently carry out research to solve practical problems in the field of artificial intelligence and data science.

3. **PSO3:** Recognize the latest trends in the industry and acquire the desired technical skills.

4. **PSO4:** Acquire zeal for experiential learning in the field of artificial intelligence and data science and develop an entrepreneurship mindset.

B.TECH. – ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SCHEME FRAMEWORK FOR 1ST TO 4TH YEAR

FIRST SEMESTER						
Group	**Paper Code**	**Paper**	**L (Hours)**	**P (Hours)**	**Credits**	**Status**
Theory Papers						
ES BS	ES101 BS103	Any one of the following: Programming in C Applied Chemistry	3	-	3	**M**
BS	BS105	Applied Physics - I	3	-	3	**M**
ES BS	ES107 ES109	Any one of the following: Electrical Science Environmental Studies	3		3	 **M**
BS	BS111	Applied Mathematics - I	4		4	**M**
HS HS HS	HS113 HS115 HS117	Group 1 or Group 2 shall be offered: Group 1 - Communication Skills OR Group 2- Indian Constitution Human Values & Ethics/ Universal Human Values	3 2 1		3 2 1	
ES	ES119	Manufacturing Process	4		4	
Practical/Viva-Voce						
BS	BS151	Physics Lab – I	-	2	1	**M**
ES BS	ES153 BS155	Any one of the following corresponding to the theory paper offered: Programming in 'C' Lab Applied Chemistry Lab	-	2	1	**M**
ES	ES-157	Engineering Graphics – I	-	4	2	**M**
ES BS	ES159 BS161	Any one of the following corresponding to the theory paper offered: Electrical Science Lab Environmental Studies Lab	-	2	1	 **M**
		Total	20	10	**25**	

M= Mandatory for award of the B.Tech degree

SECOND SEMESTER						
Group	**Paper Code**	**Paper**	**L (Hours)**	**P (Hours)**	**Credits**	**Status**
Theory Papers						
ES BS	ES102 BS104	Any one of the following: Programming in C Applied Chemistry	3	-	3	**M**
BS	BS106	Applied Physics – II	3	-	3	
ES BS	ES108 BS110	Any one of the following: Electrical Science Environmental Studies	3		3	 **M**
BS	BS111	Applied mathematics - II	4		4	**M**
HS HS HS	HS114 HS116 HS118	Group 1 or Group 2 shall be offered: Group 1 - Communication Skills OR Group 2- Indian Constitution Human Values & Ethics/Universal Human Values	3 2 1		3 2 1	
ES	ES114	Engineering Mechanics	3		3	**M**
Practical/Viva-Voce						
BS	BS152	Physics Lab – II	-	2	1	
ES BS	ES154 BS156	Any one of the following corresponding to the theory paper offered: Programming in 'C' Lab Applied Chemistry Lab	-	2	1	**M**
ES	ES-158	Engineering Graphics – II	-	2	1	**M**
ES BS	ES160 BS162	Any one of the following corresponding to the theory paper offered: Electrical Science Lab Environmental Studies Lab	-	2	1	 **M**
ES	ES164	Workshop Practice	-	4	2	**M**
		Total	19	12	**25**	

M= Mandatory for award of the B.Tech degree

PROPOSED THIRD SEMESTER						
Group	**Paper Code**	**Paper**	**L (Hours)**	**P (Hours)**	**Credits**	**Status**
Theory Papers						
PC	AIDS201	Data Structures	3	-	3	**M**
PC	AIDS203	Foundations of Data Science	3	-	3	**M**
PC	AIDS205	Digital Logic Design	3	-	3	
PC	AIDS207	Principles of Artificial Intelligence	3	-	3	**M**
ES/BS	AIDS209	Probability, Statistics and Linear Algebra	3	-	3	**M**
HS/MS	AIDS211	Universal Human Values- II	3	-	3	**M**
HS/MS	AIDS 213	Critical Reasoning and Systems Thinking	2	-	2	
HS/MS (NUES)	AIDS215	Selected Reads	-	1	1	
Practical/Viva-Voce						
PC	AIDS251	Data Structures Lab	-	2	1	**M**
PC	AIDS253	Foundations of Data Science Lab	--	2	1	**M**
PC	AIDS255	Digital Logic Design Lab	-	2	1	
PC	AIDS257	Web Programming Lab	-	2	1	**M**
		Total	20	9	**25**	

M= Mandatory for award of the B.Tech degree

PROPOSED FOURTH SEMESTER						
Group	**Paper Code**	**Paper**	**L (Hours)**	**P (Hours)**	**Credits**	**Status**
Theory Papers						
PC	AIDS202	Object Oriented Programming	3	-	3	**M**
PC	AIDS204	Database Management Systems	3	-	3	**M**
PC	AIDS206	Software Engineering	3	-	3	**M**
PC	AIDS208	Computer Networks and Internet Protocol	3	-	3	
PC	AIDS210	Fundamentals of Machine Learning	3	-	3	**M**
ES/BS	AIDS212	Computational Methods	3	-	3	**M**
HS/MS/PC (NUES)	AIDS214	Effective Technical Writing	1	-	1	**M**
HS/MS (NUES)	AIDS216	Emerging Trends in Technological Industries	1	-	1	**M**
Practical/Viva-Voce						
PC	AIDS252	Object Oriented Programming Lab	-	2	1	**M**
PC	AIDS254	Database Management Systems Lab	-	2	1	**M**
PC	AIDS256	Fundamentals of Machine Learning Lab	-	2	1	**M**
PC	AIDS258	Practicum (Integrated Project)	-	2	1	**M**
		Total	20	8	**24**	

M= Mandatory for award of the B.Tech degree

PROPOSED FIFTH SEMESTER						
Group	**Paper Code**	**Paper**	**L (Hours)**	**P (Hours)**	**Credits**	**Status**
Theory papers						
PC	AIDS301	Operating Systems	3	--	3	
PC	AIDS303	Design and Analysis of Algorithms	3	-	3	**M**
PC	AIDS305	Data Mining	3	-	3	**M**
PC	AIDS307	Computer Organization and Architecture	3	-	3	**M**
PC	AIDS309	Internet of Things	3	-	3	**M**
HS/MS	AIDS311	Entrepreneurship, Innovation and Start-ups in Computing	2	-	2	**M**
HC	**HCA-HCG**	Honours Course	**-**	**-**	**20**	
OC	**OCA-OCE**	Optional Online Course	**-**	**-**	**0-12**	
Practical/Viva-Voce						
PC	AIDS351	Mobile Applications Development Lab	-	2	1	**M**
PC	AIDS353	Design and Analysis of Algorithms Lab	-	2	1	**M**
PC	AIDS355	Data Mining lab	-	2	1	**M**
PC	AIDS357	Internet of Things Lab	-	2	1	**M**
PC	AIDS359	Summer Training (After 4th Semester) Report	-	2	1	**M**
PC (NUES)	AIDS361	Seminar on Case Study of Emerging Areas of Technology	-	1	1	**M**
		Total	17	11	**23**	

M= Mandatory for award of the B.Tech degree

PROPOSED SIXTH SEMESTER						
Group	**Paper Code**	**Paper**	**L (Hours)**	**P (Hours)**	**Credits**	**Status**
Theory Papers						
PC	AIDS302	Digital Image Processing	3	-	3	**M**
PCE	AIDS304 AIDS306 AIDS308	**Program Core Elective 1 (Choose 1)** 1. Fundamentals of Deep Learning 2. Next Generation Databases 3. Big Data Analytics	3	-	3	**M**
PCE	AIDS310 AIDS312 AIDS314	**Program Core Elective 2 (Choose 1)** 1. Statistical Analysis & Data Science Applications 2. Spatial Data Analytics 3. Quantum Computing	3	-	3	**M**
EAE/OAE	AIDS316 AIDS318 AIDS320	**Emerging Area/Open Area Core Elective 1 (Choose 1)** 1. Network Science 2. Blockchain Technology 3. Wireless sensor Networks	3	-	3	**M**
EAE/OAE	AIDS322 AIDS324 AIDS326	**Emerging Area/Open Area Core Elective 2 (Choose 1)** 1. AI & Humanity 2. Cognitive Computing 3. Data Security & Privacy	3	-	3	
EAE/OAE	AIDS328 AIDS330 AIDS332	**Emerging Area/Open Area Core Elective 3 (Choose 1)** 1. Biomedical Data Analysis 2. Virtual Reality and Augmented Reality 3. Human Computer Interaction	3	-	3	**M**
HC	**HC (a-g)**	Honours Course	-	-	**20**	
OC	**OC (a-e)**	Optional Online Course	-	-	**0-12**	
Practical/Viva-Voce						
PC	AIDS352	Digital Image Processing Lab	-	2	1	**M**
PCE	AIDS354	Program Core Elective 1 Lab	-	2	1	**M**
PCE	AIDS356	Program Core Elective 2 Lab	-	2	1	**M**
EAE/OAE	AIDS358	Emerging Area/Open Area Core Elective 1 Lab	-	2	1	**M**
PC	AIDS362	Practicum (Integrated Project)	-	2	1	**M**
HS	AIDS360	NSS/NCC/Cultural Clubs/Technical Society/Technical Club	-	-	2	**M**
		Total	18	10	**25**	

M= Mandatory for award of the B.Tech degree

PROPOSED SEVENTH SEMESTER						
Group	**Paper Code**	**Paper**	**L (Hours)**	**P (Hours)**	**Credits**	**Status**
Theory Papers						
PC	AIDS401	Natural Language Processing	3	-	3	**M**
PCE	AIDS403 AIDS405 AIDS407	**Program Core Elective 1 (Choose 1)** 1. Digital and Social Media Analytics 2. Business Intelligence & Analytics 3. Web Intelligence	3	-	3	**M**
PCE	AIDS409 AIDS411 AIDS413	**Program Core Elective 2(Choose 1)** 1. Data Visualization 2. Game Analytics 3. Advanced Data Science	3	-	3	
EAE/OAE	AIDS415 AIDS417 AIDS419	**Emerging Area/Open Area Core Elective 1 (Choose 1)** 1. Reinforcement Learning 2. Data Science for Complex Systems 3. Cloud Computing	3	-	3	
EAE/OAE	AIDS421 AIDS423 AIDS425	**Emerging Area/Open Area Core Elective 2 (Choose 1)** 1. Computer Vision 2. Audio & Speech Processing 3. Smart Analog and Digital Systems for Industry 4.0	3	-	3	**M**
EAE/OAE	AIDS427 AIDS429 AIDS431	**Emerging Area/Open Area Core Elective 3 (Choose 1)** 1. Cyber Forensics and Cyber Crime Investigation 2. Information Retrieval & Recommender Systems 3. Metaverse and its Applications	3	-	3	**M**
HC	**HC (a-g)**	Honours Course			**20**	
OC	**OC (a-e)**	Optional Online Course			**0-12**	
Practical/Viva-Voce						
PC	AIDS451	Natural Language Processing Lab	-	2	1	M
PCE	AIDS453	Program Core Elective 1 Lab	-	2	1	M
PCE	AIDS455	Program Core Elective 2 Lab	-	2	1	
EAE/OAE	AIDS457	Emerging Area/Open Area Core Elective 1 Lab	-	2	1	
PC	AIDS459	Minor Project**	-	-	4	M
PC	AIDS461	Summer Training (After 6th Semester) Report	-	-	1	M
		Total	18	8	**27**	

M= Mandatory for award of the B.Tech degree.

PROPOSED EIGHTH SEMESTER						
Group	**Paper Code**	**Paper**	**L (Hours)**	**P (Hours)**	**Credits**	**Status**
EAE/OAE	AIDS452	MOOC Course 1	**-**		4	**M**
Practical/Viva-Voce/Internship						
PC	AIDS454	Major Project – Dissertation	-		12	**M**
	AIDS 456	Major Project – Viva Voce and Project Progress Evaluation	-		4	**M**
OR						
PC	AIDS 458	Internship Report	-		12	**M**
	AIDS 460	Internship Viva Voce and Internship Progress Evaluation	-		4	**M**
HC	**HC (a-g)**	Honours Course	-		**20**	
OC	**OC (a-e)**	Optional Online Course	-		**0-12**	
Total					**20**	

M= Mandatory for award of the B.Tech degree

MINOR SPECIALIZATIONS TABLES

Table 2: Minor Specialization in Blockchain

Group	Paper Code	Paper	L	P	Credits
Theory Papers					
6th Semester					
MiSC	MiSCBC61	Blockchain Technology	3	-	3
MiSE	MiSEBC62 MiSEBC63	**Minor Specialization Elective (Choose 1)** 1. Smart Contracts and Solidity 2. Blockchain Platforms and Use Cases	3	-	3
MiSE	MiSEBC64 MiSEBC65	**Minor Specialization Elective (Choose 1)** 1. Blockchain in Internet of Things 2. Advances in Blockchain and its Applications	3	-	3
Practical/Viva-Voce					
MiSC	MiSCBC66	Blockchain Technology Lab	-	2	1
Group	**Paper Code**	**Paper**	**L**	**P**	**Credits**
Theory Papers					
7th Semester					
MiSC	MiSCBC71	Security & Privacy in Blockchain	3	-	3
MiSE	MiSEBC72 MiSEBC73	**Minor Specialization Elective (Choose 1)** 1. Bitcoin & Cryptocurrency 2. Blockchain and FinTech	3	-	3
MiSE	MiSEBC74 MiSEBC75	**Minor Specialization Elective (Choose 1)** 1. Wireless Blockchain 2. Blockchain in Digital Healthcare	3	-	3
Practical/Viva-Voce					
MiSC	MiSCBC76	Security & Privacy in Blockchain Lab	-	2	1
		Total	18	4	20

Table 3: Minor Specialization in Cyber Security					
Group	**Paper Code**	**Paper**	**L**	**P**	**Credits**
Theory Papers					
6th Semester					
MiSC	MiSCCS61	Cryptography	3	-	3
MiSE	MiSECS62 MiSECS63	**Minor Specialization Elective (Choose 1)** 1. Cyber Threat Intelligence & Network Security 2. Secure Coding	3	-	3
MiSE	MiSECS64 MiSECS65	**Minor Specialization Elective (Choose 1)** 1. Industrial Network Security 2. Vulnerability Assessment and Penetration Testing	3	-	3
Practical/Viva-Voce					
MiSC	MiSCCS66	Cryptography Lab	-	2	1
Group	**Paper Code**	**Paper**	**L**	**P**	**Credits**
Theory Papers					
7th Semester					
MiSC	MiSCCS71	Malware Analysis and Intrusion Detection	3	-	3
MiSE	MiSECS72 MiSECS73	**Minor Specialization Elective (Choose 1)** 1. Cyber Forensics and Cyber Crime Investigation 2. Privacy and Security in IOT	3	-	3
MiSE	MiSECS74 MiSECS75	**Minor Specialization Elective (Choose 1)** 1. Database Security and Access Control 2. Advances in Cyber Security and its Applications	3	-	3
Practical/Viva-Voce					
MiSC	MiSCCS76	Malware Analysis and Intrusion Detection Lab	-	2	1
		Total	18	4	20

Table 4: Minor Specialization in Robotics					
Group	**Paper Code**	**Paper**	**L**	**P**	**Credits**
Theory Papers					
6th Semester					
MiSC	MiSCSR61	Introduction to Robotics	3	-	3
MiSE	MiSESR62 MiSESR63	**Minor Specialization Elective (Choose 1)** 1. Microprocessor & Embedded Systems 2. Machine Learning Algorithms for Robotics	3	-	3
MiSE	MiSESR64 MiSESR65	**Minor Specialization Elective (Choose 1)** 1. Intelligent Automation 2. Mechatronics: Fundamentals and Applications	3	-	3
Practical/Viva-Voce					
MiSC	MiSCSR66	Introduction to Robotics Lab	-	2	1
Group	**Paper Code**	**Paper**	**L**	**P**	**Credits**
Theory Papers					
7th Semester					
MiSC	MiSCSR71	Drone Applications, Components & Assembly	3	-	3
MiSE	MiSESR72 MiSESR73	**Minor Specialization Elective (Choose 1)** 1. Understanding and Designing Sociable Robots 2. Electronics and its Manufacturing in Robotics	3	-	3
MiSE	MiSESR74 MiSESR75	**Minor Specialization Elective (Choose 1)** 1. Mechanics & Control of Robotic Systems 2. Advances in Robotics and its Applications	3	-	3
Practical/Viva-Voce					
MiSC	MiSCSR76	Drone Applications, Components & Assembly Lab	-	2	1
		Total	18	4	20

Table 5: Minor Specialization in Virtual & Augmented Reality					
Group	**Paper Code**	**Paper**	**L**	**P**	**Credits**
Theory Papers					
6th Semester					
MiSC	MiSCVAR61	Mobile VR & AR Application Development	3	-	3
MiSE	MiSEVAR62 MiSEVAR63	**Minor Specialization Elective (Choose 1)** 1. Virtual and Augmented Reality 2. Scientific and Engineering Data Visualization	3	-	3
MiSE	MiSEVAR64 MiSEVAR65	**Minor Specialization Elective (Choose 1)** 1. Mobile Deep Learning 2. Computer Graphics for Virtual Reality	3	-	3
Practical/Viva-Voce					
MiSC	MiSCVAR66	Mobile VR & AR Application Development Lab	-	2	1
Group	**Paper Code**	**Paper**	**L**	**P**	**Credits**
Theory Papers					
7th Semester					
MiSC	MiSCVAR71	Multimedia and Virtual Reality	3	-	3
MiSE	MiSEVAR72 MiSEVAR73	**Minor Specialization Elective (Choose 1)** 1. Metaverse and its Applications 2. Mathematical Modelling and Computer Aided Engineering	3	-	3
MiSE	MiSEVAR74 MiSEVAR75 MiSEVAR76	**Minor Specialization Elective (Choose 1)** 1. Mobile Cloud Visual Media Computing 2. Advances in Virtual and Augmented Reality and its Applications 3. Game Designing	3	-	3
Practical/Viva-Voce					
MiSC	MiSCVAR77	Multimedia and Virtual Reality Lab	-	2	1
		Total	18	2	20

Table 6: Minor Specialization in Internet of Things					
Group	**Paper Code**	**Paper**	**L**	**P**	**Credits**
Theory Papers					
6th Semester					
MiSC	MiSCIOT61	Wireless Sensor Networks	3	-	4
MiSE	MiSEIOT62 MiSEIOT63 MiSEIOT64	**Minor Specialization Elective (Choose 1)** 1. Cloud Computing 2. Big Data in IoT 3. Mobile Computing	3	-	3
MiSE	MiSEIOT65 MiSEIOT66 MiSEIOT67	**Minor Specialization Elective (Choose 1)** 1. Wearable and Body Area Network 2. IoT Processors and Peripherals 3. IoT Protocols	3	-	3
Practical/Viva-Voce					
MiSC	MiSCIOT67	Wireless Sensor Networks Lab	-	2	1
Group	**Paper Code**	**Paper**	**L**	**P**	**Credits**
Theory Papers					
7th Semester					
MiSC	MiSCIOT71	Human Computer Interaction	3	-	4
MiSE	MiSEIOT72 MiSEIOT73 MiSEIOT74	**Minor Specialization Elective (Choose 1)** 1. AI and IoT based Intelligent Automation 2. Remote Sensing and its Applications 3. IoT Deployment, Testing & its Challenges	3	-	3
MiSE	MiSEIOT 75 MiSEIOT76 MiSEIOT77 MiSEIOT78	**Minor Specialization Elective (Choose 1)** 1. Real-Time Systems 2. Communications & Networking Technologies for IoT 3. Fog and Edge Computing 4. Digital and Smart Cities	3	-	3
Practical/Viva-Voce					
MiSC	MiSCIOT78	Human Computer Interaction Lab	-	2	1
		Total	18	2	20

Table 7: Minor Specialization in Machine Learning					
Group	**Paper Code**	**Paper**	**L**	**P**	**Credits**
Theory Papers					
6th Semester					
MiSC	MiSCML61	Advances in Supervised and Unsupervised Learning	3	-	3
MiSE	MiSEML62 MiSEML63 MiSEML64	**Minor Specialization Elective (Choose 1)** 1. Network Science 2. Statistical Analysis and Machine learning Applications 3. Predictive Business Analysis	3	-	3
MiSE	MiSEML65 MiSEML66 MiSEML67	**Minor Specialization Elective (Choose 1)** 1. Machine Learning for Intelligent Communications & Systems 2. Modelling and Simulation 3. Artificial Intelligence for Game Designing	3	-	3
Practical/Viva-Voce					
MiSC	MiSCML67	Advances in Supervised and Unsupervised Learning Lab	-	2	1
Group	**Paper Code**	**Paper**	**L**	**P**	**Credits**
Theory Papers					
7th Semester					
MiSC	MiSCML71	Reinforcement Learning	3	-	3
MiSE	MiSEML72 MiSEML73 MiSEML74	**Minor Specialization Elective (Choose 1)** 1. Computer Vision 2. Machine Learning in Healthcare 3. Information Retrieval & Recommender Systems	3	-	3
MiSE	MiSEML75 MiSEML76 MiSEML77 MiSEML78	**Minor Specialization Elective (Choose 1)** 1. Fuzzy Systems: Theory and Applications 2. Modelling Complex Systems using Machine Learning 3. Cyber Security and Machine Learning 4. AI and ML for Intelligent Automation	3	-	3
Practical/Viva-Voce					
MiSC	MiSCML78	Reinforcement Learning Lab	-	2	1
		Total	18	2	20

Table 8: Minor Specialization in Data Science					
Group	**Paper Code**	**Paper**	**L**	**P**	**Credits**
Theory Papers					
6th Semester					
MiSC	MiSCDS61	Data Mining	3	-	3
MiSE	MiSEDS62 MiSEDS63 MiSEDS64	**Minor Specialization Elective (Choose 1)** 1. Statistical Analysis & Data Science Applications 2. Big Data Analytics 3. Web Intelligence	3	-	3
MiSE	MiSEDS65 MiSEDS66 MiSEDS67	**Minor Specialization Elective (Choose 1)** 1. Business Intelligence & Analytics 2. Next Generation Databases 3. Spatial Data Analytics	3	-	3
Practical/Viva-Voce					
MiSC	MiSCDS67	Data Mining Lab	-	2	1
Group	**Paper Code**	**Paper**	**L**	**P**	**Credits**
Theory Papers					
7th Semester					
MiSC	MiSCDS71	Digital and Social Media Analytics	3	-	3
MiSE	MiSEDS72 MiSEDS73 MiSEDS74	**Minor Specialization Elective (Choose 1)** 1. Data Visualization 2. Advanced Data Science 3. Data Science for Complex Systems	3	-	3
MiSE	MiSEDS75 MiSEDS76 MiSEDS77	**Minor Specialization Elective (Choose 1)** 1. Natural Language Processing 2. Game Analytics 3. Biomedical Data Analysis	3	-	3
Practical/Viva-Voce					
MiSC	MiSCDS78	Digital and Social Media Analytics Lab	-	2	1
Total			18	2	20

EVALUATION SCHEME

Elective Papers-

The Elective Papers can be a (a) Only Theory: In this case, the teacher's continuous evaluation shall be of 25 marks, while the term end examinations shall be of 75 marks, (b) The elective paper may have Theory and practical components, in this case the Theory Credits shall be of 3 credits while the practical component shall be of 1 credit. The Teachers Continuous Evaluation Component for the complete paper (inclusive of Theory and Practical Component) shall be 25 Marks, The Term End Semester Examination for Theory Component shall be 50 Marks, while the Term End Semester Component for Practical shall be of 25 marks. The marksheet of results for the students shall reflect all components of marks.

Note on Elective Papers: The elective papers shall be allowed to be takes/studied by the students, by the APC of the School, keeping in view that two papers studied by the student should not have a substantial overall overlap. All papers studied by the student should be substantially distinct in content.

a) Papers with only theory component shall have 25 marks continuous evaluation by the teacher and 75 marks term-end examinations. Both these component marks shall be reflected on the marksheet of the student.
b) Papers with only practical component shall have 40 marks continuous evaluation by the teacher and 60 marks term-end examinations. Both these component marks shall be reflected on the marksheet of the student.
c) Papers with both theory and practical components shall have 25 marks continuous evaluation by the teacher and 25 marks term-end examinations for practical and 50 marks term-end examinations for the theory component. All three component marks shall be reflected on the marksheet of the student.

NUES-

NUES - Comprehensive evaluation of the students by the concerned coordinator of NCC/NSS/Cultural Clubs/Technical Society/Technical Clubs, out of 100 as per the evaluation schemes worked out by these activity societies, organizations; the co-ordinators shall be responsible for the evaluation of the same. These activities shall start from the 1st semester and the evaluation shall be conducted at the end of the 6th semester for students admitted in the first semester. Students admitted in the 2nd year (3rd semester) as lateral entry shall be for the period of 3rd semester to 6th semester only.

Comprehensive Evaluation by a committee of teachers, constituted by the Academic Programme Committee, out of 100. The training shall be of 4 to 6 weeks duration, The training can be under the mentorship of a teacher of the institution.

Practicum-

This is a semester Integrated Project work included in IV and VI semesters. The practical course constitutes an integrated Project work based on the concurrently studied theory in that semester.

Seminar on Case Study of Emerging Areas of Technology-

In this, the student will be required to select 2-5 research papers of good quality and study them in detail and outline the literature review. The student should then prepare and give a presentation on the summary of his/her learnings from those research papers.

Major and Minor Project-

The student shall be allocated a supervisor/guide for Project work at the end of 6th semester by the department/institution, the Project shall continue into the 8th semester. In the 7th semester evaluation, the criteria for evaluation shall be conceptualization of the Project work, the back-ground study/literature survey and identification of objectives and methodology to be followed for Project. 40 marks evaluation for the Teachers' Continuous Evaluation/Internal Assessment shall be done by the concerned supervisor while the term end examinations of 60 marks shall be conducted by the supervisor concerned and the external examiner deputed by the Examinations Division. In the absence of the supervisor, the Director of the Institution Head of Department can assign the responsibility of the supervisor (for purpose of examinations) to any faculty of the Institution/Department.

Practical/Viva-Voce/Internship in the final semester-

By default, every student shall do the AIDS452 MOOC Course and Project work (AIDS454 and AIDS456 or AIDS458 and AIDS460). A student shall either be allowed to do a Project work (AIDS454and AIDS456) or an internship (AIDS 458 and AIDS 460). The student must apply for approval to do internship before the commencement of the 8th semester to the school, and only after approval of Head of Department through Training and Placement Officer of the Department, shall proceed for internship.

The student offered Project work shall be allocated a supervisor/guide for Project work at the end of 6th semester by the School, the Project shall continue into the 8th semester.

Students may be allowed to do internship in this semester in lieu of Major Project. The students allowed to proceed for internship shall be required to maintain a logbook of activities performed during internship. The same must be countersigned by the mentor at the organization where internship is connected.

AIDS 454: Evaluation shall be conducted of 40 marks (Teacher's continuous evaluation/internal assessment) by the supervisor and, 60 marks by an external examiner deputed by examinations division (COE), for a total of 100 marks.

AIDS456/AIDS460: Evaluation shall be conducted of 40 marks (Teacher's continuous evaluation/internal assessment) by the supervisor. And, 60 marks by a bench of the supervisor and

the external examiner deputed by examinations division (COE), for a total of 100 marks. Comprehensive evaluation by the committee of teachers, constituted by the Academic Programme Committee, out of 100.

AIDS 458/ AIDS460: Evaluation shall be conducted of 40 marks (Teacher's continuous evaluation/internal assessment) by the training and placement officer of the department on the basis of the report submitted by the student. And, 60 marks by a bench of the Training and Placement Officer of the department and external examiner deputed by examinations division (COE), for a total of 100 marks. Comprehensive evaluation by the committee of teachers, constituted by the Academic Programme Committee, out of 100.

In the absence of the supervisor or the Training and Placement officer (as the case may be), the head of department can assign the responsibility of the supervisor or the Training and Placement officer (for purpose of examinations) to any faculty of the department.

Minor Specialization-

Students can take minor specializations in the following seven areas: (i) Cyber Security (ii) Blockchain (iii) Internet of things (iv) Data Science (v) Machine Learning (vi) Augmented and Virtual Reality (vii) Robotics. For minor specialization, the students have to take EAE/OAE route and papers for the same are listed in ***Table 2 to Table 8*** respectively. Minor specializations and papers for EAE/OAE other than those mentioned in this scheme shall be defined by the schools if new minor specializations need to be offered to students so as to keep them abreast with advancements in the technology. The emerging area/open electives can also be offered as standalone papers not forming a part of any elective groups also. The APC of the department/institution will decide on all of the above and the decision of APC will be final. The institution shall decide the group(s) and/or individual papers to be offered as electives based on the availability of infrastructure and faculty. From the groups/papers offered by the institution, an elective paper/group shall be taught if and only if the number of students in a paper is at-least 20 or at-least 1/3 of the students of a major discipline for which the paper/group is to be offered. The APC of the department/institution may define a maximum number of students allowed to register for a paper as an elective (EAE / OAE) and the decision will be finalized by the APC. Note that Students of B.Tech in AI&DS programme cannot take minor specialization in Data Science. Similarly, students of B.Tech in IIOT programme cannot take minor specialization in the Internet of Things and students of B.Tech in AI&ML programme cannot take minor specialization in Machine learning.

***Note on Minor Specialization Papers**: The elective of Minor Specialization papers shall be allowed to be taken/studied by the students, by the APC of the School, keeping in view that two papers studied by the student should not have a substantial overall overlap and it should be distinct in content.

Selected Reads-

In third semester, under Selected Reads, the students will be required to select a book (non-technical book that is not related to engineering) that they want to read in the semester and explore their content critically thereby get inspired to use the assimilated knowledge from the books to shape their personalities and to enhance their life skills. Selected reads will have 1 credit.

IMPLEMENTATION RULES

1. The examinations, attendance criteria to appear in examinations, promotion and award of the degree shall be governed by the Ordinance 11 of the University. The term "major discipline"/"primary discipline" in this document refers to the discipline in which student is admitted/studies from 3rd semester onwards. However, credits of courses/paper for OAE/EAE groups shall not be considered for the purpose of promotion from one year of study to the subsequent year of study.
2. Minimum duration of the Bachelor of Technology Programme shall be 4 years (N=4 years) (8 semesters).
3. Maximum duration of the Bachelor of Technology Programme shall be 6 years (N+2 years). After completion of N+2 years of study, if the student has appeared in the papers of all the semesters up to 8th semester, then a maximum extension of 1 year may be given to the student for completing the requirements of the degree if and only if the number of credits already earned by the student is at least 152. Otherwise, the admission of the student shall stand cancelled. After the period of allowed study, the admission of the student shall be cancelled.
4. The degree shall be awarded only after the fulfilment of all requirements of the scheme and syllabus of Examinations.
5. This document pertains to the Bachelor of Technology programme only.
6. The students shall undergo the following group of Courses/Papers as enumerated in the scheme. *(As listed in Table no. 1, Distribution of Credits)*
7. Mandatory Credits specify the number of credits from each subject group to be mandatorily acquired by the student for the award of the degree. See clause 12 and 13 also.
8. Some of the papers are droppable in the sense that the student may qualify for the award of the degree even when the student has not cleared/passed some of the papers of these group. However, the student must earn the minimum 182 credits for the programme of study as specified. See clause 12 and 13 also.
9. One MOOC course has been added in Eighth Semester with 4 credits which is mandatory. The open electives of the OAE group of courses may be taken through NPTEL/SWAYAM MOOCs/ any other MOOCs education portals of Government of India. The student desirous of doing a MOOC based course among the OAE group must seek approval of the APC of the institution for the same before the commencement of the semester. The APC shall allow the MOOC based OAE option to the student if and only if the MOOC subject/course being considered for the student is being offered in line with the Academic Calendar applicable. The student shall submit the successful completion certificate with marks to the institution for onwards transfer to the Examination Division. The Examinations Divisions shall take these marks on record for incorporation in the result of the appropriate semester. These marks/grades of these courses shall be used for calculation of the SGPA/CGPA of the student concerned by the examination division of the University. If a student takes even one OAE paper through MOOC's then the student shall not be eligible for minor specialization. The degree to the student on fulfilment of other requirements for such cases shall be through clause 13.b. or 13.c.

   These MOOC courses taken by the students, if allowed by the APC of the institution shall be of 4 credits or more collectively to be against or for one paper slot in the scheme, through MOOC's though the marks shall be shown individually. That is one paper slot in the scheme wherever a MOOC course is allowed, the student may register for more than one paper to aggregate 4 credits or more. If the credits of these MOOC Courses, allowed to a student is more than 4, then the

maximum credit for the programme shall be amended accordingly for the student. Also, in a particular semester, a student may take more than one MOOC course with the approval of the APC to meet the credit requirements of OAE for the semester. The cost of taking the MOOC courses shall be declared separately by the examination division from the result for the papers conducted by the examination division of the University.

The student opts for emerging area electives in this group also, the same shall be allowed subject to other conditions specified in the rules/scheme.

– To earn an Honours degree, the student may enroll for 20 credits or more through SWAYAM/NPTEL/any other MOOCs educational Portals of Government of India.

10. This point has to be read together with other points specially point 13 and 14, The acquisition of the credits should be completed before the 15th of the July of the admission year plus 4 years. That is, if a student is admitted in the year X, then these credits must be acquired through MOOCs in (X+4), no extra duration or time shall be allocated.

    Honours is the degree shall be awarded if and only if at least 20 credits are acquired through MOOCs. To obtain Honours in the Programme, the student must apply to the institution about the same before the commencement of the 5th semester. The specific courses through MOOCs shall be registered by the student only after approval by the Academic Programme Committee (APC) of the Institution. The APC shall approve the course if it is not already studied by the student, or the student shall not study it in future and adds value to the major area of specialization (which is the degree). The papers for which the student desires to appear for Honours through MOOCs, all papers results shall be submitted by the student to the institution for onwards transfer to Examination Division of the University, to be taken on record of the University. The results of these papers shall be a part of the records of the examinations of the students. The records shall be submitted by the student to the Institution, then transferred to the Examinations division, shall be notified by the Examinations division of the University, and a separate marksheet shall be issued by the Examinations divisions. The cost of taking the MOOC course is to be borne by the concerned student. Such courses shall be reflected as additional courses/papers for the student.

    If a student acquires less than 20 credits through MOOCs, following the mechanism specified, then also the results of these papers shall be taken on record as specified above, though no Honours degree shall be awarded.

    The papers through MOOCs, for Honours degree shall not be a part of the set of the papers over which the SGPA/CGPA of the student shall be calculated.

    The papers through MOOCs for Honours degree shall be additional papers studied by the students and are to be taken into account only for award of Honours in the degree Programme, if 20 credits are earned through MOOCs as approved by APC, by a student, See Clause 14 also.

11. Maximum Credits: The whole B.Tech scheme consists of total 194 credits. At least 182 credits out of 194 credits (Table 1), the student shall have to study for the non-Honours component of the curriculum. The student has to appear in the examinations for these credits.

12. Minimum Credits: The student has to obtain minimum 182 credits for the award of B.Tech degree. Out of theses 182 credits, 152 credits are to be earned by the papers marked M $(Mandatory)$ in the B.Tech scheme and the remaining 30 credits to make it 182 credits to obtain B.Tech degree can be earned from the balance of 42 credits i.e. Maximum credits -

Mandatory credits $(194 - 152)$. However, if the students wish to earn Honours degree, he has to earn 182 credits to be eligible for the Honours degree.

13. The following degree route can be taken by a student (also refer point 14):
    a. The students shall be awarded one minor specializations, one from EAE/OAE route under the following conditions:
        i. The student has earned the mandatory credits as defined in Table 1 and clause 7, 12.
        ii. The student earns 20 credits from courses offered as a minor specialization by the institution.
        iii. In addition, the total credits (including the above specified credits) earned by the student is at least 182 credits.

The degree nomenclature of the degree shall be as: "Bachelor of Technology (Primary Discipline) with minor specializations in <concerned EAE/OAE discipline>)"; if criteria/point 10 is met, then the degrees shall be an Honours degree and the nomenclature shall be as: "Bachelor of Technology (Primary Discipline) with minor specializations in <concerned EAE/OAE discipline>) (Honours)", if in addition to point 13.a.i, 13.a.ii and 13.a.iii, the student fulfils the criteria for Honours as specified at point 10.

    b. The students shall be awarded the degree without any minor specialization under the following conditions:
        i. The student has earned the mandatory credits as defined in Table 1 and clause 7.
        ii. In addition, the total credits (including the above specified credits) earned by the student is at least 182 credits.

The degree nomenclature of the degree shall be as: "Bachelor of Technology (Major Discipline)"; if criteria/point 6 is not satisfied for Honours. Otherwise, if criteria/point 10 is met, then the degrees shall be an Honours degree and the nomenclature shall be as:
"Bachelor of Technology (Major Discipline) (Honours)", if in addition to point 13.b.i or 13.b.ii, the student fulfils the criteria for Honours as specified at point 10.
If the student does not fulfil any of the above criterions (point 13.a, or 13.b), if the student earns at least 182 credits out of 194 credits as enumerated in Table 1 (disregarding the mandatory credits clause of Table 1 and Clause 7), then the student shall be awarding the degree as Bachelor of Technology (Primary Discipline). Such students shall not be eligible for the award of an Honours degree. Though if credits are accumulated through MOOCs as per clause 10, the same shall be reflected in the marksheets of the students.

14. The Honours degree shall only be awarded if the CGPA of the student is above or equal to 7.5 in addition to fulfilment of criteria/point 10 and 13 above and the degree is awarded after the immediate completion of the 4^{th} of the batch from the year of admission. No Honours shall be conferred if the degree requirements are not completed in the minimum duration.

15. Pass marks in every paper shall be 40.
16. Grading System shall be as per Ordinance 11 of the University.
17. The Programme Core Electives (PCE) shall be specific to a major discipline. Students can take minor specializations in the following seven areas: (i) Cyber Security (ii) Blockchain (iii) Internet of things (iv) Data Science (v) Machine Learning (vi) Augmented and Virtual Reality (vii) Robotics. For minor specialization, the students have to take EAE/OAE route and papers for the same are listed in ***Table 2 to Table 8*** respectively. Minor specializations and papers for

EAE/OAE other than those mentioned in this scheme shall be defined by the schools if new minor specializations need to be offered to students so as to keep them abreast with advancements in the technology. The emerging area/open electives can also be offered as standalone papers not forming a part of any elective groups also. The APC of the department/institution will decide on all of the above and the decision of APC will be final. The institution shall decide the group(s) and/or individual papers to be offered as electives based on the availability of infrastructure and faculty. From the groups/papers offered by the institution, an elective paper/group shall be taught if and only if the number of students in a paper is at-least 20 or at-least 1/3 of the students of a major discipline for which the paper/group is to be offered. The APC of the department/institution may define a maximum number of students allowed to register for a paper as an elective (EAE / OAE) and the decision will be finalized by the APC. Note that Students of B.Tech in AI&DS programme cannot take minor specialization in Data Science. Similarly, students of B.Tech in IIOT programme cannot take minor specialization in the Internet of Things and students of B.Tech in AI&ML programme cannot take minor specialization in Machine learning.

18. Teachers of other departments, as and when deputed by their department, for teaching the students enrolled in programmes offered by the department offering the programme shall be a part of the Academic Programme Committee of the discipline. Such teachers, for all academic matters, including teaching, teachers' continuous evaluation, term end examinations etc. shall be governed by the decisions of the APC of department offering the programme of study. Similarly, the guest faculty, the visiting faculty, and the contract/Ad Hoc faculty as and when deputed to teach students of a particular department shall form a part of APC of the department.
19. The medium of instructions shall be English.

SYLLABUS

(2nd Year)

FOR

BACHELOR OF TECHNOLOGY

For

Artificial Intelligence and Data Science

Semester: 3rd			
Paper code: AIDS201	**L**	**T/P**	**Credits**
Subject: Data Structures	**3**	**0**	**3**

Marking Scheme

1. Teachers Continuous Evaluation: 25 Marks
2. End term Theory Examination: 75 Marks

INSTRUCTIONS TO PAPER SETTERS: Maximum Marks: 75

1. There should be 9 questions in the end term examination question paper.
2. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 15 marks.
3. Apart from Question No. 1, the rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, students may be asked to attempt only 1 question from each unit. Each question should be 15 marks.
4. The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
5. The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required.

Course Objectives:

1.	To understand the basic concepts of data structures.
2.	To perform basic operations on linked list, stacks and queues.
3.	To perform sorting and searching on a given set of data items.
4.	To understand the concepts of trees, hashing, and graph theory.

Course Outcomes:

CO1	Understand and identify the concepts of fundamentals of data structures and efficient access strategies for solving a computational problem.
CO2	Apply suitable data structure for solving a given problem and differentiate the usage of data structures and their applications.
CO3	Analyse the choice of data structures and their usage for sorting and searching numbers in data structures.
CO4	Create the solution for a particular problem and gain ability to provide solutions/approaches with file handling and tree structures.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale 1: Low, 2: Medium, 3: High)

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	2	1	1	1	1	1	1	1	2	1	1	1	1
CO2	2	2	2	2	1	1	1	1	1	1	1	2	1	-	-	-
CO3	2	2	2	2	1	-	-	-	-	-	1	2	1	-	-	-
CO4	2	2	2	2	1	1	-	-	-	-	1	2	1	-	-	-

Course Overview:

This subject gives an overview of data structure concepts including arrays, stack, queues, linked lists, trees, and graphs. Discussions shall be held of various implementations of these data structures in real life. This subject also examines algorithms for sorting and searching. The concepts of trees and graph based algorithms shall be introduced.

UNIT I: **[10]**

Introduction- Introduction to Algorithmic Complexity, Introduction to various data structures, Arrays and Strings operations, Stacks and Queues, Operations on Stacks and Queues, Array representation of Stacks, Applications of Stacks- Recursion, Polish expression and their compilation conversion of infix expression to prefix and postfix expression, Operations of Queues, Representations of Queues Applications of Queues, Priority queues, Overview of the list, set, tuples, and dictionary data structures.

UNIT II: **[10]**

Searching and Sorting- Linear Search, Binary search, Insertion Sort, Quick sort, Radix sort, Merge sort, Heap sort. Linked Lists- Singly linked lists, Representation of linked list, Operations of the Linked list such as Traversing, Insertion, and Deletion, Searching, and applications of Linked List. Concepts of Circular linked list and doubly linked list and their applications. Stacks and Queues as a linked list.

UNIT III: **[10]**

Trees- Basic Terminology, Binary Trees and their representation, binary search trees, various operations on Binary search trees like traversing, searching, Insertion and Deletion, Applications of Binary search Trees, Complete Binary trees, Extended binary trees. General trees, AVL trees, Threaded trees, B- trees, 2-3 trees, 2-3-4 trees, B* and B+ trees.

UNIT IV: **[10]**

File Structure- File Organization, Indexing & Hashing, Hash Functions, Application Dictionary- Telephone Directory. Graphs- Terminology and Representations, Graphs & Multi-graphs, Directed Graphs, Representation of graphs and their Transversal, Euler and Hamiltonian paths, Spanning trees, shortest path and Transitive Closure, Activity Networks, Topological Sort, and Critical Paths. Applications of list, set, tuples, and dictionary data structures.

Text Books:

1. Tannenbaum. Data Structures, PHI, 2007 (Fifth Impression).
2. An introduction to data structures and application by Jean-Paul Tremblay & Pal G. Sorenson (McGraw Hill).

Reference Books:

1. Data Structures with C - By Schaum Series.
2. R.L. Kruse, B.P. Leary, C.L. Tondo. Data structure and program design in C, PHI, 2009(Fourth Impression).

Semester: 3rd			
Paper code: AIDS251	L	T/P	Credits
Subject: Data Structures Lab	0	2	1

Marking Scheme

1. Teachers Continuous Evaluation: 40 Marks
2. End term Theory Examination: 60 Marks

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks: 60**

1. This is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement under the intimation to the office of the HOD/ Institution in which they appear is being offered from the list of practicals below.
3. Instructors can add any other additional experiments over and above the mentioned in the experiment list which they think is important.
4. At least 8 experiments must be performed by the students.

Course Objectives:

1.	To teach students how to analyse different types of data structures.
2.	To design applications based on different types of data structures.

Course Outcomes:

CO1	Design programs using a variety of data structures such as stacks, queues, hash tables, binary trees, search trees, heaps, graphs, B-trees, list, set, tuples, dictionary.
CO2	Implement and analyse abstract data types such as lists, graphs, search trees to solve real world problems efficiently.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale 1: Low, 2: Medium, 3: High)

CO/PO	PO01	PO 02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	2	1	-	-	-	-	-	-	1	1	-	-	-
CO2	2	2	2	2	1	1	1	1	1	1	1	2	1	1	1	1

LIST OF EXPERIMENTS:

1. Perform Linear Search and Binary Search on an array.
2. Create a stack and perform Pop, Push, and Traverse operations on the stack using a Linear Linked list.
3. Create a Linear Queue using Linked List and implement different operations such as insert, delete, and display the queue elements.
4. Implement sparse matrices using arrays.
5. Implement the following sorting techniques:
    a. Insertion sort
    b. Merge sort
    c. Bubble sort
    d. Selection sort
6. Create a linked list with nodes having information about a student. Insert a new node at the specified position.
7. Create a doubly linked list with nodes having information about an employee and perform Insertion at front of doubly linked list and perform deletion at end of that doubly linked list.
8. Create a circular linked list having information about a college and perform Insertion at the front end and perform deletion at the end.
9. Create a Binary Tree and perform Tree Traversals (Preorder, Postorder, Inorder) using the concept of recursion.
10. Implement insertion, deletion, and display (Inorder, Preorder, Postorder) on binary search tree with the information in the tree about the details of an automobile (type, company, year of make).

Semester: 3rd			
Paper code: AIDS203	**L**	**T/P**	**Credits**
Subject: Foundations of Data Science	**3**	**0**	**3**

Marking Scheme

1. Teachers Continuous Evaluation: 25 Marks
2. End term Theory Examination: 75 Marks

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks: 75**

1. There should be 9 questions in the end term examination question paper.
2. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 15 marks.
3. Apart from Question No. 1, the rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, students may be asked to attempt only 1 question from each unit. Each question should be 15 marks.
4. The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
5. The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required.

Course Objectives:

1.	To analyse different types of data using Python.
2.	To prepare data for analysis and perform simple statistical analysis.
3.	To create meaningful data visualizations and predict future trends from data.

Course Outcomes:

CO1	Understand and identify the basic concepts of data science for performing data analysis.
CO2	Apply & perform pre-processing steps along with data visualization to get insights from data.
CO3	Analyse and apply different modules of data science to evaluate mathematical, and scientific problems of data analysis.
CO4	Develop the model for data analysis and evaluate the model's performance to optimize business decisions and create competitive advantage with data analytics.

Course Outcomes (CO) to Programme Outcomes (PO) **Mapping (**Scale 1: Low, 2: Medium, 3: High)

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	1	-	-	-	-	-	1	2	3	1	1	1
CO2	2	3	3	3	3	1	1	1	1	1	1	2	3	3	1	1
CO3	2	3	3	3	1	-	-	-	-	-	2	3	3	3	1	1
CO4	3	3	3	3	1	1	1	1	1	1	2	3	3	2	3	3

Course Overview:

Foundations of Data Science is a blend of statistical mathematics, data analysis tools and visualization, domain knowledge representation, tools and algorithms and computer science applications. The hidden insights or patterns are identified and analysed to form a decision.

UNIT I: [8]

Introduction to data science, applications of data science, data scientist roles and responsibilities, skills needed to become a data scientist. Need of Python for data analysis, Introduction to Data Understanding and Pre-processing, domain knowledge, Understanding structured and unstructured data. Creation of synthetic dataset in MS Excel.

UNIT II: [12]

Basics of Python programming: Variables, printing values, if condition, arithmetic operations, loops. Data Analysis process, Dataset generation, Importing Dataset: Importing and Exporting Data, Basic Insights from Datasets, Cleaning and Preparing the Data: Identify and Handle Missing Values.

UNIT III: [12]

Basics of essential Python libraries: Introduction to NumPy, Pandas, Matplotlib, SciPy. Data Processing, Data Visualization, Basic Visualization Tools, Specialized Visualization Tools, Seaborn Creating and Plotting Maps.

UNIT IV: [8]

Mathematical and scientific applications for data Analysis, Basics of Supervised and Unsupervised Learning. Decision Making. Trend & predictive mining using Python, Recommender systems.

Text Books:

1. Wes Mckinney. Python for Data Analysis, First edition, Publisher O'Reilly Media.
2. Foundational Python for Data Science, 1st edition, Kennedy Behrman, Pearson Publication.
3. Data analytics using Python, Bharti Motwani, Wiley Publication.

Reference Books:

1. Allen Downey, Jeffrey Elkner, Chris Meyers, Learning with Python, Dreamtech Press.
2. Reema Thareja. Python Programming using Problem Solving approach, Oxford University press.

Semester: 3rd			
Paper code: AIDS253	**L**	**T/P**	**Credits**
Subject: Foundations of Data Science Lab	**0**	**2**	**1**

Marking Scheme

1. Teachers Continuous Evaluation: 40 Marks
2. End term Theory Examination: 60 Marks

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks: 60**

1. This is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement under the intimation to the office of the HOD/ Institution in which the appear is being offered from the list of practicals below.
3. Instructors can add any other additional experiments over and above the mentioned in the experiment list which they think is important.
4. Atleast 8 experiments must be performed by the students.

Course Objectives:

1.	To analyse different types of data using Python.
2.	To perform statistical analysis and create meaningful data insights.

Course Outcomes:

CO1	Apply data science principles to identify meaningful solutions to actual problems.
CO2	Analyse and create programs based on statistical analysis using different libraries of Python programming language.

Course Outcomes (CO) to Programme Outcomes (PO) **Mapping (**Scale 1: Low, 2: Medium, 3: High)

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	1	1	2	1	1	1	2	3	2	2	2
CO2	3	3	3	3	3	1	1	2	1	1	1	2	3	2	2	2

LIST OF EXPERIMENTS:

1. Introduction and installation of Python and Python IDEs for data science (Spyder-Anaconda, Jupyter Notebook etc.)
2. Design a Python program to generate and print a list except for the first 5 elements, where the values are squares of numbers between 1 and 30.
3. Design a Python program to understand the working of loops.
4. Design a Python function to find the Max of three numbers.
5. Design a Python program for creating a random story generator
6. Create a synthetic dataset (.csv/.xlsx) to work upon and design a Python program to read and print that data.
7. Design a Python program using NumPy library functions.
8. Perform Statistics and Data Visualization in python.
9. Design a Python program to implement Linear Regression
10. Design a Python program to create a recommender system

Faculties should also motivate students to make a project on the topics taught in theory and lab.

Semester: 3rd			
Paper code: AIDS205	**L**	**T/P**	**Credits**
Subject: Digital Logic Design	**3**	**0**	**3**

Marking Scheme

1. Teachers Continuous Evaluation: 25 Marks
2. End term Theory Examination: 75 Marks

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks: 75**

1. There should be 9 questions in the end term examination question paper
2. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 15 marks.
3. Apart from Question No. 1, the rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, students may be asked to attempt only 1 question from each unit. Each question should be 15 marks.
4. The questions are to be framed keeping in view the learning outcomes of course/paper. Thestandard/ level of the questions to be asked should be at the level of the prescribed textbooks.
5. The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required.

Course Objectives:

1.	To teach various number systems, binary codes and their applications.
2.	To familiarize the students with the importance of error detection and error correction codes.
3.	To inculcate concepts of K-MAP to simplify a Boolean expression.
4.	To facilitate students in designing a logic circuit.

Course Outcomes:

CO1	Understand number systems and complements for the basic functionality of digital systems
CO2	Identify the importance of canonical forms in the minimization or other optimization of Boolean formulas in general and digital circuits.
CO3	Apply and evaluate circuits of minimizing algorithms (Boolean algebra, Karnaugh map or tabulation method).
CO4	Analyse the design procedures of combinational and sequential circuits.
CO5	Design and implement real world projects involving combinational and sequential logics.

Course Outcomes (CO) to Programme Outcomes (PO) **Mapping (**Scale 1: Low, 2: Medium, 3: High)

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	2	1	-	-	-	-	-	-	1	1	-	-	1
CO2	2	2	2	2	1	-	-	-	-	-	-	1	1	-	-	-
CO3	2	2	2	2	1	-	-	-	-	-	-	1	1	-	-	-
CO4	2	2	2	2	1	-	-	-	-	-	-	1	1	-	-	-
CO5	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1

Course Overview:

The course addresses the concepts of digital systems logic design, and techniques of designing digital systems. The course teaches the fundamentals of digital systems applying the logic design and development techniques. This course forms the basis for the study of advanced subjects like Computer Organization and Architecture, Microprocessor through Interfacing, VLSI Designing.

UNIT I: [10]

Digital systems, binary numbers, number base conversions, octal and hexadecimal numbers, complements, signed binary numbers, binary codes, error detection and error correction codes. Boolean Algebra and Logic Gates: Basic definitions, axiomatic definition of Boolean algebra, basic theorems and properties of Boolean algebra, Boolean functions, canonical and standard forms, other logic operations, digital logic gates.

UNIT II: [8]

GATE level minimization, Logic gates and Logic families, The K-map method, four-variable map, five-variable map, product of sums simplification, don't-care conditions, NAND and NOR implementation, determination and selection of Prime Implicants, Essential and Nonessential prime Implicants.

UNIT III: [10]

Combinational logic and their Design procedure, Binary Adder, Binary Subtractor, Binary Multiplier, Magnitude Comparator, Decoders, Encoders, Multiplexers, and Demultiplexers. Memories such as ROM, RAM, EPROM.

UNIT IV: [12]

Sequential logic and circuits, latches, flip-flops, analysis of clocked sequential circuits, State reduction and assignment, design procedure. REGISTERS AND COUNTERS: Registers, shift registers, ripple counters, synchronous counters, counters with unused states, ring counter, Johnson counter. Random access memory, memory decoding, error detection and correction, read only memory, programmable logic array, programmable array logic, sequential programmable devices. A/D and D/A converters.

Text Books:

1. M. Morris Mano, Michael D. Ciletti (2008), Digital Design, 4th edition, Pearson Education Inc, India.
2. Donald D. Givone (2002), Digital Principles and Design, Tata McGraw Hill, India.

Reference Books:

1. C. V. S. Rao (2009), Switching and Logic Design, 3rd Edition, Pearson Education, India.
2. Roth (2004), Fundamentals of Logic Design, 5th Edition, Thomson, India.

Semester: 3rd			
Paper code: AIDS255	**L**	**T/P**	**Credits**
Subject: Digital Logic Design Lab	**0**	**2**	**1**

Marking Scheme

1. Teachers Continuous Evaluation: 40 Marks
2. End term Theory Examination: 60 Marks

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks: 60**

1. This is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement under the intimation to the office of the HOD/ Institution in which the appear is being offered from the list of practicals below.
3. Instructors can add any other additional experiments over and above the mentioned in the experiment list which they think is important.
4. At least 8 experiments must be performed by the students.

Course Objectives:

1.	To familiarize with the understanding of various aspects of designing real life applications through digital logic.
2.	Design and analysis of the digital circuits and systems.

Course Outcomes:

CO1	Design an experiment to validate through hypothesis, a Boolean logic gates, truth table and circuit simulation.
CO2	Create circuits to solve real life problems via digital logic design.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale 1: Low, 2: Medium, 3: High)

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	2	1	-	-	-	-	-	-	1	-	-	-	-
CO2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1

LIST OF EXPERIMENTS:

1. a) Introduction to Digital Logic Trainer kits and their function.
   b) Verify the truth table of Basic logic gates using their ICs.
   c) Realize logic functions of NOT, AND, OR, EX-OR, EX-NOR with the help of universal gates-NAND and NOR Gates.
2. a) Verify De-Morgan's theorem for two variables using basic gates.
   b) Realize Sum of Product (SOP) and Product of sum (POS) expressions using universal gates.
3. Realize Binary to Gray & Gray to Binary code converter and their truth table.
4. Design and test the Adder circuit.
   a) Half Adder
   b) Full Adder
   c) Parallel Adder using 7483
5. Design and test the Subtractor circuit.
   a) Half Subtractor
   b) Full subtractor
6. Design and test the Multiplexer circuit.
   a) 8:1 Multiplexer using IC 74151
   b) 1:8 Demultiplexer circuit using IC 74138
7. Verify and test the Counter circuit.
   a) BCD Counter using ICs 7493
   b) Ring counter using 7495
   c) Johnson Ring Counter using 7495
8. Design and implement Comparator circuit.
   a) 1 bit comparator
   b) 4 bit magnitude Comparator using 7485
9. Design and implement Encoder circuit.
   a) Decimal to BCD Encoder using IC 74147
   b) Octal to Binary Encoder using IC 74148
10. Verify 2:4 Decoder using seven segment decoder and using ICs 7447.
11. Investigate the operation of various Flip-Flops using IC 7400, 7410.
    a) SR & Clocked Flip flop
    b) D flip flop
    c) T flip flop
    d) JK flip flop
12. Realize Shift Register using ICs 7495.
    a) SISO (Serial in Serial out)
    b) SIPO (Serial in Parallel out)
    c) PIPO (Parallel in Parallel out)
    d) PISO (Parallel in Serial out)

Semester: 3rd			
Paper code: AIDS207	L	T/P	Credits
Subject: Principles of Artificial Intelligence	3	0	3

Marking Scheme

1. Teachers Continuous Evaluation: 25 Marks
2. End term Theory Examination: 50 Marks
3. End term Practical Examination: 25 Marks

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks: 50**

1. There should be 9 questions in the end term examination question paper
2. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 15 marks.
3. Apart from Question No. 1, the rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, students may be asked to attempt only 1 question from each unit. Each question should be 15 marks.
4. The questions are to be framed keeping in view the learning outcomes of the course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
5. Instructors can add any other additional experiments over and above the mentioned in the experiment list which they think is important.
6. The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required.

Course Objectives:

1.	To understand the basic concepts of Artificial Intelligence, its principles, and techniques.
2.	To analyse the applicability of the basic knowledge representation, reason under uncertainty, develop a plan for concrete computational problems, and learn from experiences to solve various problems
3.	To Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
4.	To devise development tools such as prediction models, expert systems, and data mining tools.

Course Outcomes:

CO1	Understand theories and concepts necessary for building an Artificial Intelligent System for knowledge representation.
CO2	Apply heuristic algorithms to develop better searching algorithms for solving real-world problems.
CO3	Analyse and understand concepts of Neural Networks and Fuzzy data to deal with uncertainty and imprecision, subsequently apply suitable soft-computing technique to do approximate reasoning and build computational models capable of learning meaningful patterns from data.
CO4	Create logic programming to build systems capable of making decision to solve real-world problems by applying critical thinking, problem-solving and AI algorithms.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale 1: Low, 2: Medium, 3: High)

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3	3	1	-	-	-	-	-	1	2	3	2	1	2
CO2	2	3	3	3	1	1	1	1	1	1	1	1	3	2	1	2
CO3	2	3	3	3	1	-	-	-	-	-	2	2	3	2	1	2
CO4	2	3	3	3	1	1	1	1	1	1	2	3	3	3	1	2

Course Overview:

Principles of artificial Intelligence is the simulation of intelligence process by computer systems. It gives understanding of the main abstractions and reasoning techniques used in artificial intelligence including understand of AI, reasoning by machines, planning techniques, and basic machine learning methods.

UNIT I: **[10]**

Introduction to AI, History of Artificial Intelligence, Applications of AI in the real world (Gaming, Computer Vision, Expert Systems, Natural Language Processing, Robotics & others). AI techniques, Problem Solving: Production Systems, State Space Search, Depth First Search, Breadth First Search, Heuristic Search, Hill Climbing, Best First Search, best-first search, A*, Problem Reduction, AO*, Constraint Satisfaction, Means-End Analysis.

UNIT II: **[8]**

Knowledge representation, Knowledge representation using Predicate logic, Propositional logic, Inferences, First-Order Logic, Inferences, Unification, Resolution, Natural Deduction, Procedural versus declarative knowledge, logic programming, forward versus backward reasoning.

UNIT III: **[10]**

Reasoning, Introduction to Uncertainty, Bayesian Theory, Bayesian Network, Dempster-Shafer Theory. Overview of Planning and its Components. Overview of Learning and basic Techniques. Introduction of Fuzzy Reasoning and Neural Networks.

UNIT IV: **[12]**

Game Playing and Current Trends in AI, MinMax search procedure, Alpha-Beta Cutoffs, Game Development using AI, Applications of AI, Emerging Trends in AI Research in various domains.

Practical Component:

1. Introduction to Prolog.
2. Implement Syntax and Numeric Functions in Prolog
3. Implement Basic List Manipulation Functions in Prolog
4. Implement Input, Output, Predicates in Prolog
5. Implement Local Variables and Conditional statements in Prolog
6. Write a program to calculate factorial of a given number.
7. Write a program to solve 4-Queen problem using Prolog.
8. Write a program to solve any real-life problem using depth first search.

Text Books:

1. Rich and Knight. Artificial Intelligence, Tata McGraw Hill, 1992.
2. S. Russel and P. Norvig. Artificial Intelligence – A Modern Approach, Second Edition, Pearson Edu.

Reference Books:

1. Kheemani, Deepak, A First Course in Artificial Intelligence, McGraw Hill Education, 1 Edition, 2017.
2. Artificial Intelligence: foundations of computational agents, Cambridge University Press, 2017.
3. Poole, David L., and Alan K. Mackworth. Artificial Intelligence: foundations of computational agents. Cambridge University Press, 2010.
4. Luger, G.F. Artificial Intelligence -Structures and Strategies for Complex Problem Solving, 6th edition, Pearson, 2008.

Semester: 3rd			
Paper code: AIDS209	**L**	**T/P**	**Credits**
Subject: Probability, Statistics and Linear Algebra	**3**	**0**	**3**

Marking Scheme

1. Teachers Continuous Evaluation: 25 Marks
2. End term Theory Examination: 75 Marks

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks: 75**

1. There should be 9 questions in the end term examination question paper
2. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 15 marks.
3. Apart from Question No. 1, the rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, students may be asked to attempt only 1 question from each unit. Each question should be 15 marks.
4. The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
5. The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required.

Course Objectives:

1.	To build a strong foundation on probabilistic and statistical analysis and linear Algebra.
2.	To apply tools of statistics, probability, discrete random variables and probability distributions, in various applications of engineering and technology.
3.	To analyse tools of continuous random variables and probability distributions and linear algebra in various applications of engineering and technology.
4.	To create systems using probabilistic and statistical analysis in varied applications of engineering and science like disease modeling, climate prediction and computer networks etc.

Course Outcomes:

CO1	Understand the fundamentals of probability, Conditional Probability, Baye's theorem, random variables, sampling distribution, mean, and other statistical row reduced echelon form, Solutions of system of linear equations, Vector Space, Basis, Linear Transformations, Eigen values, and Eigen Vectors techniques and apply them to various real-life problems.
CO2	Perform hypothesis testing to analyse various Engineering problems.
CO3	Analyse different distributions, systems of linear equations, and linear transformations in engineering problems.
CO4	Design network models, Markov chain, and their applications.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale 1: Low, 2: Medium, 3: High)

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	1	1	1	1	1	1	1	1	-	-	1	-
CO2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	-
CO3	2	2	2	2	1	1	1	1	1	1	2	-	-	-	1	1
CO4	3	2	2	2	-	-	-	-	-	-	2	-	-	-	-	-

Course Overview:

Probability, statistics and linear algebra gives and allows to access and examine the certainty of outcomes of a study or experiment that is executed. The course also addresses the statistics to gather, review, analyse and draw conclusion from raw data, as well as quantified mathematical models to understand machine learning algorithms.

UNIT I: **[10]**

Probability - Probability spaces, conditional probability, independence; Discrete random variables, continuous random variables and their properties, distribution functions and densities, exponential and gamma densities. Independent random variables, the multinomial distribution, Chebyshev's Inequality, Bayes' rule.

UNIT II: **[10]**

Basic Statistics- Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.

UNIT III: **[10]**

Applied Statistics- Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance- large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

UNIT IV: **[10]**

Linear Algebra- Cramer's rule, Singular Value decomposition, Euclidian vector spaces, Projection. Hermitian and Unitary Matrix, Gram -Schmidt orthogonalization, LU-decomposition.

Text Books:

1. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003.
2. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
3. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.

Reference Books:

1. N.P. Bali and Manish Goyal, A textbook of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
3. Veerarajan T. Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.
4. Mathematics For Machine Learning-Marc Peter Deisenroth, A. Aldo Faisal, Cheng soon ong.

Semester: 3rd			
Paper code: AIDS211	**L**	**T/P**	**Credits**
Subject: Universal Human Values II	**3**	**0**	**3**

Marking Scheme

1. Teachers Continuous Evaluation: 25 Marks
2. End term Theory Examination: 75 Marks

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks: 75**

1. There should be 9 questions in the end term examination question paper
2. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 15 marks.
3. Apart from Question No. 1, the rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, students may be asked to attempt only 1 question from each unit. Each question should be 15 marks.
4. The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
5. The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required.

Course Objectives:

1.	To develop a holistic perspective based on self-exploration about themselves (human beings), family, society, and nature/existence and to appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2.	To understand the harmony in the human being, family, society, and nature/existence.
3.	To Strengthen the power of self-reflection.
4.	To develop commitment and courage to act.

Course Outcomes:

CO1	Understand and become more aware of self and our surroundings (family, society, and nature).
CO2	Become more responsible in life for handling problems with sustainable solutions while keeping human relationships and human nature in mind.
CO3	Enhance critical ability for self-reflection.
CO4	Boost sensitivity to our commitment in terms of human values, human relationships, and human society.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale 1: Low, 2: Medium, 3: High)

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	-	-	-	-	1	-	3	2	1	-	3	-	-	-	-
CO2	-	-	-	-	-	1	-	3	2	1	-	3	-	-	-	-
CO3	-	-	-	-	-	1	-	3	2	1	-	3	-	-	-	1
CO4	-	-	-	-	-	1	-	3	2	1	-	3	-	-	-	-

Course Overview:

This course is aimed at giving inputs that will help to ensure the right understanding and right feelings in the students in their life and profession, enabling them to lead an ethical life. In this course, the students learn the process of self-exploration, the difference between the Self and the Body, the naturally acceptable feelings in relationships in a family, the comprehensive human goal in the society, the mutual fulfilment in the nature and the co-existence in existence.

UNIT I: **[8]**

Introduction to Value Education - Need, Basic Guidelines, Content and Process for Value Education, Self-Exploration, Natural Acceptance, Experiential Validation as the mechanism for Self Exploration. Continuous Happiness and Prosperity, Basic Human Aspirations. Right Understanding, Relationship and Physical Facilities - the basic requirements for fulfillment of aspirations of every human being with their priority, Understanding Happiness and Prosperity, Method to fulfill the above human aspirations: Understanding and living in harmony at various levels.

UNIT II: **[12]**

Understanding Harmony in the Human Being, human being as a Co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body', happiness and physical facility, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Health, correct appraisal of Physical needs, meaning of Prosperity, Programs to ensure Sanyam and Health.

UNIT III: **[12]**

Harmony in Human-Human Relationship, Understanding values in human-human relationship, meaning of Justice (Nine universal values in relationships) and program for its fulfillment to ensure Mutual Happiness, Trust and Respect as the foundational values of relationship, Understanding the meaning of Trust, Difference between Intention and Competence, Understanding the meaning of Respect, Difference between Respect and Differentiation, the other salient values in relationship, Understanding the harmony in the society (society being an extension of family), Resolution, Prosperity, Fearlessness (trust) and Co-existance as comprehensive Human Goals, Visualizing a universal harmonious order in society: Undivided Society, Universal order from family to world family.

UNIT IV: **[8]**

Understanding Harmony in Nature. Interconnectedness: Self-regulation and Mutual Fulfillment among the Four Orders of Nature: Recyclability and Self-regulation in Nature, Realizing Existence as Co-existence at All Levels. The Holistic Perception of Harmony in

Existence. Natural Acceptance of Human Values. Definitiveness of (Ethical) Human Conduct. A Basis for Humanistic Education, Humanistic Constitution and Universal Humanistic Order.

Text Books:

1. R. R. Gaur, R. Asthana & G. P. Bagaria, A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1.
2. Teacher's Manual for: A Foundation Course in Human Values and Professional Ethics, R. R. Gaur, R. Asthana & G. P. Bagaria,2nd Revised Edition, Excel Books, New Delhi, 2019, ISBN 978-93-87034-53-2.

Reference Books:

1. A. Nagraj, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak, 1999.
2. A. N. Tripathy, Human Values, New Age International Publishers, 2004.
3. B. L. Bajpai, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.
4. P. L. Dhar & R. R. Gaur, 1990, Science and Humanism, Commonwealth Purblishers.

Semester: 3rd			
Paper code: AIDS257	**L**	**T/P**	**Credits**
Subject: Web Programming Lab	**0**	**2**	**1**

Marking Scheme

1. Teachers Continuous Evaluation: 40 Marks
2. End term Theory Examination: 60 Marks

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks: 60**

1. This is only the practical subject.
2. The practical list shall be notified by the teacher in the first week of the class commencement under the intimation to the office of the HOD/ Institution in which the appear is being offered from the list of practicals below.
3. Instructors can add any other additional experiments over and above the mentioned in the experiment list which they think is important.
4. Atleast 8 experiments must be performed by the students.

Course Objectives:

1.	To apply JavaScript Language programming concepts and techniques to create web pages and develop, plan and debug web pages as per the requirement. CSS, this course will familiarize students with how browsers
2.	To understand how browsers represent webpage data using the Document Object Model (DOM), how to develop dynamic, interactive web pages using JavaScript in the browser.

Course Outcomes:

CO1	Apply different core scripting modules to design a server.
CO2	Design and develop single-page applications, interactive and dynamic websites that can be used to resolve real world issues.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale 1: Low, 2: Medium, 3: High)

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	2	2	-	-	-	-	-	-	2	1	-	1	1
CO2	2	2	2	2	2	1	1	1	1	1	1	3	1	1	1	1

Course Overview and Context:

This course will cover JavaScript technologies that power a modern full-stack development workflow, including server-side scripting, single-page web applications with MVC structure, package management, and JSON data storage. The students will learn server-side JavaScript with web frameworks such as Node.js making it simple to create and deploy complex, data-driven web applications.

LIST OF EXPERIMENTS:

1. Create a web page that covers your CV using various HTML Tags (UL, OL , Table, etc).
2. Create a webpage that displays brief details of various Programming Languages using various types of CSS.
3. Create a webpage using JavaScript and HTML to demonstrate Simple Calculator Application.
4. Create a web page covering the basic CRUD operations (Create, Read, Update, Delete) that implements To-do/Grocery lists using JavaScript and HTML
5. Create a JavaScript application based on various Data Types, Statements, Keywords and Operators.
6. Create a JavaScript application with Window Objects and Document Object.
7. Create a JavaScript application with Object Creation and by adding methods of objects.
8. Create a JavaScript application with Loops to incorporate the concept of Iteration.
9. Create a JavaScript application for random number generation.
10. Build a unit convertor application using HTML & JavaScript.

Semester: 3rd			
Paper code: AIDS213	**L**	**T/P**	**Credits**
Subject: Critical Reasoning and Systems Thinking	**2**	**0**	**2**

Marking Scheme

1. Teachers Continuous Evaluation: 25 Marks
2. End term Theory Examination: 75 Marks

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks: 75**

1. There should be 9 questions in the end term examination question paper
2. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 15 marks.
3. Apart from Question No. 1, the rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, students may be asked to attempt only 1 question from each unit. Each question should be 15 marks.
4. The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
5. The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required.

Course Objectives:

1.	To inculcate critical reasoning and system thinking to take decisions.
2.	To understand Critical reasoning, examine assumptions, uncover hidden values, evaluate evidence, accomplish actions, and assess conclusions.
3.	To learn a holistic approach to analysis that focuses on the way a system's constituent parts interrelated and how systems work overtime and within the context of larger systems
4.	To formulate solutions for social and business enterprises using critical thinking and brainstorming and covert opportunities into innovation products and services.

Course Outcomes:

CO1	Apply critical reasoning so as to have clarity and wisdom while decision making.
CO2	Apply systems thinking concepts to enhance individual and collaborative skills to recognize opportunities and find innovative solutions for the same.
CO3	Apply and analyse systems thinking, critical thinking, lateral thinking, creative thinking to different real-life scenarios.
CO4	Understand how to translate broadly defined opportunities into innovation products and services and create a business or social enterprise.

Course Outcomes (CO) to Programme Outcomes (PO) **Mapping (**Scale 1: Low, 2: Medium, 3: High

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	1	1	1	1	-	1	1	3	1	1	-	1
CO2	2	3	3	3	1	1	-	-	-	-	1	2	1	1	1	1
CO3	2	3	3	3	1	1	-	1	-	-	1	2	1	1	1	1
CO4	3	3	3	3	1	1	-	-	1	1	1	3	1	1	2	1

Course Overview:

This is a perspective course which exposes students to the disciplines of building and evaluating rational arguments and using a system perspective in applied engineering. Critical reasoning and system thinking enhances the though process with reasoning and critical analysis to take to the final decision in order to solve any specific problems. It enables seeing and understanding systems as wholes rather than as collections of parts, as a web of interconnections that work together to deliver an outcome.

UNIT I: [12]

Introduction, foundations and principles of critical reasoning, concepts in critical reasoning, analyzing reasoning, evaluating reasoning, Integrated reasoning, uncritical and critical reasoning, scientific reasoning, strategic reasoning, analytical reasoning, different kinds of biases, recognizing implications, drawing conclusion.

UNIT II: [8]

Arguments, structure of an argument, premises, claims, Inductive and deductive arguments, valid & invalid arguments, sound & unsound arguments, inductive and deductive arguments, descriptions, explanations, clarifications, illustrations and summary.

UNIT III: [12]

What is problem solving, steps in problem solving, problem definition, idea generation, brainstorming, fish bone analysis, thinking out of the box, lateral thinking tools & techniques, Information and data gathering and analysis, evaluating & prioritizing ideas, six thinking hats method, problem solving in teams, planning in teams, Tools and applications in project and risk management, problem solving in teams, planning in teams.

Unit IV: [8]

System structures and behavior, Abilene paradox, fallacies in reasoning, barriers in critical thinking, cognition and perception in Indian knowledge systems (Nyaya Darshana), systems thinking, operational and design thinking, system thinking for social change, critical thinking, the art of asking questions, Tools and applications in project and risk management.

Text Books:

1. Concise Guide to Critical Thinking by Lewis Vaughn
2. Critical Thinking by Tom Chatfield
3. Managing Complex Systems - Thinking Outside the Box by Howard Eisner A
4. Strategies for creative problem solving by H Scott Fogler and Steven E LeBlanc

Reference Books:

1. Thinking Fast and Slow by Daniel Kahneman
2. Factfulness by Hans Rosling

Semester: 3rd			
Paper code: AIDS215	**L**	**T/P**	**Credits**
Subject: Selected Reads	**3**	**0**	**3**

Marking Scheme

1. Teachers Continuous Evaluation: 25 Marks
2. End term Theory Examination: 75 Marks

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks: 75**

1. There should be 9 questions in the end term examination question paper
2. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 15 marks.
3. Apart from Question No. 1, the rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, students may be asked to attempt only 1 question from each unit. Each question should be 15 marks.
4. The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
5. The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required.

Course Objectives:

1.	To Enhance Comprehension Skills
2.	To learn and enhance communication and speaking skills

Course Outcomes:

CO1	Apply and analyse comprehension and reading skills
CO2	Develop presentation and report writing skills

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale 1: Low, 2: Medium, 3: High)

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	-	-	-	-	-	-	1	1	3	-	3	-	-	-	1
CO2	1	1	1	1	1	1	1	1	1	3	-	3	1	1	1	-

Course Overview:

Reading books other than one's curriculum expands the imaginative horizon of a student. Under Selected Reads, the students will be required to select a book (a non-technical book that is not related to engineering) that they want to read in the semester. Reading fiction, non-fiction and science books are beneficial for students as it is a vital means to imagine a life other than our own, which in turn makes us more empathetic beings. The students will prepare a summary of the report and will be evaluated based on the presentation that they give on the book read. The whole idea is to present the story in a customized manner. That might also include a video/poster created for the same.

Evaluation Rubrics might be based on:

- Remembering: Recalling or retrieving previously read information.
- Understanding: Comprehending the content and expressing in one's own words.
- Relating and Interpreting: Relating and interpreting the theme or message of the book with a new context or situation.
- Critical Evaluation: Making critical comments about the choice of subject, handling of the subject, author's style of writing, etc.
- Communication Skills: Speaking skills, Report writing, Presentation skills.

Sample Books (not limited to these):

S. No	Title	Authors	Language
1.	Exam Warriors	Narendra Modi	English
2.	Work Ethics	Narendra Modi	English
3.	स्टेफेन हाकिंग	महेश शर्मा	Hindi
4.	Jeff Bezos: Biography of A Billionaire Business Titan	Elliot Reynolds	English
5.	Bill Gates: A Biography	Michael B. Becraft	English
6.	स्टील किंग लक्ष्मी मित्तल	प्रतीक्षा ऍम तिवारी	Hindi
7.	फेसबुक निर्माता: मार्क ज़ुकेरबर्ग	संजय भोला 'धीर	Hindi
8.	Stay हंगरी Stay फुलिश	रश्मि बंसल	Hindi, Gujrati, Tamil
9.	मैं, स्टीव: मेरा जीवन मेरी जुबानी	नीरू	Hindi
10.	अमीर न १ एलन मस्क की बायोग्राफी	पूर्णिमा मजूमदार	Hindi
11.	सुन्दर पिचाई : Google का भविष्य	जगमोहन भानवेरी	Hindi
12.	Dream With Your Eyes Open	Ronnie Screwvala	English
13.	डॉट्स कनेक्ट करें	रश्मि बंसल	Hindi
14.	Take Me Home	Rashmi Bansal	English
15.	Bhujia Barons: The Untold Story of How Haldiram Built A 5000 Crore Empire	Pavitra Kumar	English
16.	The Z Factor: My Journey as The Wrong Man at The Right Time	Subhash Chandra And Pranjal Sharma	English
17.	The Hard Things About Hard Things	Ben Horowitz	English
18.	Blue Ocean Strategy	Harvard Business School	English
19.	Zero to One: Notes on Start Ups, or How to Build the Future	Peter Thiel & Blake Masters	English
20.	The Holy Book of Luck	A Saed Alzein	English
21.	How To Begin	Michael Bungay Stanier	English

22.	Start-up Myths and Models	Rizwan Virk	English
23.	80/20 सिद्धांत - कम के साथ अधिक प्राप्त करने का रहस्य	रिचर्ड कोचो	Hindi
24.	Discover Your Destiny: 7 Stages of Self Awakening	Robin Sharma	English
25.	Hyper Focus	Chris Bailey	English
26.	How To Talk to Anyone	Leil Lowndes	English
27.	Never Split the Difference	Voss, Chris,Raz, Tahl	English
28.	Games People Play	Berne, Eric	English
29.	Achieving Meaningful Success Unleash the Power of Me	Dr. Vivek Mansubgh	English
30.	गेटिंग टू यस	रोजर फिशर	Hindi
31.	Your Next Five Moves	Patrick Bet-David	English
32.	बड़ी सोच का बड़ा जादू	श्वार्ट्ज, डेविड जू	Hindi
33.	How To Become a People Magnet	Marc Reklau	English
34.	सबसे मुश्किल काम सबसे पहले	ब्रायन ट्रेसी	Hindi
35.	Show Your Work	Austin Kleon	English
36.	How To Find Fulfilling Work	Roman Krznaric	English
37.	जीवन के अद्भुत रहस्य	गौर गोपाल दास	Hindi
38.	Attitude Is Everything	Jeff Keller	English
39.	The World is yours to change	Daisaku Ikeda	English
40.	The Defining Decade: Why Your 20's Matter and How the Make the Most of Them Now	Jay, Meg	English
41.	Quiet: The Power of Introvert in A World That Can't Stop Talking	Susan Cain	English
42.	Find Your Why: A Practical Guide for Discovering Purpose You and Your Team	Simon Sinek	English
43.	डीप वर्क	कैल न्यूपोर्ट	Hindi
44.	कैसे करे स्टार्ट उप बिज़नेस शुरू : बिज़नेस का सपना पूरा करने की गाइड	पंकज गोयल	Hindi
45.	Alex Adventure in Number land	Alex Bellos	English
46.	A Certain Ambiguity	Gaurav Suri	English
47.	The Everyday Hero Manifesto	Robin Sharma	English
48.	The Incredible World of Nichiren Buddhism	Suraj Jagtani	English
49.	My Life in Full: Work, Family, And Our Future (With A Special Epilogue for India)	Indra Nooyi	English

50.	India's Greatest Minds: Spiritual Masters, Philosophers, Reformers	Rao, Mukunda	English
51.	Inspiring Thoughts	Swami Vivekananda	English
52.	The Man Behind the Wheel: How Onkar S. Kanwar Created a Global Giant	Tim Bouquet	English
53.	Azim Premji: The Man Beyond the Billions	Sundeep Khanna, Varun Sood	English
54.	Warren Buffett: Inside the Ultimate Money Mind Warren Buffett: Inside the Ultimate Money Mind	Robert G. Hagstrom	English
55.	Rahul Bajaj: An Extraordinary Life | Official Biography of The Chairman of Bajaj Group	Gita Piramal	English
56.	5 Am क्लब: अपनी सुबह का मालिक बनें, अपना जीवन बढ़ाएं	रॉबिन शर्मा	Hindi
57.	Happiness Becomes You: A Guide to Changing Your Life for Good	Tina Turner	English
58.	एटॉमिक हैबिट्स: छोटे बदलाव, असधरन परिनाम	जेम्स क्लियर (लेखक), डॉ सुधीर दीक्षित (अनुवादक)	Hindi
59.	हाउ टू डेवेलोप सेल्फ कॉन्फिडेंस एंड इन्फ्लुएंस पीपल बी पब्लिक स्पीकिंग	डेल कारनेगी	Hindi
60.	धन-संपत्ति का मनोविज्ञान	मॉर्गन हाउसेल	Hindi
61.	रिच डैड पुअर डैड	रॉबर्ट टी. कियोसाकी	Hindi, Bengali
62.	इकिगाई	फ्रांसेस मिरेलस हेक्टर गार्सिया	Hindi, Marathi, Bengali
63.	आपके अवचेतन मन की शक्ति	जोसेफ मर्फी	Hindi, Bengali
64.	सोचा और अमीर हो जाओ	नेपोलियन हिल	Hindi, Bengali
65.	पर्सनालिटी डेवेलोप्मेटन हैंडबुक	डीपी सभरवाल	Hindi
66.	पावर ऑफ़ पॉजिटिव ऐटिटूड	रोजर फ्रिट्ज	Hindi
67.	चिंता छोडो सुख से जियो	डेल कारनेगी	Hindi, Bangla, Marathi, Gujrati & Oria
68.	मुट्ठी में तकदीर	रॉबिन शर्मा	Hindi
69.	जैसे विचार, वैसा जीवन	जेम्स एलन (लेखक), डॉ. सुधीर दीक्षित (अनुवादक)	Hindi
70.	चाणक्य के टॉप 100 प्रेरक विचार	महेश शर्मा	Hindi
71.	'लोक व्यवहार'	डेल कारनेगी	Hindi, Bangla, Marathi, Gujrati & Oria
72.	रहसय	रोंडा बर्न	Hindi

73.	मेमोरी: हाउ टू डेवेलोप, ट्रैन, एंड यूज़ इट	विलियम वॉकर एटकिंसन	Hindi
74.	बड़ा सोचै, बड़ा करै	अंकुर वारिकू	Hindi
75.	द लॉ ऑफ अट्रैक्शन	एस्थर और जेरीहिक्स	Hindi
76.	गोरा	रवींद्र नाथ	Hindi, Bengali
77.	सफलता शब्दों का खेल है	डॉ. सुधीर दीक्षित	Hindi
78.	पॉजिटिव थिंकिंग	नेपोलियन हिल	Hindi
79.	हाउ टू एन्जॉय योर लाइफ एंड जॉब	डेल कारनेगी	Hindi, Bengali
80.	Swami Vivekananda Bani O Rachana (Set) - 10 Volumes - Bengal	Swami Vivekananda	Bengali
81.	The Wisdom of Lotus Sutra	Daisaku Ikeda	English
82.	स्वामी विवेकानंद पुस्तक: जीवन, विचार आणि कार्य	Rajeev Ranjan, Kailas Kalkate	Marathi
83.	विश्वगुरु विवेकानंद	एम. आई. राजसवे	Hindi
84.	बिजनेस कोहिनूर रतन टाटा	बी.सी. पाण्डेय	Hindi
85.	Rattan Tata	P M Tiwari	Bengali
86.	गीतांजलि	रवींद्र नाथ	Hindi, Bengali
87.	सन्यासी जिसने अपनी संपति बीच दी	रॉबिन शर्मा	Hindi
88.	Ignited Minds: Unleashing the Power Within India: Unleashing the Power Within India	Dr APJ Abdul Kalam	English
89.	आपका भविष्य आपके हाथ में	ए पीजे कलाम	Hindi
90.	द स्टोरी ऑफ़ माय एक्सपेरिमेंट्स विथ ट्रुथ	महात्मा गांधी	Hindi
91.	मैं कलाम बोल रहा हूँ	प्रशांत गुप्ता	Hindi
92.	कौन रोयेगा आपकी मृत्यु पर	रॉबिन शर्मा	Hindi
93.	अग्नि की उड़ान	ए पीजे कलाम	Hindi
94.	आनन्द मठ	बंकिमचंद्र चटर्जी	Hindi
95.	The Science of Mind Management	Swami Mukundanadan	English
96.	Soak Education	Daisaku Ikeda	English
97.	7 Mindsets for Success Fulfilment and Happiness	Swami Mukundanadan	English
98.	Business Sutra: A Very Indian Approach to Management	Devdutt Pattanaik	English
99.	The Five Steps to Success	Yandamoori Veerendranath	English
100.	You Are Born to Blossom	Dr APJ Abdul Kalam	English
101.	7 Divine Laws to Awaken Your Best Self	Swami Mukundanadan	English
102.	The Way of Youth	Daisaku Ikeda	English

103.	बेबीलोन का सबसे अमीर आदमी	जॉर्ज एस. क्लैसन	Hindi, Telugu
104.	अमीर होना आपका अधिकारी	जोसेफ मर्फी	Hindi
105.	Buddha: Spirituality for Leadership & Success	Pranay	English
106.	सीक्रेट्स ऑफ़ द मिलियनेअर माइंड	टी. हार्व एकर	Hindi
107.	The Almanack of Naval Ravikant: A Guide to Wealth and Happiness	Eric Jorgenson	English
108.	Ananda: Happiness Without Reason	Achrya Prashant	English
109.	The Awakening of Intelligence (New Edition)	J. Krishnamurti	English
110.	दुनिया का महान सेल्समैन	ओ जी मैंडिनो	Hindi
111.	जिंदगी वो जो आप बनायें	प्रीति शेनॉय	Hindi
112.	The White Tiger	Arvind Adiga	English
113.	Inspirational Thoughts	Swami Vivekananda	English
114.	जीत आपकी: कामयाबी कीऔर ले जाने वाली सीडी	शिव खेरा	Hindi
115.	The God of Small Things	Arundhati Roy	English
116.	Buddhism A Way of Values	Prof. Lokesh Chandra and Dr. Daisaku Ikeda	English
117.	Buddha At Work: Finding Purposes, Balance, And Happiness at Your Workplace	Geetanjali Pandit	English
118.	Hope Is a Decision	Daisaku Ikeda	English

Semester: 4th			
Paper code: AIDS202	**L**	**T/P**	**Credits**
Subject: Object Oriented Programming	**3**	**0**	**3**

Marking Scheme

1. Teachers Continuous Evaluation: 25 Marks
2. End term Theory Examination: 75 Marks

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks: 75**

1. There should be 9 questions in the end term examination question paper
2. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 15 marks.
3. Apart from Question No. 1, the rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, students may be asked to attempt only 1 question from each unit. Each question should be 15 marks.
4. The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
5. The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required.

Course Objectives:

1.	To Identify importance of object-oriented programming and difference between structured oriented and object-oriented programming features.
2.	To use various object oriented concepts to solve different problems.
3.	To Learn Java programming Language applying the concepts of object-oriented programming language.
4.	To design and implement programs for complex problems, making good use of the features of the language such as classes, inheritance, polymorphism.

Course Outcomes:

CO1	Ability to understand the concepts of object oriented programming i.e abstract datatypes, encapsulation, inheritance, polymorphism.
CO2	Identify classes, objects, members of a class and relationships among them needed for resolving real world problems.
CO3	Ability to analyse a problem to develop algorithm with suitable logics and concepts of OOPs for solving real world problems.
CO4	Ability to create application or programs using OOP principles and proper program structuring.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale 1: Low, 2: Medium, 3: High)

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3	3	1	-	-	-	-	-	-	-	-	-	-	-
CO2	2	3	3	3	1	1	1	-	1	1	1	-	-	-	-	-
CO3	2	3	3	3	1	-	-	-	-	-	-	3	1	1	1	-
CO4	2	3	3	3	1	1	1	1	1	1	1	1	-	-	-	1

Course Overview:

This course provides an introduction to object oriented programming (OOP) using the Java programming language. This course will provide the students with a solid theoretical understanding of, as well as practical skills. Its main objective is to teach the basic concepts and techniques which form the object-oriented programming paradigm. It aims to design solutions for the complex problems.

UNIT I: [10]

Introduction of Object-Oriented Programming, Benefits of Object Oriented Development, Classes and Objects, Inheritance, Polymorphism, Object- Oriented Design. Overview & characteristics of Java, Program Compilation, Execution Process Organization of the Java Virtual Machine and security aspects, sandbox model.

UNIT II: [10]

Java Fundamentals, Data Types & Literals Variables, Wrapper Classes, Arrays, Arithmetic Operators, Logical Operators, Control of Flow, Loops, Classes and Instances, Class Member Modifiers Anonymous Inner Class Interfaces and Abstract Classes, Inheritance using java, Exception Handling. Collection API Interfaces, Vector, stack, Hashtable, enumeration, set, List, Map, Iterators.

UNIT III: [10]

Multithreading- Extending Thread Class, Runnable Interface, Starting Threads, Thread Synchronization. GUI components in Java: AWT Components, Component Class, Container Class, Layout Managers, swing package. Event Handling: AWT Events, Event, Listeners, Class Listener, Action Event Methods, Focus Event Key Event, Mouse Event, Window Event Adapters.

UNIT IV: [10]

Java I/O: Input/Output Streams, Readers and Writers. JDBC (Database connectivity with MS-Access, Oracle, MS-SQL Server), Object serialization, Socket Programming, development of client Server applications, Design of multithreaded server.

Text Books:

1. Patrick Naughton and Herbertz Schidt. Java-2 the complete Reference, TMH.
2. Sierra & bates. Head First Java, O"Reilly.

Reference Books:

1. E. Balaguruswamy. Programming with Java, TMH.
2. Horstmann. Computing Concepts with Java 2 Essentials, John Wiley.
3. Decker & Hirshfield. Programming. Java, Vikas Publication.

Semester: 4th			
Paper code: AIDS252	**L**	**P**	**Credits**
Subject: Object-Oriented Programming Lab	**0**	**2**	**1**

Marking Scheme

1. Teachers Continuous Evaluation: 40 Marks
2. End term Theory Examination: 60 Marks

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks: 60**

1. This is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement under the intimation to the office of the HOD/ Institution in which the appear is being offered from the list of practicals below.
3. Instructors can add any other additional experiments over and above the mentioned in the experiment list which they think is important.
4. At least 8 experiments must be performed by the students.

Course Objectives:

1.	To implement real-world entities like inheritance, hiding, polymorphism, etc in developing software applications.
2.	To understand how binding together the data and the methods operating on them helps in developing the applications.

Course Outcomes:

CO1	Apply object-oriented principles to design programming solutions to actual problems.
CO2	Analyse different packages of object-oriented programming language.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale 1: Low, 2: Medium, 3: High)

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	2	1	1	1	2	1	1	1	3	1	2	1	1
CO2	2	2	2	2	1	-	-	-	-	-	-	-	-	-	-	-

LIST OF EXPERIMENTS:

1. Generate a random number up to 100 and print whether it is prime or not.
2. **A.** Design a program to generate first 10 terms of Fibonacci series.

   B. Find the factorial of a given number using Recursion.
3. Find the average and sum of array of N numbers entered by user.
4. Create a class to find out the Area and perimeter of rectangle.
5. Design a class that perform String operations (Equal, Reverse the string, change case).
6. Demonstrate the use of final keyword with data member, function and class.
7. Demonstrate the use of keywords try, catch, finally, throw and throws.
8. Design a program to demonstrate multi-threading using Thread Class.
9. Design a program to create game 'Tic Tac Toe'.
10. Design a program to basic calculator using Applet and Event Handling.
11. Design a program to read a text file and after printing that on scree write the content to another text file.
12. Design a program to count number of words, characters, vowels in a text file.
13. Design a program to create simple chat application using Socket Programming.
14. Design a program to connect to access database and display contents of the table.

Semester: 4th			
Paper code: AIDS204	**L**	**T/P**	**Credits**
Subject: Database Management Systems	**3**	**0**	**3**

Marking Scheme

1. Teachers Continuous Evaluation: 25 Marks
2. End term Theory Examination: 75 Marks

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks: 75**

1. There should be 9 questions in the end term examination question paper
2. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 15 marks.
3. Apart from Question No. 1, the rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, students may be asked to attempt only 1 question from each unit. Each question should be 15 marks.
4. The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
5. The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required.

Course Objectives:

1.	To introduce the concepts of databases, database models, and their uses.
2.	To assess the need for Database design to create a strong foundation for application.
3.	To understand the various complications & its solution for Transaction management.
4.	To understand advanced data bases and its application.

Course Outcomes:

CO1	Understand the principles of Database Management Systems.
CO2	Apply Structured Query Language to a varied range of queries and work on database using state of art tools.
CO3	Analyse various techniques and various models used for designing databases for different real-life situations.
CO4	Investigate normalized database schema and prepare a report for a real-life scenario.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale 1: Low, 2: Medium, 3: High)

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	2	1	-	-	-	-	-	1	2	-	-	1	-
CO2	2	3	2	2	3	-	-	-	-	-	1	1	-	-	1	1
CO3	2	3	3	2	1	1	1	1	1	1	1	3	1	1	1	1
CO4	2	3	2	2	1	-	-	-	-	-	1	3	1	1	1	1

Course Overview:

The objective of the course is to present an introduction to database management systems with advanced topics of DBMS, with an emphasis on how to organize, maintain and retrieve - efficiently, and effectively - information from databases. It includes Entity-Relational model, Normalization, Relational model, Relational algebra, and data access queries as well as an Introduction to SQL, MongoDB.

UNIT I: [8]

Introduction-Overview of Database System and various Data Models (Hierarchical, Network, and Relational Models), Views of Data**,** Database Management System, Architecture of DBMS, components of DBMS. Data Independence. Entity-Relationship Model- Entities, Entity Types, Attributes, Relationships, Relationship types, E/R diagram notation.

UNIT II: [12]

Relational Data Model- Concept of Relations, Overview of Various Keys, Referential Integrity, and foreign keys. Relational Language- Relational Algebra, Tuple and Domain Relational Calculus, SQL, DDL and DML, embedded SQL. Introduction and basic concepts of PL/SQL. Query Processing and Optimization. Study of various open Source and Commercialized Database Management Systems- MySQL, PostgreSQL, Oracle, DB2, SQL Server

UNIT III: [12]

Database Design- Dependencies and Normal forms, Functional Dependencies, 1NF, 2NF, 3NF, and BCNF. Higher Normal Forms-4NF and 5NF. Transaction Management: ACID properties, Serializability, Concurrency Control, Database recovery management. Data Storage and Indexes, Hashing Techniques.

UNIT IV: [10]

Advanced Topics- CAP Theorem, Data Security, Object Oriented Database, Web Database, Distributed Database, Data Warehousing, and Mining. NOSql, MongoDB: Introduction, History of MongoDB, Installation and configuration. Key Features. Core servers & tools. Basic commands. Queries & Indexes.

Text Books:

1. Silberschatz, A., Korth, Henry F., and Sudharshan, S., Database System Concepts, 5th Edition, Tata McGraw Hill, 2016.
2. Elmasri, Ramez and Navathe, Shamkant B., Fundamentals of Database Systems 7th Edition, Pearson, 2015.

Reference Books:

1. Date, C. J, Kannan, A. and Swamynathan, S., An Introduction to Database Systems, 8th edition, Pearson Education, 2012.
2. J. D. Ullman, Principles of Database Systems, 2nd Ed., Galgotia Publications, 1999.
3. Vipin C. Desai, An Introduction to Database Systems, West Publishing Co.

Semester: 4th			
Paper code: AIDS254	L	T/P	Credits
Subject: Database Management System Lab	0	2	1

Marking Scheme

1. Teachers Continuous Evaluation: 40 Marks
2. End term Theory Examination: 60 Marks

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks: 60**

1. This is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement under the intimation to the office of the HOD/ Institution in which the appear is being offered from the list of practicals below.
3. Instructors can add any other additional experiments over and above the mentioned in the experiment list which they think is important.
4. At least 8 experiments must be performed by the students.

Course Objectives:

1.	To create a database as per the proper rules.
2.	To organize, maintain and efficiently, and effectively retrieve information from a database.

Course Outcomes:

CO1	Apply Database management principles to fetch and maintain details efficiently and effectively from the data bases of the real world.
CO2	Use the basics of SQL, MongoDB commands and construct queries using in database creation and interaction.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale 1: Low, 2: Medium, 3: High)

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3	2	2	1	1	1	1	1	1	2	1	1	1	1
CO2	2	3	3	2	3	-	-	-	-	-	-	2	-	-	3	1

LIST OF EXPERIMENTS:

1. Study and practice various database management systems like MySQL/Oracle/PostgreSQL/SQL Server and others.
2. Implement simple queries of DDL and DML.
3. Implement basic queries to Create, Insert, Update, Delete and Select Statements for two different scenarios (For instance: Bank, College etc.)
4. Implement queries including various functions- mathematical, string, date etc.
5. Implement queries including Sorting, Grouping and Subqueries- like any, all, exists, not exists.
6. Implement queries including various Set operations (Union, Intersection, Except etc.).
7. Implement various JOIN operations- (Inner, Outer).
8. Write a PL/SQL program using FOR loop to insert ten rows into a database table.
9. Given the table EMPLOYEE (Emp No, Name, Salary, Designation, DeptID), write a cursor to select the five highest-paid employees from the table.
10. Illustrate how you can embed PL/SQL in a high-level host language such as C/Java And demonstrates how a banking debit transaction might be done.

The students should be motivated to make a project using MySql and MongoDb.

Semester: 4th			
Paper code: AIDS206	**L**	**T/P**	**Credits**
Subject: Software Engineering	**3**	**0**	**3**

Marking Scheme

4. Teachers Continuous Evaluation: 25 Marks
5. End term Theory Examination: 50 Marks
6. End term Practical Examination: 25 Marks

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks: 50**

1. There should be 9 questions in the end term examination question paper
2. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 15 marks.
3. Apart from Question No. 1, the rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, students may be asked to attempt only 1 question from each unit. Each question should be 15 marks.
4. The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
5. Instructors can add any other additional experiments over and above the mentioned in the experiment list which they think is important.
6. The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required.

Course Objectives:

1.	To familiarize students with basic Software engineering methods and practices and their applications.
2.	To explain layered technology in software engineering
3.	To teach software metrics and software risks.
4.	To familiarize students with software requirements and the SRS documents.
5.	To facilitate students in software design.

Course Outcomes:

CO1	Understand software systems of the real world and their life cycle.
CO2	Design the software solutions per the SRS requirement and proper tools.
CO3	Estimate software development cost and its maintenance.
CO4	Deploy various testing techniques to test software.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale 1: Low, 2: Medium, 3: High)

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	3	1	1	1	1	1	1	2	1	1	-	1
CO2	2	2	2	2	3	-	-	-	-	-	1	2	-	-	1	-
CO3	2	2	2	2	3	-	-	-	-	-	1	2	-	-	1	-
CO4	3	2	2	2	3	-	-	-	-	-	1	2	-	-	1	-

Course Overview:

Software Engineering comprises the core principles consistent in software construction and maintenance: fundamental software processes and life cycles, mathematical foundations of software engineering, requirements analysis, software engineering methodologies, and standard notations, principles of software architecture and re-use, software quality frameworks and validation, software development, and maintenance environments and tools. It's an introduction to the object-oriented software development process and design.

UNIT I: [8]

Introduction to Software- Nature of Software, Introduction to Software Engineering, Software Engineering Layers, Software Myths, The Software Processes, Project, Product, Process Models: A Generic Process Model, Waterfall Model, Incremental Process Models, Evolutionary Process Models, Spiral Model. COCOMO Model. UML diagrams and DFDs

UNIT II: [10]

Requirements Engineering- Functional and Non-Functional Requirements, The Software Requirements Document, Requirements Specification, Requirements Engineering, Requirements Elicitation and Analysis, Requirement Validation, Requirement Management, DFD, Data Dictionary. Introduction to ER diagrams

UNIT III: [10]

Software Design- Design concepts and principles - Abstraction - Refinement - Modularity Cohesion coupling, Architectural design, Detailed Design Transaction Transformation, Refactoring of designs, Object-oriented Design User-Interface Design. Software Testing: White-Box Testing, Black Box Testing. Stress Testing. Alpha, Beta, and Acceptance Testing. Debugging.

UNIT IV: [12]

Software Maintenance and Management- Software Maintenance, Types of Maintenance, Software Configuration Management, Overview of RE-engineering Reverse Engineering, Reliability: Failure and Faults, Reliability Models. Quality and Risk Management: Product Metrics, Software Measurements, Metrics for Software Quality, Risk Management: Software Risks, Risk Identification, Risk Projection, Risk Refinements, Risk Mitigation Monitoring and Management (RMMM). Overview Of Quality Management. CMM, ISO 9000, and Six Sigma.

Practical Component:

Unit 1: Introduction to UML diagrams and DFDs (using Edraw Max/Adobe Spark). Introduction to the basic functioning of SE tools for model visualization (Tableau Public /Gallery)
Unit 2: Introduction to ER diagrams (Lucidchart)
Unit 3: Debugging Tools: Visual Studio Debugger, GNU Debugger
Unit 4: Project Management Tools: HubSpot Project Management Tool; Toggl Plan. Requirements Analysis Tools; Testing Tools: Loadium, Qase, RedLine 13

Faculty can teach the above-mentioned tools & techniques (through unit 1 to unit 4) to students through the following experiments:

a. Create a UML diagram using Edraw Max/Adobe Spark for library management system
b. Create an ER diagram using Lucidchart for student management system
c. Explore debugging of an existing system using Visual Studio Debugger/GNU Debugger
d. Create a detailed requirement analysis report for a software project and perform testing using Loadium/Qase/RedLine 13

Text Books:

1. Roger S. Pressman (2011), Software Engineering, A Practitioner's Approach, 7th edition, McGraw Hill International Edition, New Delhi.
2. Sommerville (2001), Software Engineering, 9th edition, Pearson Education, India.

References:

1. K. K. Aggarwal, Yogesh Singh (2007), Software Engineering, 3rd edition, New Age International Publishers, India.
2. Lames F. Peters, Witold Pedrycz (2000), Software Engineering an Engineering approach, John Wiley & Sons, New Delhi, India.
3. Shely Cashman Rosenblatt (2006), Systems Analysis and Design, 6th edition, Thomson Publications, India

Semester: 4th			
Paper code: AIDS208	**L**	**T/P**	**Credits**
Subject: Computer Networks and Internet Protocol	**3**	**0**	**3**

Marking Scheme

1. Teachers Continuous Evaluation: 25 Marks
2. End term Theory Examination: 50 Marks
3. End term Practical Examination: 25 Marks

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks:50**

1. There should be 9 questions in the end term examination question paper
2. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 15 marks.
3. Apart from Question No. 1, the rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, students may be asked to attempt only 1 question from each unit. Each question should be 15 marks.
4. The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
5. Instructors can add any other additional experiments over and above the mentioned in the experiment list which they think is important.
6. The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required.

Course Objectives:

1.	To implement a simple LAN with hubs, bridges and switches.
2.	To describe how computer networks are organized with the concept of layered approach.
3.	To demonstrate internet protocols using the modern tools of computer networks.
4.	To design and implement a network for an organization.

Course Outcomes:

CO1	Understand concepts of computer networks and various Internet protocols.
CO2	Analyse given data segments/packets/frames and protocols in various layers of computer networks.
CO3	Design real networks using state of art components using simulation tools.
CO4:	Design and implement a network for an organization.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale 1: Low, 2: Medium, 3: High)

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	2	2	-	-	-	-	-	-	1	-	-	-	-
CO2	2	2	2	2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	-	-	1	1
CO4	2	2	2	2	2	1	1	1	1	1	1	2	1	1	3	1

Course Overview:

This course deals with fundamentals of computer networks and Internet protocols. It addresses various network models, Data link protocols, network layer protocols and implementation of computer network models and OSI layers. The course also deals with Transport layer protocols. The main emphasis of this course is on the organization and management of networks and internet protocols.

UNIT I: **[8]**

Introduction to Layered Network Architecture- What are computer networks, Layered models for networking, different types of communication models, ISO-OSI Model, TCP/IP.

UNIT II: **[10]**

Data Link Protocols- Stop and Wait protocols, Noise-free and Noisy Channels, Performance and Efficiency, Sliding Window protocols, MAC Sublayer: The Channel Allocation Problem, Carrier Sense Multiple Access Protocols, Collision Free Protocols, FDDI protocol.IEEE Standard 802.3 & 802. 11 for LANs and WLANs

UNIT III: **[12]**

Network Layer protocols- Design Issues: Virtual Circuits and Datagrams, Routing Algorithms, Optimality principle, shortest path routing Algorithms, Flooding and Broadcasting, Distance Vector Routing, Link State Routing, Flow-Based Routing, Multicast Routing; Flow and Congestion Control.

UNIT IV: **[10]**

Transport Layer Protocols- Design Issues, Quality of Services. The Internet Transport Protocols. IPV4 vs IPV6. Session Layer protocol: Dialog Management, Synchronization, Connection Establishment. Quality of service, security management, Firewalls. Application layer protocols: HTTP, SMTP, FTP, SNMP, etc.

Practical Component:

Unit 1: Introduction to basic networking tools: Wireshark and Network Miner.

Unit 2: Introduction to Datadog tool for data monitoring in network

Unit 3: Introduction to Network Bandwidth Analyser tool for network monitoring.

Unit 4: Implement the following in lab:

a. Packet Capture and Observations using Packet Sniffer.

b. Explore various aspects of HTTP Protocol.

c. Tracing DNS with Wireshark.

d. Analyzing various parameters for TCP protocol in action

e. Create various topologies using any network simulator

f. Create Ring, Bus, Star and Mesh topology using Cisco Packet Tracer

Text Books:

1. Tanenbaum, S., C*omputer Networks, Fifth Edition*, Prentice Hall, India, 2013.
2. Behrouz A. Forouzan, Data communication and networking, 5E, Tata McGraw Hill, 2013.

Reference Book:

1. Computer networking- A top-down approach, Pearson Publications. 2017 edition.

Semester: 4th			
Paper code: AIDS210	**L**	**T/P**	**Credits**
Subject: Fundamentals of Machine Learning	**3**	**0**	**3**

Marking Scheme

1. Teachers Continuous Evaluation: 25 Marks
2. End term Theory Examination: 75 Marks

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks: 75**

1. There should be 9 questions in the end term examination question paper
2. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 15 marks.
3. Apart from Question No. 1, the rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, students may be asked to attempt only 1 question from each unit. Each question should be 15 marks.
4. The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
5. The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required.

Course Objectives:

1.	To understand regression, classification and prediction algorithms to classify data.
2.	To gain knowledge about feature selection.
3.	To analyse feature engineering techniques to formulate the solutions for the complex problems
4.	To apply machine learning techniques in real world problems.

Course Outcomes:

CO1	Understand machine learning tools and techniques with their applications.
CO2	Apply machine learning techniques for classification and regression.
CO3	Perform feature engineering techniques.
CO4	Design supervised and unsupervised machine learning based solutions for real-world problems.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale 1: Low, 2: Medium, 3: High)

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	1	1	1	1	1	1	2	2	3	3	3
CO2	3	3	3	3	2	1	1	1	1	1	1	1	2	3	2	3
CO3	3	3	3	3	2	-	-	-	-	-	-	-	2	2	2	3
CO4	3	3	3	3	2	1	1	1	1	1	1	2	2	3	3	3

Course Overview:

This course covers fundamental concepts and methods of computational data analysis, including pattern classification, prediction, visualization, and recent topics in machine learning. The course will give the student the basic ideas and intuition behind modern machine learning methods as well as a bit more formal understanding of how, why, and when they work. The underlying theme in the course is a statistical inference as it provides the foundation for most of the methods covered.

UNIT I: **[10]**

Introduction to machine learning- Basic concepts, developing a learning system, Learning Issues, and challenges. Types of machine learning: Learning associations, supervised, unsupervised, semi-supervised and reinforcement learning, Feature selection Mechanisms, Imbalanced data, Outlier detection, Applications of machine learning like medical diagnostics, fraud detection, email spam detection

UNIT II: **[10]**

Supervised Learning- Linear Regression, Multiple Regression, Logistic Regression, Classification; classifier models, K Nearest Neighbour (KNN), Naive Bayes, Decision Trees, Support Vector Machine (SVM), Random Forest

UNIT III: **[10]**

Unsupervised Learning- Dimensionality reduction; Clustering; K-Means clustering; C-means clustering; Fuzzy C means clustering, EM Algorithm, Association Analysis- Association Rules in Large Databases, Apriori algorithm, Markov models: Hidden Markov models (HMMs).

UNIT IV: **[10]**

Reinforcement learning- Introduction to reinforcement learning, Methods and elements of reinforcement learning, Bellman equation, Markov decision process (MDP), Q learning, Value function approximation, Temporal difference learning, Concept of neural networks, Deep Q Neural Network (DQN), Applications of Reinforcement learning.

Text Books:

1. Tom M. Mitchell, Machine Learning, McGraw-Hill, 2010.
2. Ethem Alpaydin, Introduction to Machine Learning, MIT Press, Pearson, Third Edition, 2014.
3. Bishop, Christopher. Neural Networks for Pattern Recognition. New York, NY: Oxford University Press, 1995

Reference Books:

1. Ethem Alpaydin, (2004), Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press
2. T. Astie, R. Tibshirani, J. H. Friedman, The Elements of Statistical Learning, Springer (2nd ed.), 2009
3. Bishop, C., Pattern Recognition and Machine Learning. Berlin: Springer-Verlag

Semester: 4th			
Paper code: AIDS256	**L**	**P**	**Credits**
Subject: Fundamentals of Machine Learning Lab	**0**	**2**	**1**

Marking Scheme

1. Teachers Continuous Evaluation: 40 Marks
2. End term Theory Examination: 60 Marks

INSTRUCTIONS TO PAPER SETTERS: Maximum Marks: 60

1. This is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement under the intimation to the office of the HOD/ Institution in which the appear is being offered from the list of practicals below.
3. Instructors can add any other additional experiments over and above the mentioned in the experiment list which they think is important.
4. At least 8 experiments must be performed by the students.

Course Objectives:

1.	To formulate and analyse algorithm based on machine learning.
2.	To design the use cases of machine learning algorithms as per the user requirement.

Course Outcomes:

CO1	Apply and differentiate machine learning algorithms for regression, classification and prediction problems.
CO2	Implement supervised and unsupervised machine learning models to analyse data for executing feature engineering and feature selection for real-life scenarios.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale 1: Low, 2: Medium, 3: High)

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	1	1	1	1	1	1	2	2	3	3	3
CO2	3	3	3	3	3	1	1	1	1	1	2	1	2	3	2	3

LIST OF EXPERIMENTS:

1. Study and Implement Linear Regression.
2. Study and Implement Logistic Regression.
3. Study and Implement K Nearest Neighbour (KNN).
4. Study and Implement classification using SVM.
5. Study and Implement Bagging using Random Forests.
6. Study and Implement Naive Bayes.
7. Study and Implement Decision Trees.
8. Study and Implement K-means Clustering to Find Natural Patterns in Data.
9. Study and Implement Gaussian Mixture Model Using the Expectation Maximization.
10. Study and Implement Classification based on association rules.
11. Study and Implement Evaluating ML algorithm with balanced and unbalanced datasets.
12. Comparison of Machine learning algorithms based on different-different parameters.

Semester: 4th			
Paper code: AIDS212	**L**	**T/P**	**Credits**
Subject: Computational Methods	**3**	**0**	**3**

Marking Scheme

1. Teachers Continuous Evaluation: 25 Marks
2. End term Theory Examination: 75 Marks

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks: 75**

1. There should be 9 questions in the end term examination question paper
2. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 15 marks.
3. Apart from Question No. 1, the rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, students may be asked to attempt only 1 question from each unit. Each question should be 15 marks.
4. The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
5. The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required.

Course Objectives:

1.	To develop a practical approach to mathematical problem solving.
2.	To introduce many commonly used tools and techniques in numerical work.
3.	To convert algorithms and techniques to working computer codes.
4.	To understand the nuances of the numerical techniques and computer applications of the same.

Course Outcomes:

CO1	Ability to understand numerical techniques to find the roots of non-linear equations and solution of system of linear equations.
CO2	Ability to understand the solution of the linear simultaneous equations using iterative methods and apply them to real world applications.
CO3	Ability to understand numerical differentiation and integration and numerical solutions of ordinary and partial differential equations.
CO4	Ability to understand numerical methods to solve the ordinary differential equation and partial differential equation.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale 1: Low, 2: Medium, 3: High)

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	3	3	1	1	1	1	1	1	1	1	1	1	1	1
CO3	3	2	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	3	3	-	-	-	-	-	-	-	-	-	-	-	-

UNIT I: **[10]**

Numerical solution to Linear algebraic & transcendental equations- Numerical algorithms and their complexities, Computer implementation and efficiency, Root finding- bracketing methods: Bracketing Methods, graphical methods, Bisection method, False Position (Regula Falsi), Root finding -Open Methods: Simple Fixed-Point Iteration, Newton-Raphson method, Secant methods, Brent's method

UNIT II: **[12]**

Numerical linear algebra- Gauss elimination, Pivoting, Tridiagonal systems, LU factorization, Gauss elimination as LU factorization, Cholesky factorization, Matrix inverse and condition, Error analysis and system condition. Iterative Methods: Gauss-Seidel method, Nonlinear Systems. Eigenvalues: The Power Method, Interpolations, Lagrange's, piecewise/splines

UNIT III: **[10]**

Numerical Differentiation- High-Accuracy differentiation formulas, Richardson Extrapolation, Derivatives of unequally spaced data, Partial Derivatives. Numerical Integration: Newton-Cotes Formulas, The trapezoidal rule, Simpson's Rules, Higher-Order Newton-Cotes formulas, Integration with unequal segments, Numerical Integration of Functions, Romberg integration, Gauss quadrature, Adaptive quadrature

UNIT IV: **[8]**

Ordinary differential equations- Euler's Method, Runge-Kutta Methods, Adaptive methods, finite difference methods, Initial value problems, Boundary value problems, Partial differential equations

Text Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.

Reference Books:

1. Numerical Methods in Engineering & Science (with Programs in C,C++ & MATLAB), B. S. Grewal, Khanna Publishers.
2. Numerical Methods for Engineers, Steven Chapra, Raymond Canale, McGraw-Hill Higher Education, 2010

Semester: 4th			
Paper code: AIDS214	**L**	**T/P**	**Credits**
Subject: Effective Technical Writing	**3**	**0**	**3**

Marking Scheme

1. Teachers Continuous Evaluation: 25 Marks
2. End term Theory Examination: 75 Marks

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks: 75**

1. There should be 9 questions in the end term examination question paper
2. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 15 marks.
3. Apart from Question No. 1, the rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, students may be asked to attempt only 1 question from each unit. Each question should be 15 marks.
4. The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
5. The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required.

Course Objectives:

1.	To understand the fundamentals of effective technical writing.
2.	To develop the skill of preparing logical and persuasive technical papers/proposals/ reports.
3.	To apply standard technical formats for drafting protocol and research papers.
4.	To inculcate habits of effective technical writing applying precision, conciseness, and lucidity.

Course Outcomes:

CO1	The concepts of effective technical writing
CO2	Apply precision, conciseness and lucidity while writing
CO3	Demonstrate by writing a technical paper/article by using global standard formats.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale 1: Low, 2: Medium, 3: High)

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	-	-	-	2	-	-	-	1	3	-	2	-	1	-	1
CO2	-	-	-	-	2	-	-	-	1	3	-	2	-	-	-	-
CO3	1	1	1	1	2	1	1	1	1	3	1	2	1	1	1	1

Course Overview: -

Under Effective Technical Writing, students are expected to understand the process of writing technical research papers/ articles. The students are required to take up a topic of their choice and write a research paper/ article on the same using state-of-art document preparation software like Latex, overleaf, etc. Students must be familiar with all primary international template styles of a research paper like IEEE, Springer, ACM, etc. Students will also be taught various referencing formats (for example: APA). Research paper/ article writing is a must-have skill for future scientists & researchers, and it opens up their domain of knowledge. The research paper/article/proposal submitted by students will be checked for plagiarism. This will lead to the development of skills including proper paper format, proper referencing, inclusion of figures, tables, use of keywords, writing abstract, title etc.

Semester: 4th			
Paper code: AIDS216	**L**	**T/P**	**Credits**
Subject: Emerging Trends in Technological Industries	**2**	**0**	**1**

Marking Scheme

1. Teachers Continuous Evaluation: 25 Marks
2. End term Theory Examination: 75 Marks

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks: 75**

1. There should be 9 questions in the end term examination question paper
2. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 15 marks.
3. Apart from Question No. 1, the rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, students may be asked to attempt only 1 question from each unit. Each question should be 15 marks.
4. The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
5. The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required.

Course Objectives:

1.	To Understand the importance of seeking experts in the technological domain
2.	To remain technically abreast with latest developments world-wide.

Course Outcomes:

CO1	Understand the importance of having awareness of latest technological Trends.
CO2	Apply the knowledge gained by interacting with experts in their day to day lives.

Course Outcomes (CO) to Programme Outcomes (PO) **Mapping (Scale 1: Low, 2: Medium, 3: High)**

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	1	-	1	3	1	1	-	-	1	-	2	1	2	3	1
CO2	2	1	1	1	3	1	1	1	1	1	1	2	1	2	3	1

Course Overview:

In this, the faculty coordinator will invite experts from the industry/ academia to give seminars/webinars/expert lectures to students on recent technological advances in the industry. In every semester, at least 8 seminars/webinars/expert lectures should be conducted. An evaluation would be conducted by the faculty coordinator based on quiz, report submissions, etc. on the seminars/webinars/expert lectures conducted. The aim is to give the latest technical and research exposure to the students.

Semester: 4th			
Paper code: AIDS218	**L**	**T/P**	**Credits**
Subject: Practicum (Integrated Project)	**0**	**1**	**1**

Marking Scheme

1. Teachers Continuous Evaluation: 25 Marks
2. End term Theory Examination: 75 Marks

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks: 75**

1. There should be 9 questions in the end term examination question paper
2. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 15 marks.
3. Apart from Question No. 1, the rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, students may be asked to attempt only 1 question from each unit. Each question should be 15 marks.
4. The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
5. The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required.

Course Objectives:

1.	To enhance experiential learning component by applying the knowledge and skills gained through various subjects in developing a solution for real-world problems.
2.	To give an exposure to multi-disciplinary domains to identify problems that exist around them to develop solutions thereby improving their technical skillset and their employability.
3.	To increase the collaboration skills.
4.	To understand the feasibility, quality, novelty, innovation and the application of the project.

Course Outcomes:

CO1	Apply engineering concepts learned so far for project identification, formulation, and a feasible solution.
CO2	Develop and demonstrate a comprehensive technical knowledge on the selected project topic.
CO3	Design novel and innovative technological solutions to real problems utilizing an integrated approach.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale 1: Low, 2: Medium, 3: High)

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	2	2	1	2	1	1	3	3	2	2	2	3
CO2	3	3	3	3	2	2	1	2	1	1	3	3	2	2	2	3
CO3	3	3	3	3	2	2	1	2	1	1	3	3	2	2	2	3

Course Overview:

Under practicum the students will be involved in experiential learning. The students are required to apply the knowledge and skills gained through various subjects in developing a solution for solving real world problems. Interdisciplinary projects give an opportunity to students to identify problems that exist around them for which they could develop solutions. Working as a team for the project also increases their collaboration skills.