Study & Evaluation Scheme

Of

Bachelor of Technology
Computer Science & Engineering

With Specialization in

Artificial Intelligence
(In Collaboration with iNurture)

(Based on Choice Based Credit System)

[Applicable w.e.f. Academic Session 2019-20]

COLLEGE OF COMPUTING SCIENCES AND INFORMATION TECHNOLOGY
TEERTHANKER MAHAVEERUNIVERSITY

N.H.-24, Delhi Road, Moradabad, UttarPradesh-244001 Website:www.tmu.ac.in

Study & Evaluation Scheme	
SUMMARY	
Institute Name	*College of Computing Sciences and Information Technology (CCSIT), Delhi Road, Moradabad*
Programme	*B.Tech. CSE (**Artificial Intelligence**)*
Duration	*Four Years full time(Eight Semesters)*
Medium	*English*
Minimum Required Attendance	*75%*
Credits	
Maximum Credits	*180*
Minimum Credits Required for Degree	*172*

Assessment:

Evaluation			**Internal**	**External**	**Total**
Theory			40	60	100
Practical/ Dissertations/ Project Reports/ Viva-Voce			50	50	100
Class Test-1	**Class Test-2**	**Class Test-3**	**Assignment(s)**	**Attendance & Participation**	**Total**
Best two out of three					
10	10	10	10	10	40
Duration of Examination			**External**	**Internal**	
			3 Hours	1.5 Hours	

To qualify the course a student is required to secure a minimum of 45% marks in aggregate including the semester end examination and teachers continuous evaluation.(i.e. both internal and external).A candidate who secures less than 45% of marks in a course shall be deemed to have failed in that course. The student should have at least 45% marks in aggregate to clear the semester.

 # Provision for delivery of 25% content through online mode.

 # Policy regarding promoting the students from semester to semester & year to year. No specific condition to earn the credit for promoting the students from one semester to next semester.

 # Maximum Duration: Maximum no of years required to complete the program: N+2 (N=No of years for program for B.TECH(CSE) N=4)

Question Paper Structure	
1	*The question paper shall consist of six questions. Out of which first question shall be of short answer type (not exceeding 50 words) and will be compulsory. Question no. 2 to 6 (from Unit-I to V) shall have explanatory answers (approximately 350 to 400 words) along with having an internal choice within each unit.*
2	*Question No. 1 shall contain 8 parts from all units of the syllabus with at least one question from each unit and students shall have to answer any five, each part will carry 2 marks.*
3	*The remaining five questions shall have internal choice within each unit; each question will carry 10 marks.*
IMPORTANT NOTES:	
1	*The purpose of examination should be to assess the Course Learning Outcomes (CO) that will ultimately lead to of attainment of Programme Specific Outcomes (PSOs). A question paper must assess the following aspects of learning: Remember, Understand, Apply, Analyze, Evaluate & Create (reference to Bloom's Taxonomy).*
2	*Case Study is essential in every question paper (wherever it is being taught as a part of pedagogy) for evaluating higher-order learning. Not all the courses might have case teaching method used as pedagogy.*
3	*There shall be continuous evaluation of the student and there will be a provision of fortnight progress report.*

Program Structure-B.Tech.(Artificial Intelligence)

A. Introduction:

High-quality technical education is essential for the digital age and using technology is powerful way to enhance changing requirements of the corporate, business enterprises and society. B.Tech students should be equipped to work across time zones, languages, and cultures. Employability, innovation, theory to practice connectedness is the central focus of B.Tech curriculum. The curriculum is designed as such that the students can gain an in-depth mastery of the academic disciplines and applied functional areas necessary to meet the requirements of IT enterprises and the industry.

The institute emphasis on the following courses ***balanced with core and elective courses****:* The curriculum of B.Tech program emphasizes an intensive, flexible technical education with 113 credits of core courses (all types), 27 credits of electives and 40 credits of Lab Work and internship/projects. Total 180 credits are allotted for the B.Tech(AI) degree.

The programme structure and credits for B.Tech(AI) are finalized based on the stakeholders' requirements and general structure of the programme. Minimum number of classroom contact teaching credits for the B.Tech(AI) program will be 157 credits (one credit equals 10 hours); Project/internship will be of 15 credits. However, the minimum number of the credits for award of B.Tech(AI) degree will be 172 credits. Out of 157 credits of classroom contact teaching, 20 credits are to be allotted for Basic Science Courses (BSC), 17 credits are allotted to Engineering Science Courses (ESC), 19 credits are allotted to Humanities and Social Sciences including Management Courses (HSMC), 54 credits are allotted to Professional Core Courses (PCCC), 21 credits are allotted to Professional Elective Courses (PEC), 6 credits are allotted to Open Elective Courses(OEC), 3 credits are allotted to Mandatory Courses(MC) and rest of 25 credits for Laboratory Courses (LC).

The institute offers **B.Tech CSE with Specialization in Artificial Intelligence** due to the importance of Artificial Intelligence and Machine Learning has been increasing as a growing number of companies are using these technologies to improve their products and services, evaluate their business models, and enhance their decision-making process. This has led to a huge demand for AI specialists all over the globe. Artificial Intelligence degrees prepare specialists who create intelligent machines and systems, which perform tasks that would normally require human intelligence, like playing games or understanding natural language. Thus this degree course help our student to find good and relative job in this field.

Course handouts for students will be provided in every course. A course handout is a thorough teaching plan of a faculty taking up a course. It is a blueprint which will guide the students about the pedagogical tools being used at different stages of the syllabus coverage and more specifically the topic-wise complete plan of discourse, that is, how the faculty members treat each and every topic from the syllabus and what they want the student to do, as an extra effort, for creating an effective learning. It may be a case study, a role-play, a classroom exercise, an assignment- home or field, or anything else which is relevant and which can enhance their learning about that particular concept or topic. Due to limited availability of time, most relevant topics will have this kind of method in course handout.

B.Tech(AI) : Four-Year (8-Semester) CBCS Programme			
Basic Structure: Distribution of Courses			
S.No.	**Type of Course**	**Credit Hours**	**Total Credits**
1	Basic Science Courses(BSC)	5 Courses of 4 Credit Hrs. each (Total Credit Hrs. 5X4)	20
2	Engineering Science Courses(ESC)	2 Courses of 4 Credit Hrs. each (Total Credit Hrs. 2X4) 3 Courses of 3 Credit Hrs. each (Total Credit Hrs. 2X3)	17
3	Humanities and Social Sciences including Management Courses(HMSC)	5 Courses of 3 Credit Hrs. each (Total Credit Hrs. 5X3) 1 Courses of 4 Credit Hrs. each (Total Credit Hrs. 1X4)	19
4	Professional Core Courses(PCC)	18 Courses of 3 Credit Hrs. each (Total Credit Hrs. 18X3)	54
5	Professional Elective Courses(PEC)	7 Courses of 3 Credit Hrs. each (Total Credit Hrs. 7X3)	21
6	Open Elective Courses(OEC)	2 Course of 3 Credit Hrs. each (Total Credit Hrs.1X3)	6
7	Mandatory Courses(MC)	1 Courses of 3 Credit Hrs. each (Total Credit Hrs. 1X3)	3
8	Laboratory Courses(LC)	9 Course of 2 Credit Hrs. each (Total Credit Hrs.8X2) 7 Course of 1 Credit Hrs. each (Total Credit Hrs.7X1)	25
9	Project(PROJ)	1 Course of 8 Credit Hrs. each (Total Credit Hrs. 1X8) 1 Course of 4 Credit Hrs. each (Total Credit Hrs. 1X4) 3 Course of 1 Credit Hrs. each (Total Credit Hrs. 3X1)	15
Total Credits			**180**

Contact hours include work related to Lecture, Tutorial and Practical (LTP), where our institution will have flexibility to decide course wise requirements.

B. Choice Based Credit System (CBCS)

Choice Based Credit System (CBCS) is a versatile and flexible option for each student to achieve his target number of credits as specified by the UGC and adopted by our University.

The following is the course module designed for the B.Tech program:

Basic Science Courses (BSC): Basic Science courses include compulsory courses. Compulsory courses cater to all departments: it consists of Mathematic courses, Physics course, Chemistry course, Physics and Chemistry laboratories. The basic foundation is important for students because it will not only allow them to build upon existing skills, but they can also set the path for good career options. We offer basic science courses in semester I, II & III during the B.Tech program which common for all B.Tech first year students. There will be total 20 credits for basic science course offered.

Engineering Science Courses (ESC): Engineering Science completely opens the doors to different specializations. The goal of this course is to create engineers of tomorrow who possess the knowledge of all disciplines and can apply their interdisciplinary knowledge in every aspect. Engineering Science Courses including Basic Engineering courses such as Basic Workshop, Engineering Drawing, Engineering Basics of Electrical and Electronics. A strong foundation of engineering skill set is provided through these Engineering Science courses. We offer engineering science courses in semester I & II during the B.Tech program. There will be total 17 credits for engineering science course offered.

Humanities and Social Sciences including Management Courses (HMSC): All the Humanities and Social Science courses should compulsorily be studied by a student. These courses help students to their personal and social development. We offer Humanities and Social Sciences courses in semester I, II, III, IV & VI during the B.Tech program. There will be total 16 credits for Humanities and Social Sciences courses offered.

Professional Core Courses (PCC): Professional Core courses introducing the students to the foundation of engineering topics related to the chosen programme of study comprising of theory and Practical. These core courses are the strong foundation to establish Technical knowledge and provide broad multi-disciplined knowledge can be studied further in depth during the elective phase. The core courses will provide more practical-based knowledge and collaborative learning models. . It will train the students to understand, analyze and implement their knowledge. It help to develop decision-making ability of student and contribute to the industry and community at large. We offer Professional Core courses in semester III, IV, V, VI & VII during the B.Tech program. There will be total 57 credits for Professional Core courses offered.

Professional Elective Courses (PEC): Professional elective course can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline or nurtures the student's proficiency/skill. We offer Professional elective courses in semester IV, V, VI, VII & VIII during the B.Tech program. There will be total 21 credits for Professional elective courses offered.

Open Elective Courses (OEC): An open elective course chosen generally from other discipline/ subject, with an intention to seek interdisciplinary exposure. We offer Open elective courses in semester VII & VIII during the B.Tech program. There will be total 6 credits for Open elective courses offered.

Mandatory Courses (MC): This is a compulsory course that does not have any choice and will be in 3 credits. Each student of B.Tech program has to compulsorily pass the course and acquire 3 credits. We offer Mandatory courses in semester Ist during the B.Tech program.

Laboratory Courses (LC): A laboratory oriented course which will provide a platform to students to enhance their practical knowledge and skills by development of small

application/project. We offer Laboratory courses in semester I, II, III, IV, V, VI & VII during the B.Tech program. There will be total 25 credits for Open elective courses offered.

Project (PROJ): Every student must do one major project in the 8th Semester. The minimum duration of project is 6 months. Students can do their major project in Industry or R&D Lab or in house or combination of any two. There will be total 15 credits for Project course offered.

C. PROGRAMME OUTCOMES (POs):

PO – 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO – 2	**Problem analysis& Solving:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO – 3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO – 4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO – 5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO – 6	**Social Interaction & effective citizenship:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO – 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO – 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO – 9	**Attitude (Individual and team work):** Function effectively as an individual, and as member or leader in diverse teams, and in multidisciplinary settings.
PO– 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large such as, being able to comprehend and write effective reports and design

	documentation, make effective presentations, and give and receive clean instructions.
PO– 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO- 12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PO-13	**Entrepreneurship:** An Entrepreneurship cut across every sector of human life including the field of engineering, engineering entrepreneurship is the process of harnessing the business opportunities in engineering and turning it into profitable commercially viable innovation.
PO-14	**Interpersonal skills:** Interpersonal skills involve the ability to communicate and build relationships with others. Effective interpersonal skills can help the students during the job interview process and can have a positive impact on your career advancement.
PO-15	**Technology savvy/usage:** Being technology savvy is essentially one's skill to be smart with technology. This skill reaches far beyond 'understanding' the concepts of how technology works and encompasses the 'utilization' of such modern technology for the purpose of enhancing productivity and efficiency.

D. Programme Specific Outcomes (PSOs)

The learning and abilities or skills that a student would have developed by the end of Four-year **B.Tech(AI)**

PSO – 1	Understanding Artificial Intelligence concepts, techniques & tools used in IT industry.
PSO – 2	Apply the knowledge of programming skills to develop Artificial Intelligence applications.
PSO – 3	Demonstrate the implementation of AI with tools and technologies available from different sources
PSO – 4	Design the AI solutions for real time scenarios.

E. Pedagogy & Unique practices adopted: "Pedagogy is the method and practice of teaching, especially for teaching an academic subject or theoretical concept". In addition to conventional time-tested lecture method, the institute will **emphasize on experiential learning:**

***1. Case Based Learning*:** Case based learning enhances student skills at delineating the critical decision dilemmas faced by organizations, helps in applying concepts, principles and analytical skills to solve the delineated problems and develops effective templates for business problem solving. Case method of teaching is used as a critical learning of technology specific tools for effective learning and implementation to fullest. We encourage students to implement different tools to develop various applications and projects based on the case studies.

2. Role Play & Simulation: Role-play and simulation are forms of experiential learning. Learners take on different roles, assuming a profile of a character or personality, and interact and participate in diverse and complex learning settings. Role-play and simulation function as learning tools for teams and groups or individuals as they "play" online or face-to-face. They alter the power ratios in teaching and learning relationships between students and educators, as students learn through their explorations and the viewpoints of the character or personality they are articulating in the environment. This student-centered space can enable learner-oriented assessment, where the design of the task is created for active student learning. Therefore, role-play& simulation exercises such as UI designing, Technical presentation and S/w or H/W simulation etc. are being promoted for the practical-based experiential learning of our students.

3. Video Based Learning (VBL) & Learning through Movies (LTM): These days technology has taken a front seat and classrooms are well equipped with equipment and gadgets. Video-based learning has become an indispensable part of learning. Similarly, students can learn various concepts through movies. In fact, many teachers give examples from movies during their discourses. Making students learn few important theoretical concepts through VBL & LTM is a good idea and method. The learning becomes really interesting and easy as videos add life to concepts and make the learning engaging and effective. Therefore, our institute is promoting VBL & LTM, wherever possible.

4. Field / Live Projects**:** The students, who take up experiential projects in companies, where senior executives with a stake in teaching guide them, drive the learning. All students are encouraged to do some live project other their regular classes.

5. Industrial Visits: Industrial visit are essential to give students hand-on exposure and experience of how things and processes work in industries. Our institute organizes such visits to enhance students' exposure to practical learning and work out for a report of such a visit relating to their specific topic, course or even domain.

6. MOOCS: Students may earn credits by passing MOOCS as decided by the college from time to time. Graduate level programs may award Honors degree provided students earn earn pre-requisite credits through MOOCs

7. Special Guest Lectures (SGL) & Extra Mural Lectures (EML): Some topics/concepts need extra attention and efforts as they either may be high in difficulty level or requires experts from specific industry/domain to make things/concepts clear for a better understanding from the perspective of the industry. Hence, to cater to the present needs of industry we organize such lectures, as part of lecture-series and invite prominent personalities from academia and industry from time to time to deliver their vital inputs and insights.

8. Student Development Programs (SDP): Harnessing and developing the right talent for the right industry an overall development of a student is required. Apart from the curriculum teaching various student development programs (training programs) relating to soft skills, interview skills, Reasoning and Aptitude etc. that may be required as per the need of the student and industry trends, are conducted across the whole program. Participation in such programs is solicited through volunteering and consensus.

9. Industry Focused programs: Establishing collaborations with various industry partners to deliver the programme on sharing basis. The specific courses are to be delivered by industry experts to provide practice based insight to the students.

10. Special assistance programe for slow learners & fast learners: write the note how would you identify slow learners, develop the mechanism to correcting knowledge gap. Terms of advance topics what learning challenging it will be provided to the fast learners.

11. Orientation program:

Purpose of the Student Orientation Program is to help new students adjust and feel comfortable in the new environment, inculcate in them the ethos and culture of the institution, help them build bonds with other students and faculty members, and expose them to a sense of larger purpose and self-exploration. The term induction is generally

used to describe the whole process whereby the incumbents adjust to or acclimatize to their new roles and environment. In other words, it is a well-planned event to educate the new entrants about the environment in a particular institution, and connect them with the people in it. Student Orientation Program engages with the new students as soon as they come into the institution; regular classes start only after that. At the start of the induction, the incumbents learn about the institutional policies, processes, practices, culture and values, and their mentor groups are formed.

The time during the Orientation Program is also used to rectify some critical lacunas, for example, English background, for those students who have deficiency in it. These are included under Proficiency Modules. There will be a 3-week long induction program for the UG students entering the institution, right at the start. Normal classes start only after the Orientation program is over. Its purpose is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

Activities to be covered

- Physical Activity
- Creative Arts and Culture
- Mentoring & Universal Human Values
- Familiarization with College, Dept./Branch
- Literary Activity
- Proficiency Modules
- Lectures & Workshops by Eminent People
- Visits in Local Area
- Extra-Curricular Activities in College
- Feedback and Report on the Program

12. **Mentoring scheme:** Every Student shall be provided with a faculty Mentor to help him /her in their personal & Academic Issues. The mentor maintains a register of al all his/her mentees with complete personal & parents 'details. It is essential to have at least to meet once in a month. The mentor enters the discussions held, advice given and efforts & improvements made by the mentee. This register of the mentor must be counter signed by the HOD once a month and by the Principal once in a semester

13. **Career & personal counseling:** Students in college, need to career & personal counseling, who are still confused about what they want to do. Career Counselling helps them understand the career options that they have, and how to pursue them. Career Counselling helps them understand their own strengths and weaknesses and lets them know what career they would be suited for.

14. **Competitive exam preparation**: Unlike school or college academic tests, competitive exams require a different approach, a focused mindset, and a thorough understanding of subjects and concepts. University or Department help students about the exam the pattern, stages and the competition. Department conduct various exam preparation activity for students.

15. **Extracurricular Activities:** Organizing & participation in extracurricular activities will be mandatory to help students develop confidence & face audience with care. It brings out their leadership qualities along with planning & organizing skills. Students undertake various cultural, sports and other competitive activities within and outside then campus. This helps them build their wholesome personality.

16. **Participation in Workshops, Seminars & writing & Presenting Papers:** Seminars and Workshops is also common when participating in extra-curricular academic and students' union activities. Seminar and Workshop is highly interactive, engaging and

productive; designed to enhance both individual and group learning processes. Paper writing and research help student to develop abstract thinking and personal or professional growth.

17. **Formation of Student Clubs, Membership & Organizing & Participating events:** A club is "a group of students organized with a similar interest for a social, literary, technical, athletic, political, or other common purpose. Students have the opportunity and choose to join these groups for many reasons including: pursuit of individual interests; career networking opportunities; social camaraderie; and technical activisms.

18. **Capability Enhancement & Development Schemes:** The University has these schemes to enhance the capability and holistic development of the students. The **capability enhancement** and **development schemes** are the stimulating factors in getting the **students** corporate-ready and become a responsible social citizen. To enhance the soft skills and employability skills of the students value added courses such as Communication Skills, Business Communication and Personality Enhancement are made an integral part of the curriculum of the students.

19. **Library Visit & Utilization of E-Learning Resources:** The library is the center of the intellectual and social activities of college. With its books suited to the interests and aptitude of students of different age group, with its magazines, periodicals and newspapers, it has a special call to the students who go there and quench their thirst for reading the material which cannot be provided to them in the class room. Today E-learning is a rapidly growing industry. Today's learners want relevant, mobile, self-paced, and personalized content. This need is fulfilled with the online mode of learning. E-learning offers the ability to share material in all kinds of formats such as videos, slideshows, word documents, and PDFs. Conducting webinars (live online classes) and communicating with professors via chat and message forums is also an option available to students.

Study & Evaluation Scheme
Program: B. Tech. CS&E (Specialization in AI)
SEMESTER – I

S. No.	*Course Category*	*Course Code*	*Course Title*	*Periods*			*Credits*	*Evaluation Scheme*		
				L	*T*	*P*		*Internal*	*External*	*Total*
1	BSC	EAS116	Engineering Mathematics-I	3	1	0	4	40	60	100
2	BSC	EAS112	Engineering Physics	3	1	0	4	40	60	100
		EAS113	Engineering Chemistry							
3	ESC	EEE117	Basic Electrical Engineering	3	1	0	4	40	60	100
		EEC111	Basic Electronics Engineering							
4	MC	TMU101	Environmental Studies	2	1	0	3	40	60	100
5	HSMC	TMUGE101	English Communication – I	2	0	2	3	40	60	100
6	ESC	IAI101	Web Designing	2	0	2	3	40	60	100
7	LC	EAS162	Engineering Physics (Lab)	0	0	2	1	50	50	100
		EAS163	Engineering Chemistry (Lab)							
8	LC	EEE161	Basic Electrical Engineering (Lab)	0	0	2	1	50	50	100
		EEC161	Basic Electronics Engineering (Lab)							
9	LC	EME161	Engineering Drawing (Lab)	0	0	4	2	50	50	100
		EME162	Workshop Practice (Lab)							
	Total			**14**	**5**	**12**	**25**	**390**	**510**	**900**

SEMESTER - II

S. No.	Course Category	Course Code	Course Title	Periods			Credits	Evaluation Scheme		
				L	T	P		Internal	External	Total
1	BSC	EAS211	Engineering Mathematics-II	3	1	0	4	40	60	100
2	BSC	EAS212	Engineering Physics	3	1	0	4	40	60	100
		EAS213	Engineering Chemistry							
3	ESC	EEE217	Basic Electrical Engineering	3	1	0	4	40	60	100
		EEC211	Basic Electronics Engineering							
4	ESC	IAI201	Programming in C	3	0	0	3	40	60	100
5	HSMC	TMUGE201	English Communication – II	2	0	2	3	40	60	100
6	LC	EAS262	Engineering Physics (Lab)	0	0	2	1	50	50	100
		EAS262	Engineering Chemistry (Lab)							
7	LC	EEE261	Basic Electrical Engineering (Lab)	0	0	2	1	50	50	100
		EEC261	Basic Electronics Engineering (Lab)							
8	LC	EME261	Engineering Drawing (Lab)	0	0	4	2	50	50	100
		EME262	Workshop Practice (Lab)							
9	LC	IAI251	Programming in C (Lab)	0	0	2	1	50	50	100
	Total			**14**	**3**	**12**	**23**	**400**	**500**	**900**

SEMESTER III

S. No.	Course Category	Course Code	Course Title	Periods			Credits	Evaluation Scheme		
				L	T	P		Internal	External	Total
1	BSC	IAI 301	Mathematics For Computer Science	3	1	0	4	40	60	100
2	PCC	IAI302	Data Structures Using C++	3	0	0	3	40	60	100
3	PCC	IAI 303	Introduction To Artificial Intelligence	3	0	0	3	40	60	100
4	ESC	IAI 304	Computer Architecture and Organizations	3	0	0	3	40	60	100
5	PCC	IAI 305	OOPS with Java	3	0	0	3	40	60	100
6	HSMC	TMUG E301	English Communication-III	2	0	2	3	40	60	100
7	LC	IAI351	Data Structures Using C++ (Lab)	0	0	4	2	50	50	100
8	LC	IAI 352	OOPS with Java (Lab)	0	0	4	2	50	50	100
9	PROJ	IAI353	Project	0	0	2	1	50	50	100
	Total			**17**	**1**	12	**24**	**390**	**510**	**900**

Additional Courses for Lateral Entry Students with Polytechnic/B.Sc background, to be taken in either III[rd] or IV[th] semester or all should pass with minimum of 40% marks if they have not taken these courses in their Polytechnic/B.Sc dgree: credits will not be added.

1	EME161/261	Engineering Drawing Lab	-	-	2	50	50	100
2	EME162/262	Workshop Practice (Lab)	-	-	2	50	50	100
3	TMU101	Environmental Studies	2	0	0	40	60	100

Value Added Course*

S.No.	Course Category	Course Code	Course Name	Periods			Credits	Evaluation Scheme		
				L	T	P		Internal	External	Total
1	VAC-I	TMUGA301	Foundation in Quantitative Aptitude	2	1	0	0	40	60	100

*Value Added Courses (VAC) is an audit course. The result of this course will not be added to overall result of the programme. However, it will be compulsory to pass the course with minimum 45% including both faculty continuous & end semester examination.

SEMESTER IV

S. No.	*Course Category*	*Course Code*	*Course Title*	*Periods*			*Credits*	*Evaluation Scheme*		
				L	*T*	*P*		*Inter-nal*	*Exter-nal*	*Total*
1	PCC	IAI401	Data Base Management System	3	0	0	3	40	60	100
2	PCC	IAI402	Operating System	3	0	0	3	40	60	100
3	PCC	IAI 403	Python Programming	3	0	0	3	40	60	100
4	PCC	IAI404	Computer Networks	3	0	0	3	40	60	100
5	HSMC	TMUGE401	English Communication – IV	2	0	2	3	40	60	100
6	LC	IAI451	Data Base Management System (Lab)	0	0	4	2	50	50	100
7	LC	IAI452	Python Programming(Lab)	0	0	4	2	50	50	100
8	PEC	-	Professional Elective Courses-I	3	0	0	3	40	60	100
	Total			**17**	**0**	**10**	**22**	**340**	**460**	**800**
****Industrial Training**										

Value Added Course*

S. N	Category code	Course Code	Course Name	Periods			Credits	Evaluation Scheme		
				L	*T*	*P*		*Internal*	*External*	*Total*
1	VAC-II	TMUGA401	Analytical Reasoning	2	1	0	0	40	60	100

**At the end of Semester-IV Industrial Training for at least 45 days is mandatory which is to be assessed and evaluated in Semester-V under subject code IAI553 (Industrial Training Seminar).

SEMESTER V

S. No.	*Course Category*	*Course Code*	*Course Title*	*Periods*			*Credits*	*Evaluation Scheme*		
				L	*T*	*P*		*Internal*	*External*	*Total*
1	PCC	IAI501	Knowledge Representation and Reasoning	3	0	0	3	40	60	100
2	PCC	IAI502	Natural Language Processing	3	0	0	3	40	60	100
3	PCC	IAI503	Theory of Automata and Compiler Design	3	0	0	3	40	60	100
4	PCC	IAI504	Digital Image Processing	3	0	0	3	40	60	100
5	HSMC	EHM501	HUMAN VALUES & PROFESSIONAL ETHICS	3	0	0	3	40	60	100
6	LC	IAI551	Natural Language Processing (Lab)	0	0	4	2	50	50	100
7	LC	IAI552	Digital Image Processing (Lab)	0	0	4	2	50	50	100
8	PROJ	IAI553	Industrial Training Seminar	0	0	2	1	50	50	100
9	PEC	-	Professional Elective Courses-II	3	0	0	3	40	60	100
	Total			**18**	**0**	**10**	**23**	**390**	**510**	**900**

Value Added Course***

S. No	**Category code**	**Course Code**	**Course Name**	**Periods**			**Credits**	**Evaluation Scheme**		
				L	*T*	*P*		*Internal*	*External*	*Total*
1	VAC-III	TMUGA501	Modern Algebra and Data Management	2	1	0	0	40	60	100
2	VAC-IV	TMUGS501	Managing Self	2	1	0	0	50	50	100

SEMESTER VI

S. No.	*Course Category*	*Course Code*	*Course Title*	*Periods*			*Credits*	*Evaluation Scheme*		
				L	*T*	*P*		*Internal*	*External*	*Total*
1	PCC	IAI601	Artificial Neural Networks	3	0	0	3	40	60	100
2	PCC	IAI602	Big Data Analytics	3	0	0	3	40	60	100
3	PCC	IAI603	Machine Learning	3	0	0	3	40	60	100
4	PCC	IAI604	Genetic Algorithm & Applications	3	0	0	3	40	60	100
5	HSMC	EHM601	Entrepreneurship	3	1	0	4	50	50	100
6	LC	IAI651	Machine Learning (Lab)	0	0	4	2	50	50	100
7	LC	IAI652	Big Data Analytics(Lab)	0	0	2	1	50	50	100
8	PEC	-	Professional Elective Courses-III	3	0	0	3	40	60	100
9	PEC	-	Professional Elective Courses-IV	3	0	0	3	40	60	100
	Total			21	**1**	6	**25**	**390**	**510**	**900**
****Industrial Training**										

Value Added Course*

S.No	Category code	Course Code	Course Name	Periods			Credits	Evaluation Scheme		
				L	*T*	*P*		*Internal*	*External*	*Total*
1	VAC-V	TMUGA601	Advance Algebra and Geometry	2	1	0	0	40	60	100
2	VAC-VI	TMUGS601	Managing Work and Others	2	1	0	0	50	50	100

**At the end of Semester-VI Industrial Training for at least 45 days is mandatory which is to be assessed and evaluated in Semester-VII under subject code IAI753 (Industrial Training Seminar).

SEMESTER VII

S. No.	Course Category	Course Code	Course Title	Periods			Credits	Evaluation Scheme		
				L	T	P		Internal	External	Total
1	PCC	IAI701	Fuzzy Logic And Application	3	0	0	3	40	60	100
2	PCC	IAI702	Deep Learning	3	0	0	3	40	60	100
3	PCC	IAI703	Expert System	3	0	0	3	40	60	100
4	PROJ	IAI751	Mini Project (Lab)	0	0	8	4	50	50	100
5	LC	IAI752	Deep Learning (Lab)	0	0	2	1	50	50	100
6	PROJ	IAI753	Industrial Training Seminar	0	0	2	1	50	50	100
7	PEC	-	Professional Elective Courses-V	3	0	0	3	40	60	100
8	PEC	-	Professional Elective Courses-VI	3	0	0	3	40	60	100
9	OEC	-	Open Elective Courses - I	3	0	0	3	40	60	100
	Total			**18**	**0**	**12**	**24**	**390**	**510**	**900**

SEMESTER VIII

S. No.	Course Category	Course Code	Course Title	Periods			Credits	Evaluation Scheme		
				L	T	P		Internal	External	Total
1	PROJ	IAI851	Industry Internship	0	0	28	14	150	150	300
OR										
1	PROJ	IAI851	Project	0	0	16	8	50	50	100
2	PEC	-	Professional Elective Courses-VII	3	0	0	3	40	60	100
9	OEC	-	Open Elective Courses - II	3	0	0	3	40	60	100
	Total			**6**	**0**	**16**	**14**	**130**	**170**	**300**

Semester Wise Groups of Professional Elective Courses (PEC):

SEMESTER-IV
Professional Elective Courses-I (Select any one)
(Select any one course from group no.1 given below)

S. No.	Course Category	Course Code	Course Title
1	PEC	IAI405	Exploratory Data Analysis
		IAI406	Time Series Analysis
		IAI407	Internet of Things

SEMESTER-V
Professional Elective Courses-II (Select any one)
(Select any one course from group no.1 given below)

S. No.	Course Category	Course Code	Course Title
1	PEC	IAI505	Logic Programming using Prolog & Lisp
		IAI506	Information Security
		IAI507	Computer Graphics

SEMESTER-VI
Professional Elective Courses - III (Select any one)
(Select any one course from group no.1 given below)

S. No.	Course Category	Course Code	Course Title
1	PEC	IAI606	Dimension Reduction and Model validation
		IAI607	Logic Programming And Uncertainty In Artificial Intelligence
		IAI608	Recommender System

Professional Elective Courses - IV (Select Any One)
(Select any one course from group no.2 given below)

S. No.	Course Category	Course Code	Course Title
9	PEC	IAI609	Client & Server Side Scripting
		IAI610	Mobile Applications Development
		IAI611	Cloud Computing

SEMESTER-VII
Professional Elective Courses– V (Select any one)
(Select any one course from group no.1 given below)

S. No.	Course Category	Course Code	Course Title
1	PEC	IAI704	Embedded System
		IAI705	Probabilistic Graphical Models
		IAI706	Pattern Recognition

Professional Elective Courses – VI (Select any one)
(Select any one course from group no.2 given below)

S. No.	Course Category	Course Code	Course Title
2	PEC	IAI707	Data Mining
		IAI708	Reinforcement Learning
		IAI709	Design Thinking

SEMESTER-VIII
Professional Elective Courses – VII
(Select any one course from group no.1 given below)

S. No.	Course Category	Course Code	Course Title
2	PEC	IAI801	Communication Protocols
		IAI802	Application of AI, ML & Robotics
		IAI803	Sensor Technologies

Course Code: EAS116	**Specialization- AI** **B.Tech.- Semester-I** **Engineering Mathematics-I**	**L-3 T-1 P-0 C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	***Understanding*** the concepts of eigenvalues and eigenvectors, Optimization & derivatives of functions of several variables, partial and total differentiation, implicit functions.	
CO2.	***Understanding*** the concepts of curl and divergence of vector field.	
CO3.	***Understanding*** of Green's theorem, Gauss Theorem, and Stokes theorem.	
CO4.	***Applying*** the concept of Leibnitz's theorem for successive derivatives.	
CO5.	***Analyzing*** the intangibility of a differential equation to find the optimal solution of first order first degree equations.	
CO6.	***Evaluating*** the double integration and triple integration using Cartesian, polar co-ordinates and the concept of Jacobian of transformation.	
Course Content:	**Unit A (Unit A is for building a foundation and shall not be a part of examination)** Some general theorem on deviation-Derivative of the sum or difference of two function, Derivative of product of two functions, Derivative of quotient, Derivative of Trigonometry function, Derivative of inverse Trigonometry function, Logarithms differential, Integration of 1/x, e^x, Integration by simple substitution. Integrals of the type f' (x), $[f(x)]^n$, $\frac{f'(x)}{f(x)}$, Integration of 1/x, e^x, tan x, cot x, sec x, cosec x , Integration by parts, Integration using partial fractions.	
Unit-1:	**Determinants-** Rules of computation; Linear Equations and Cramer's rule. **Matrices:** Elementary row and column transformation; Rank of matrix; Linear dependence; Consistency of linear system of equations; Characteristic equation; Cayley-Hamilton Theorem (without proof); Eigen values and Eigen vectors; Complex and Unitary matrices.	**8 Hours**
Unit-2:	**Differential Equation--**First order first degree Differential equation: variable separable, Homogeneous method, Linear differential equation method, Exact Differential equation.	**8 Hours**
Unit-3:	**Differential Calculus:** Leibnitz theorem; Partial differentiation; Euler's theorem; Change of variables; Expansion of function of several variables. Jacobians, Error function.	**8 Hours**
Unit-4:	**Multiple Integrals:** Double integral, Triple integral, Beta and Gamma functions; Dirichlet theorem for three variables, Liouville's Extension of Dirichlet theorem.	**8 Hours**
Unit-5:	**Vector Differentiation:** Vector function, Differentiation of vectors, Formulae of Differentiation, Scalar and Vector point function, Geometrical Meaning of Gradient, Normal and Directional Derivative, Divergence of a vector function, Curl of a vector **Vector Integration:** Green's theorem, Stokes' theorem; Gauss' divergence theorem.	**8 Hours**
Text Books:	1. Grewal B.S., *Higher Engineering Mathematics*, Khanna Publishers.	
Reference Books:	1. Kreyszig E., *Advanced Engineering Mathematics*, Wiley Eastern. 2. Piskunov N, *Differential & Integral Calculus*, Moscow Peace Publishers. 3. Narayan Shanti, *A Text book of Matrices*, S. Chand *** Latest editions of all the suggested books are recommended.**	

Additional electronic reference material:	**1.** https://www.youtube.com/watch?v=EGnI8WyYb3o **2.** https://www.youtube.com/watch?v=ksS_yOK1vtk&list=PLbRMhDVUMngfIrZCNOyPZwHUU1pP66vQW	

Course Code: EAS112	**Specialization- AI** **B.Tech.- Semester-I** **Engineering Physics**	**L-3 T-1 P-0 C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the basic concepts of interference, diffraction and polarisation.	
CO2.	**Understanding** the concept of bonding in solids and semiconductors.	
CO3.	**Understanding** the special theory of relativity.	
CO4.	**Applying** special theory of relativity to explain the phenomenon of length contraction, time dilation, mass-energy equivalence etc.	
CO5.	**Applying** the concepts of polarized light by the Brewster's and Malus Law	
Course Content:	**Unit A(Unit A is for building a foundation and shall not be a part of examination)** Optics- Properties of light, Lance, Mirror, Focal length, Intensity, Power, Eye-piece, Work, Energy and its types, Waves, longitudinal and transverse waves, Time period, Frequency	
Unit-1:	**Interference of Light:** Introduction,Principle of Superposition, Interference due to division of wavefront: Young's double slit experiment, Theory of Fresnel's Bi-Prism, Interference due to division of amplitude: parallel thin films, Wedge shaped film, Michelson's interferometer, Newton's ring.	**8 Hours**
Unit-2:	**Diffraction**: Introduction, Types of Diffraction and difference between them, Condition for diffraction, difference between interference and diffraction. **Single slit diffraction**: Quantitative description of maxima and minima with intensity variation, linear and angular width of central maxima. **Resolving Power**: Rayleigh's criterion of resolution, resolving power of diffraction grating and telescope.	**8 Hours**
Unit-3:	**Polarization:** Introduction, production of plane polarized light by different methods, Brewster's and Malus Law. Quantitative description of double refraction, Nicol prism, Quarter & half wave plate, specific rotation, Laurent's half shade polarimeter.	**8 Hours**
Unit-4:	**Elements of Material Science:** Introduction, Bonding in solids, Covalent bonding and Metallic bonding, Classification of Solids as Insulators, Semi-Conductor and Conductors, Intrinsic and Extrinsic Semiconductors, Conductivity in Semiconductors, Determination of Energy gap of Semiconductor. **Hall Effect:** Theory, Hall Coefficients and application to determine the sign of charge carrier, Concentration of charge carrier, mobility of charge carriers.	**8 Hours**
Unit-5:	**Special Theory of Relativity:** Introduction, Inertial and non-inertial frames of Reference, Postulates of special theory of relativity, Galilean and Lorentz Transformations, Length contraction and Time Dilation, Relativistic addition of velocities, Variation of mass with velocity, Mass-Energy equivalence.	**8 Hours**
Text Books:	1. Elements of Properties of Matter, D. S. Mathur, S. Chand & Co.	
Reference Books:	1. F. A. Jenkins and H. E. White, Fundamentals of Optics, McGraw-Hill. 2. Concept of Modern Physics, Beiser, Tata McGraw-Hill. 3. R. Resnick, Introduction to Special Relativity, John Wiley, Singapore. *** Latest editions of all the suggested books are recommended.**	

Additional electronic reference material:	1. https://www.youtube.com/watch?v=toGH5BdgRZ4&list=PLD9DDFBDC338226CA 2. https://www.youtube.com/watch?v=CuqsU7B1MtU	

Course Code: EAS113	Specialization- AI B.Tech.- Semester-I **Engineering Chemistry**	L-3 T-1 P-0 C-4
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the concept of softening & purification of water.	
CO2.	**Understanding** calorific value& combustion, analysis of coal, Physical & Chemical properties of hydrocarbons & quality improvements.	
CO3.	**Understanding** the concept of lubrication, Properties of Refractory & Manufacturing of cements.	
CO4.	**Applying** the concepts of the mechanism of polymerization reactions, Natural and synthetic rubber& vulcanization.	
CO5.	**Applying** the concepts of spectroscopic & chromatographic techniques.	
Course Content:		
Unit-1:	**Water and Its Industrial Applications:** Sources, Impurities, Hardness and its units, Industrial water, characteristics, softening of water by various methods (External and Internal treatment), Boiler trouble causes effects and remedies, Characteristic of municipal water and its treatment, Numerical problem based on water softening method like lime soda, calgon etc.	**8 Hours**
Unit-2:	**Fuels and Combustion:** Fossil fuel and classification, calorific value, determination of calorific value by Bomb and Jumker's calorimeter, proximate and ultimate analysis of coal and their significance, calorific value computation based on ultimate analysis data, Combustion and its related numerical problems carbonization manufacturing of coke, and recovery of byproduct, knocking relationship between knocking and structure and hydrocarbon, improvement ant knocking characteristic IC Engine fuels, Diesel Engine fuels, Cetane Number.	**8 Hours**
Unit-3:	**Lubricants:** Introduction, mechanism of lubrication, classification of lubricant, properties and testing of lubricating Oil Numerical problem based on testing methods. Cement and Refractories: Manufacture, IS code, Setting and hardening of cement, Portland cement Plaster of Paris, Refractories. Introduction, classification and properties of refractories.	**8 Hours**
Unit-4:	**Polymers:** Introduction, types and classification of polymerization, reaction mechanism, Natural and synthetic rubber, Vulcanization of rubber, preparation, properties and uses of the following Polythene, PVC, PMMA, Teflon, Polyacrylonitrile, PVA, Nylon 6, Terylene, Phenol Formaldehyde, Urea Formaldehyde Resin, Glyptal, Silicones Resin, Polyurethanes, Butyl Rubber, Neoprene, Buna N, Buna S.	**8 Hours**
Unit-5:	**A. Instrumental Techniques in chemical analysis:** Introduction, Principle, Instrumentation and application of IR, NMR, UV, Visible, Gas Chromatography, Lambert and Beer's Law. **B. Water Analysis Techniques:** Alkalinity, Hardness (Complexometric), Chlorides, Free Chlorine, DO, BOD, and COD, Numerical Problem Based on above techniques.	**8 Hours**
Text Books:	1. Agarwal R. K., Engineering Chemistry, Krishna Prakashan.	
Reference Books:	1. Morrison & Boyd, Organic Chemistry, Prentice Hall 2. Barrow Gordon M., Physical Chemistry, McGraw-Hill.	

	*** Latest editions of all the suggested books are recommended.**	
Additional electronic reference material:	1. https://www.youtube.com/watch?v=RV-OyRTaIOI 2. https://www.youtube.com/watch?v=phhfkikb6Lw	

Course Code: **EEE117**	**Specialization- AI** **B.Tech.- Semester-I** **Basic Electrical Engineering**	**L-3** **T-1** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the basics of Network, AC Waveform and its characteristics.	
CO2.	**Understanding** the basic concept of Measuring Instruments, Transformers & three phase Power systems.	
CO3.	**Understanding** the basic concepts of Transformer.	
CO4.	**Understanding** the basic concept of power measurement using two wattmeter methods.	
CO5.	**Applying** the concept of Kirchhoff's laws and Network Theorems to analyze complex electrical circuits.	
Course Content:		
Unit-1:	**D.C. Network Theory:** Passive, active, bilateral, unilateral, linear, nonlinear element, Circuit theory concepts-Mesh and node analysis; Voltage and current division, source transformation, Network Theorems-Superposition theorem, Thevenin's theorem, Norton's theorem, and Maximum Power Transfer theorem, Star-delta & delta-star conversion.	**8 Hours**
Unit-2:	**Steady State Analysis of A.C. Circuits:** Sinusoidal and phasor representation of voltage and Current; Single phase A.C. circuit behavior of resistance, inductance and capacitance and their Combination in series & parallel; Power factor; Series and parallel resonance; Band width and Quality factor.	**8 Hours**
Unit-3:	**Basics of Measuring Instruments:** Introduction to wattmeter & Energy meter extension range of voltmeter and ammeter. **Three Phase A.C. Circuits:** Line and phase voltage/current relations; three phase power, power measurement using two wattmeter methods.	**8 Hours**
Unit-4:	**Single phase Transformer:** Principle of operation; Types of construction; Phasor diagram; Equivalent circuit; Efficiency and losses.	**8 Hours**
Unit-5:	**Electrical machines:** DC machines: Principle & Construction, Types, EMF equation of generator and torque equation of motor, applications of DC motors (simple numerical problems)	**8 Hours**
Text Books:	1. V. Del Toro, Principles of Electrical Engineering, Prentice-Hall International.	
Reference Books:	1. Fitzgerald A.E & Higginbotham., D.E., Basic Electrical Engineering, McGraw Hill. 2. A Grabel, Basic Electrical Engineering, McGraw Hill. 3. Cotton H., Advanced Electrical Technology, Wheeler Publishing. *** Latest editions of all the suggested books are recommended.**	
Additional electronic reference material:	1. https://nptel.ac.in/courses/108/108/108108076/ 2. https://sites.google.com/tmu.ac.in/dr-garima-goswami/home	

Course Code: **EEC111**	**Specialization- AI** **B.Tech.- Semester-I** **Basic Electronics Engineering**	**L-3** **T-1** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the concepts of electronic components like diode, BJT & FET.	
CO2.	**Understanding** the applications of pn junction diode as clipper, clamper, rectifier & regulator whereas BJT & FET as amplifiers	
CO3.	**Understanding** the functions and applications of operational amplifier-based circuits such as differentiator, integrator, and inverting, non-inverting, summing & differential amplifier.	
CO4.	**Understanding** the concepts of number system, Boolean algebra and logic gates.	
CO5.	**Applying** the knowledge of series, parallel and electromagnetic circuits.	
Course Content:		
Unit-1:	**p-n Junction:** Energy band diagram in materials, Intrinsic & Extrinsic Semiconductor, Introduction to PN-Junction, Depletion layer, V-I characteristics, p-n junction as rectifiers (half wave and full wave), calculation of ripple factor of rectifiers, clipping and clamping circuits, Zener diode and its application as shunt regulator.	**8 Hours**
Unit-2:	**Bipolar Junction Transistor (BJT):** Basic construction, transistor action; CB, CE and CCconfigurations, input/output characteristics, Relation between α, β & γ, Biasing of transistors: Fixed bias, emitter bias, potential divider bias.	**8 Hours**
Unit-3:	**Field Effect Transistor (FET):** Basic construction of JFET; Principle of working; concept of pinch-off condition & maximum drain saturation current; input and transfer characteristics; Characteristics equation; fixed and self-biasing of JFET amplifier; Introduction of MOSFET; Depletion and Enhancement type MOSFET- Construction, Operation and Characteristics.	**8 Hours**
Unit-4:	**Operational Amplifier (Op-Amp):** Concept of ideal operational amplifier; ideal and practical Op-Amp parameters; inverting, non-inverting and unity gain configurations, Applications of Op-Amp as adders, difference amplifiers, integrators and differentiator.	**8 Hours**
Unit-5:	**Switching Theory:** Number system, conversion of bases (decimal, binary, octal and hexadecimalnumbers), Addition & Subtraction, BCD numbers, Boolean algebra, De Morgan's Theorems, Logic gates and truth table-AND, OR & NOT,Seven segment display & K map.	**8 Hours**
Text Books:	1. Morris Mano M., Digital Design, Prentice Hall.	
Reference Books:	1. Sedra and Smith, Microelectronic Circuits, Oxford University Press. 2. Gayakwad, R A, Operational Amplifiers and Linear Integrated circuits, Prentice Hall of India Pvt. Ltd. 3. Chattopadhyay D and P C Rakshit, Electronics Fundamentals and Applications, New Age International. *** Latest editions of all the suggested books are recommended.**	

Additional electronic reference material:	1. https://www.youtube.com/watch?v=USrY0JspDEg 2. https://www.youtube.com/watch?v=Hkz27cFW4Xs	

Course Code: TMU101	Specialization- AI B.Tech.- Semester-I **Environmental Studies**	L-2 T-1 P-0 C-3
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** environmental problems arising due to constructional and developmental activities.	
CO2.	**Understanding** the natural resources and suitable methods for conservation of resources for sustainable development.	
CO3.	**Understanding** the importance of ecosystem and biodiversity and its conservation for maintaining ecological balance.	
CO4.	**Understanding** the types and adverse effects of various environmental pollutants and their abatement devices.	
CO5.	**Understanding** Greenhouse effect, various Environmental laws, impact of human population explosion, environment protection movements, different disasters and their management.	
Course Content:		
Unit-1:	***Definition and Scope*** of environmental studies, multidisciplinary nature of environmental studies, concept of sustainability & sustainable development. ***Ecology and Environment:*** Concept of an Ecosystem- its structure and functions, Energy Flow in an Ecosystem, Food Chain, Food Web, Ecological Pyramid & Ecological succession, Study of following ecosystems: Forest Ecosystem, Grass land Ecosystem & Aquatic Ecosystem & Desert Ecosystem.	**8 Hours**
Unit-2:	***Natural Resources:*** Renewable & Non-Renewable resources; Land resources and landuse change; Land degradation, Soil erosion & desertification. Deforestation: Causes & impacts due to mining, Dam building on forest biodiversity & tribal population. Energy Resources: Renewable & Non-Renewable resources, Energy scenario & use of alternate energy sources, Case studies. Biodiversity: Hot Spots of Biodiversity in India and World, Conservation, Importance and Factors Responsible for Loss of Biodiversity, Biogeographical Classification of India	**8 Hours**
Unit-3:	***Environmental Pollutions:*** Types, Causes, Effects & control; Air, Water, soil & noise pollution, Nuclear hazards & human health risks, Solid waste Management; Control measures of urban & industrial wastes, pollution case studies.	**8 Hours**
Unit-4:	***Environmental policies & practices:*** Climate change & Global Warming (Greenhouse Effect), Ozone Layer - Its Depletion and Control Measures, Photochemical Smog, Acid Rain Environmental laws: Environment protection Act; air prevention & control of pollution act, Water Prevention & Control of Pollution Act, Wild Life Protection Act, Forest Conservation Acts, International Acts; Montreal & Kyoto Protocols & Convention on biological diversity, Nature reserves, tribal population & Rights & human wild life conflicts in Indian context	**8 Hours**
Unit-5:	***Human Communities & Environment:***Human population growth; impacts on environment, human health & welfare, Resettlement & rehabilitation of projects affected person: A case study, Disaster Management; Earthquake, Floods & Droughts, Cyclones & Landslides, Environmental Movements; Chipko, Silent Valley, Vishnoi's of Rajasthan, Environmental Ethics; Role	**8 Hours**

	of Indian & other regions & culture in environmental conservation, Environmental communication & public awareness; Case study **Field Work:** 1. Visit to an area to document environmental assets; river/forest/flora-fauna etc. 2. Visit to a local polluted site: urban/ rural/industrial/agricultural. 3. Study of common plants, insects, birds & basic principles of identification. 4. Study of simple ecosystem; pond, river etc.	
Text Books:	1. "Environmental Chemistry", De, A. K., New Age Publishers Pvt. Ltd.	
Reference Books:	1. "Biodiversity and Conservation", Bryant, P. J., Hypertext Book 2. "Textbook of Environment Studies", Tewari, Khulbe & Tewari, I.K. Publication *** Latest editions of all the suggested books are recommended.**	
Additional electronic reference material:	1. https://www.youtube.com/watch?v=8tamfocnHb8 2. https://www.youtube.com/watch?v=YlE1DDo25IQ	

Course Code: **TMUGE101**	**Specialization- AI** **B.Tech.- Semester-I** **English Communication – I**	**L-2** **T-0** **P-2** **C-3**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Remembering and understanding of the basic of English grammar and vocabulary.	
CO2.	Understanding of the basic Communication process.	
CO3.	Applying correct vocabulary and tenses in sentences construction.	
CO4.	Analyzing communication needs and developing communication strategies using both verbal & non-verbal method.	
CO5.	Drafting applications in correct format for common issues.	
CO6.	Developing self-confidence.	
Course Content:		
Unit-1:	**Introductory Session** • Self-Introduction • Building Self Confidence: Identifying strengths and weakness, reasons of Fear of Failure, strategies to overcome Fear of Failure • Importance of English Language in present scenario (*Practice: Self-introduction session)*	**6 Hours**
Unit-2:	**Basics of Grammar** • Parts of Speech • Tense • Subject and Predicate • Vocabulary: Synonym and Antonym *(Practice: Conversation Practice)*	**12 Hours**
Unit-3:	**Basics of Communication** • Communication : Process, Types, 7Cs of Communication, Importance & Barrier • Language as a tool of communication • Non-verbal communication: Body Language • Etiquette & Manners • Basic Problem Sounds *(Practice: Pronunciation drill and building positive body language)*	**10 Hours**
Unit-4:	**Application writing** • Format & Style of Application Writing • Practice of Application writing on common issues.	**8 Hours**
Unit-5:	**Value based text reading** • Short Story (Non- detailed study) • Gift of Magi – O. Henry	**4 Hours**
Text Books:	1. Singh R.P., An Anthology of Short stories, O.U.P. New Delhi.	
Reference Books:	1. Kumar, Sanjay. &Pushp Lata. "*Communication Skills"* New Delhi: Oxford University Press.	

	2. Carnegie Dale. "*How to win Friends and Influence People*" New York: Simon & Schuster. 3. Harris, Thomas. A. "*I am ok, You are ok*" New York: Harper and Row. 4. Goleman, Daniel. "*Emotional Intelligence*" Bantam Book. *** Latest editions of all the suggested books are recommended.**	
Additional electronic reference material:	**1.** https://www.youtube.com/watch?v=4XEa-8HD3lE **2.** https://www.youtube.com/watch?v=sb6ZZ2p3hEM&feature=youtu.be **3.** https://www.youtube.com/watch?v=Df3ysUkdB38 **4.** https://www.youtube.com/watch?v=0LdYaj3jcws **5.** https://www.youtube.com/watch?v=64XIkMqPm_8 **6.** https://www.youtube.com/watch?v=_vS6O8YlMq0	

Methodology:

1. Language Lab software.
2. The content will be conveyed through Real life situations, Pair Conversation, Group Talk and Class Discussion.
3. Conversational Practice will be effectively carried out by Face to Face & Via Media (Telephone, Audio-Video Clips)
4. Modern Teaching tools (PPT Presentation, Tongue-Twisters & Motivational videos with sub-titles) will be utilized.

Note:

- Class (above 30 students) will be divided in to two groups for effective teaching.
- For effective conversation practice, groups will be changed weekly.

Evaluation Scheme

Internal Evaluation			**External Evaluation**		**Total Marks**
40 Marks			**60 Marks**		
20 Marks (Best 2 out of Three CTs) ***(From Unit- II, IV & V)***	10 Marks (Oral Assignments) ***(From Unit I & III)***	10 Marks (Attendance)	40 Marks (External Written Examination) ***(From Unit- II, IV & V)***	20 Marks (External Viva)* ***(From Unit I & III)***	**100**

***Parameters of External Viva**

Content	**Body Language**	**Confidence**	**Question Responsiveness**	**TOTAL**
05 Marks	05 Marks	05 Marks	05 Marks	20 Marks

Note*: External Viva will be conducted by 2-member committee comprising*

a) *One Faculty teaching the class*

b) *One examiner nominated by University Examination cell.*

Each member will evaluate on a scale of 20 marks and the average of two would be the 20 marks obtained by the students.

Course Code: IAI101	Specialization- AI B.Tech.- Semester-I **WEB DESIGNING**	L-2 T-0 P-2 C-3
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding about internet design principles and various protocols which is widely use in the Internet.	
CO2.	Understanding the use of different web development technologies.	
CO3.	Understanding the HTML document structure and its all tags.	
CO4.	Applying different cascading style sheet in web designing.	
CO5.	Creating interactive web page(s) using HTML, CSS and JavaScript.	
Course Content:		
Unit-1:	**Introduction to Internet:** Introduction, History of internet, Internet Design Principles, Internet Protocols - FTP, TCP/IP, SMTP, Telnet, etc., Client Server Communication, Web System architecture	**8 Hours**
Unit-2:	**Introduction to World Wide Web:** Evolution of Web, Static and Dynamic Web Sites, Web Applications, Web Development Technologies - HTML, CSS, JS, XML; Protocols - HTTP, secure HTTP, etc; URL, Web Browser, Web Server, Web Services	**8 Hours**
Unit-3:	**HTML:** Introduction to Html, Html Document structure, Html Editors, Html element/tag & attributes, Designing simple page - Html tag, Head tag, Body tag; More Html tags - Anchor tag, Image tag, Table tag, List tag, Frame tag, Div tag ; Html forms - Input type, Text area, Select , Button, Images	**8 Hours**
Unit-4:	**CSS:** Introduction to CSS, Syntax, Selectors ,Embedding CSS to Html, Formatting fonts, Text & background colour, Inline styles, External and Internal Style Sheets, Borders & boxing	**8 Hours**
Unit-5:	**XML:** Introduction to XML, Difference b/w Html & XML, XML editors, XML Elements & Attributes XML DTD, XML Schema, XML Parser, Document Object Model (DOM), XML DOM..	**8 Hours**
Text Books:	1. Web Technologies - HTML, JavaScript, PHP, Java, JSP, ASP.NET, XML and Ajax, Black Book, by Dreamtech Press	
Reference Books:	1. HTML, XHTML & CSS Bible, Brian Pfaffenberger, Steven M.Schafer, Charles White, Bill Karow- Wiley Publishing Inc, 2010 2. HTML Black Book by Steven Holzner 3. Web Design with HTML, CSS, JavaScript and jQuery Set by Jon Duckett *** Latest editions of all the suggested books are recommended.**	
Additional electronic reference material:	1. https://www.w3schools.com/html/ 2. https://www.tutorialspoint.com/css/index.htm 3. https://resources.mpi-inf.mpg.de/d5/teaching/ss03/xml-seminar/talks/xml%20for%20beginners.pdf	

LISTOFEXPERIMENTS

1. Design a simple web page with head, body and footer, with heading tags, image tag
2. Design a web site for book information, home page should contain books list, when particular book is clicked, information of the books should display in the next page.
3. Design a page to display the product information such as name, brand, price and etc with table tag
4. Design a web site for book information using frames, home page should contain two parts, left part should contain books list, and right part should contain book information.
5. Design a web page to capture the user information such as name, gender, mobile number, mail id, city, state, and country using form elements.
6. Design a web page with nice formatting like background image, text colors and border for text using external CSS.
7. Design a web page to perform mathematical calculations such as addition, subtraction, multiplication, and division
8. Design a web page to read data from an XML file and display the data in tabular format, take the data as employee information.
9. Design a web site for online purchase using CSS, JS and XML, web site should contain the following web pages.
    - Home page
    - Login page
    - Signup page
    - Product details page

Course Code: **EAS162**	**Specialization- AI** **B.Tech.- Semester-I** **Engineering Physics (Lab)**	**L-0** **T-0** **P-2** **C-1**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** of the operation of various models of optical devices.	
CO2.	**Understanding** types of Semiconductors using Hall experiments.	
CO3.	**Applying** the concept of interference, polarization & dispersion in optical devices through Newton's ring, Laser, polarimeter & spectrometer.	
CO4.	**Applying** the concept of resonance to determine the AC frequency using sonometer & Melde's apparatus.	
CO5.	**Applying** the concept of resolving & dispersive power by a prism.	
Course Content:	**Note: Select any ten experiments from the following list.**	
LIST OF EXPERIMENTS	**1.** To determine the wavelength of monochromatic light by Newton's ring. **2.** To determine the wavelength of monochromatic light by Michelson-Morley experiment. **3.** To determine the wavelength of monochromatic light by Fresnel's Bi-prism. **4.** To determine the Planck's constant using LEDs of different colours. **5.** To determine the specific rotation of cane sugar solution using Polarimeter. **6.** To verify Stefan's Law by electrical method. **7.** To study the Hall Effect and determine Hall coefficient and mobility of a given semiconductor material using Hall-effect set up. **8.** To determine the Frequency of an Electrically Maintained Tuning Fork by Melde's experiment. **9.** To compare Illuminating Powers by a Photometer. **10.** To determine the frequency of A.C. mains by means of a Sonometer. **11.** To determine refractive index of a prism material by spectrometer. **12.** To determine the Flashing & Quenching of Neon bulb. **13.** Determination of Cauchy's constant by using spectrometer. **14.** To study the PN junction characteristics. **15.** To determine the resolving power and dispersive power by a prism. **16.** To determine the value of Boltzmann Constant by studying Forward Characteristics of a Diode. **17.** Study the characteristics of LDR. **18.** To study the characteristics of a photo-cell.	
Text Books:	1. B.Sc.Practical Physics, Gupta and Kumar, Pragati Prakashan.	
Reference Books:	1. B.Sc.Practical Physics, Gupta and Kumar, Pragati Prakashan. 2. B.Sc. Practical Physics, C.L. Arora, S. Chand & Company Pvt. Ltd. *** Latest editions of all the suggested books are recommended.**	

Evaluation Scheme of Practical Examination:

Internal Evaluation (50 marks)

Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 4-point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (35 MARKS)				ON THE DAY OF EXAM (15 MARKS)		TOTAL INTERNAL (50 MARKS)
EXPERIMENT (5 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)	ATTENDANCE (10 MARKS)	EXPERIMENT (5 MARKS)	VIVA (10 MARKS)	

External Evaluation (50 marks)

The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Course Code: EAS163	Specialization- AI B.Tech.- Semester-I **Engineering Chemistry (Lab)**	L-0 T-0 P-2 C-1
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the concepts of Hardness of water.	
CO2.	**Analyzing** & estimating of various parameters of water.	
CO3.	**Analyzing** of Calorific value of Solid fuel by Bomb calorimeter & Liquid Fuels by Junkers Gas Calorimeter.	
CO4.	**Analyzing** of open & closed Flash point of oil by Cleveland & Pensky's Martens apparatus.	
CO5.	**Analyzing** of viscosity of lubricating oil using Redwood Viscometer.	
Course Content:	**Select any ten experiments from the following list.**	
LIST OF EXPERIMENTS	**1.** Determination of Total Hardness of a given water sample. **2.** Determination of mixed alkalinity (a) Hydroxyl & Carbonate (b) Carbonate & Bicarbonate **3.** To determine the pH of the given solution using pH meter and pH-metric titration. **4.** Determination of dissolved oxygen content of given water sample. **5.** To find chemical oxygen demand of waste water sample by potassium dichromate **6.** Determination of free chlorine in a given water sample. **7.** To determine the chloride content in the given water sample by Mohr's method. **8.** To prepare the Bakelite resin polymer. **9.** To determine the concentration of unknown sample of iron spectrophotometrically. **10.** To determine the viscosity of a given sample of a lubricating oil using Redwood Viscometer. **11.** To determine the flash & fire point of a given lubricating oil. **12.** Determination of calorific value of a solid or liquid fuel. **13.** Determination of calorific value of a gaseous fuel. **14.** Determination of % of O_2, CO_2, % CO in flue gas sample using Orsat apparatus. **15.** Proximate analysis of coal sample.	
Reference Books:	1. Agarwal R. K., Engineering Chemistry, Krishna Prakashan. *** Latest editions of all the suggested books are recommended.**	

Evaluation Scheme of Practical Examination:

Internal Evaluation (50 marks)

Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 4-point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (35 MARKS)				ON THE DAY OF EXAM (15 MARKS)		TOTAL INTERNAL (50 MARKS)
EXPERIMENT (5 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)	ATTENDANCE (10 MARKS)	EXPERIMENT (5 MARKS)	VIVA (10 MARKS)	

External Evaluation (50 marks)

The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Course Code: **EEE161**	**Specialization- Data Science** **B.Tech.- Semester-I** **Basic Electrical Engineering (Lab)**	**L-0** **T-0** **P-2** **C-1**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the concepts of Kirchoff & Voltage law.	
CO2.	**Understanding** the concepts of Thevenin & Norton theorem.	
CO3.	**Analyzing** the energy by a single-phase energy meter.	
CO4.	**Analyzing** the losses and efficiency of Transformer on different load conditions.	
CO5.	**Analyzing** the electrical circuits using electrical and electronics components on bread board.	
Course Content:	**Select any ten experiments from the following list.**	
List of Experiments	**1.** To verify the Kirchhoff's current and voltage laws. **2.** To study multimeter. **3.** To verify the Superposition theorem. **4.** To verify the Thevenin's theorem. **5.** To verify the Norton's theorem. **6.** To verify the maximum power transfer theorem. **7.** To verify current division and voltage division rule. **8.** To measure energy by a single-phase energy meter. **9.** To measure the power factor in an RLC by varying the capacitance **10.** To determine resonance frequency, quality factor, bandwidth in series resonance. **11.** To measure the power in a 3-phase system by two-wattmeter method **12.** To measure speed for speed control of D.C. Shunt Motor. **13.** To determine the efficiency of single-phase transformer by load test.	
Reference Books:	1. Fitzgerald A.E & Higginbotham., D.E., Basic Electrical Engineering, McGraw Hill. *** Latest editions of all the suggested books are recommended.**	

Evaluation Scheme of Practical Examination:

Internal Evaluation (50 marks)

Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 4-point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (35 MARKS)				ON THE DAY OF EXAM (15 MARKS)		TOTAL INTERNAL (50 MARKS)
EXPERIMENT (5 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)	ATTENDANCE (10 MARKS)	EXPERIMENT (5 MARKS)	VIVA (10 MARKS)	

External Evaluation (50 marks)

The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Course Code: **EEC161**	**Specialization- AI** **B.Tech.- Semester-I** **Basic Electronics Engineering(Lab)**	**L-0** **T-0** **P-2** **C-1**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the implementation of diode-based circuits.	
CO2.	**Understanding** the implementation of Operational amplifier-based circuits.	
CO3.	**Analyzing** the characteristics of pn junction diode & BJT.	
CO4.	**Analyzing** the different parameters for characterizing different circuits like rectifiers, regulators using diodes and BJTs.	
CO5.	**Analyzing** the truth tables through the different type's adders.	
Course Content:	**Minimum eight experiments should be performed-**	
List of Experiments	**1.** To study the V-I characteristics of p-n junction diode. **2.** To study the diode as clipper and clamper. **3.** To study the half-wave rectifier using silicon diode. **4.** To study the full-wave rectifier using silicon diode. **5.** To study the Zener diode as a shunt regulator. **6.** To study transistor in Common Base configuration & plot its input/output characteristics. **7.** To study the operational amplifier in inverting & non-inverting modes using IC 741. **8.** To study the operational amplifier as differentiator & integrator. **9.** To study various logic gates & verify their truth tables. **10.** To study half adder/full adder & verify their truth tables.	
Reference Books:	1. Sedra and Smith, Microelectronic Circuits, Oxford University Press. 2. Chattopadhyay D and P C Rakshit, Electronics Fundamentals and Applications, New Age International. *** Latest editions of all the suggested books are recommended.**	

Evaluation Scheme of Practical Examination:

Internal Evaluation (50 marks)

Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 4-point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (35 MARKS)				ON THE DAY OF EXAM (15 MARKS)		TOTAL INTERNAL (50 MARKS)
EXPERIMENT (5 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)	ATTENDANCE (10 MARKS)	EXPERIMENT (5 MARKS)	VIVA (10 MARKS)	

External Evaluation (50 marks)

The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Course Code: EME161	Specialization- AI B.Tech.- Semester-I **Engineering Drawing (Lab)**	L-0 T-0 P-4 C-2
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the concepts of Engineering Drawing.	
CO2.	**Understanding** how to draw and represent the shape, size & specifications of physical objects.	
CO3.	**Applying** the principles of projection and sectioning.	
CO4.	**Applying** the concepts of development of the lateral surface of a given object.	
CO5.	**Creating** isometric projection of the given orthographic projection.	
Course Content:	**All to be performed**	
List of Experiments	1. To write all Numbers (0 to 9) and alphabetical Letters (A to Z) as per the standard dimensions. 2. To draw the types of lines and conventions of different materials. 3. To draw and study dimensioning and Tolerance. 4. To construction geometrical figures of Pentagon and Hexagon 5. To draw the projection of points and lines 6. To draw the Orthographic Projection of given object in First Angle 7. To draw the Orthographic Projection of given object in Third Angle 8. To draw the sectional view of a given object 9. To draw the development of the lateral surface of given object **10.** To draw the isometric projection of the given orthographic projection	

Evaluation Scheme of Practical Examination:

Internal Evaluation (50 marks)

Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 4-point scale which would include the drawing sheet by the students and a Viva taken by the faculty concerned. The marks shall be given on the drawing sheet & regard maintained by the faculty.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (35 MARKS)				ON THE DAY OF EXAM (15 MARKS)		TOTAL INTERNAL (50 MARKS)
EXPERIMENT (5 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)	ATTENDANCE (10 MARKS)	EXPERIMENT (5 MARKS)	VIVA (10 MARKS)	

External Evaluation (50 marks)

The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

Drawing Sheet (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Course Code: **EME162**	**Specialization- AI** **B.Tech.- Semester-I** **Workshop Practice (Lab)**	**L-0** **T-0** **P-4** **C-2**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the concepts to prepare simple wooden joints using wood working tools.	
CO2.	**Applying** the techniques to produce fitting jobs of specified dimensions.	
CO3.	**Applying** the concepts to prepare simple lap, butt, T and corner joints using arc welding equipment.	
CO4.	**Applying** the concepts of black smithy and lathe machine to produce different jobs.	
CO5.	**Creating** core and moulds for casting.	
Course Content:	**Perform any ten experiments selecting at least one from each shop**	
List of Experiments	**Carpentry Shop**: 1. To prepare half-lap corner joint. 2. To prepare mortise & tenon joint. 3. To prepare a cylindrical pattern on woodworking lathe. **Fitting Bench Working Shop:** 1. To prepare a V-joint fitting 2. To prepare a U-joint fitting 3. To prepare a internal thread in a plate with the help of tapping process **Black Smithy Shop:** 1. To prepare a square rod from given circular rod 2. To prepare a square U- shape from given circular rod **Welding Shop:** 1. To prepare a butt and Lap welded joints using arc welding machine. 2. To prepare a Lap welded joint Gas welding equipment. 3. To prepare a Lap welded joint using spot welding machine. **Sheet-metal Shop:** 1. To make round duct of GI sheet using 'soldering' process. 2. To prepare a tray of GI by fabrication **Machine Shop:** 1. To study the working of basic machine tools like Lathe m/c, Shaper m/c, Drilling m/c and Grinding m/c. 2. To perform the following operations on Centre Lathe: Turning, Step turning, Taper turning, Facing, Grooving and Knurling 3. To perform the operations of drilling of making the holes on the given metallic work-piece (M.S.) by use of drilling machine. **Foundry Shop:** 1. To prepare core as per given size. 2. To prepare a mould for given casting.	

Evaluation Scheme of Practical Examination:

Internal Evaluation (50 marks)

Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 4-point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (35 MARKS)				ON THE DAY OF EXAM (15 MARKS)		TOTAL INTERNAL (50 MARKS)
EXPERIMENT (5 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)	ATTENDANCE (10 MARKS)	EXPERIMENT (5 MARKS)	VIVA (10 MARKS)	

External Evaluation (50 marks)

The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Course Code: EAS211	**Specialization- AI** **B.Tech.- Semester-II** **Engineering Mathematics-II**	**L-3** **T-1** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the concepts of the wave, diffusion and Laplace equations & Fourier series.	
CO2.	**Understanding** the methods of separation of variables	
CO3.	**Understanding** the concepts of Fourier series' representation of single variable function.	
CO4.	**Applying** Laplace transform to determine the complete solutions of linear ODE	
CO5.	**Applying** the method of variations of parameters to find solution of equations with variable coefficients.	
Course Content:		
Unit-1:	**Differential Equations:** Linear Differential Equation, Linear Differential Equation with constant coefficient: Complementary functions and particular integrals, Linear Differential Equation with variable coefficient: Removal method, changing independent variables, Method of variation of parameters, Homogeneous Linear Differential Equation, Simultaneous linear differential equations.	**8 Hours**
Unit-2:	**Series Solutions:** PowerSeries solutions of ODE, Ordinary Point, Singular Points, Frobenius Method. **Special Functions:** Legendre equation and Polynomial, Legendre Function, Rodrigue's formula, Laplace definite integral for first and second kind, Bessel equation and Polynomial, Bessel Function, Orthogonal properties and Recurrence Relation for Legendre and Bessel function.	**8 Hours**
Unit-3:	**Partial differential equations** –Method of separation of variables for solving partial differential equations; Wave equation up to two dimensions; Laplace equation in two-dimensions; Heat conduction equations up to two-dimensions; Equations of transmission Lines.	**8 Hours**
Unit-4:	**Fourier Series:** Periodic functions, Trigonometric series; Fourier series; Dirichlet's conditions, Determination of fourier coefficient by Euler's formulae; Fourier series for discontinuous functions, Even and odd functions, Half range sine and cosine series.	**8 Hours**
Unit-5:	**Laplace Transform:** Laplace transform; Existence theorem; Laplace transform of derivatives and integrals; Inverse Laplace transform; Unit step function; Diratch delta function; Laplace transform of periodic functions; Convolution theorem.	**8 Hours**
Text Books:	1. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers.	
Reference Books:	1. Kreyszig E., Advanced Engineering Mathematics, Wiley Eastern. 2. Piskunov N, Differential & Integral Calculus, Moscow Peace Publishers. 3. Narayan Shanti, A Text book of Matrices, S. Chand 4. Bali N.P., Engineering Mathematics-II, Laxmi Publications *** Latest editions of all the suggested books are recommended.**	
Additional	1. https://www.youtube.com/watch?v=luJMl37-nso	

electronic reference material:	**2.** https://www.youtube.com/watch?v=NdouX5-KD6Y	

Course Code: EAS212	**Specialization- AI** **B.Tech.- Semester-II** **Engineering Physics**	**L-3 T-1 P-0 C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the basic concepts of interference, diffraction and polarisation.	
CO2.	**Understanding** the concept of bonding in solids and semiconductors.	
CO3.	**Understanding** the special theory of relativity.	
CO4.	**Applying** special theory of relativity to explain the phenomenon of length contraction, time dilation, mass-energy equivalence etc.	
CO5.	**Applying** the concepts of polarized light by the Brewster's and Malus Law	
Course Content:	**Unit A(Unit A is for building a foundation and shall not be a part of examination)** Optics- Properties of light, Lance, Mirror, Focal length, Intensity, Power, Eye-piece, Work, Energy and its types, Waves, longitudinal and transverse waves, Time period, Frequency	
Unit-1:	**Interference of Light:** Introduction,Principle of Superposition, Interference due to division of wavefront: Young's double slit experiment, Theory of Fresnel's Bi-Prism, Interference due to division of amplitude: parallel thin films, Wedge shaped film, Michelson's interferometer, Newton's ring.	**8 Hours**
Unit-2:	**Diffraction**: Introduction, Types of Diffraction and difference between them, Condition for diffraction, difference between interference and diffraction. **Single slit diffraction**: Quantitative description of maxima and minima with intensity variation, linear and angular width of central maxima. **Resolving Power**: Rayleigh's criterion of resolution, resolving power of diffraction grating and telescope.	**8 Hours**
Unit-3:	**Polarization:** Introduction, production of plane polarized light by different methods, Brewster's and Malus Law. Quantitative description of double refraction, Nicol prism, Quarter & half wave plate, specific rotation, Laurent's half shade polarimeter.	**8 Hours**
Unit-4:	**Elements of Material Science:** Introduction, Bonding in solids, Covalent bonding and Metallic bonding, Classification of Solids as Insulators, Semi-Conductor and Conductors, Intrinsic and Extrinsic Semiconductors, Conductivity in Semiconductors, Determination of Energy gap of Semiconductor. **Hall Effect:** Theory, Hall Coefficients and application to determine the sign of charge carrier, Concentration of charge carrier, mobility of charge carriers.	**8 Hours**
Unit-5:	**Special Theory of Relativity:** Introduction, Inertial and non-inertial frames of Reference, Postulates of special theory of relativity, Galilean and Lorentz Transformations, Length contraction and Time Dilation, Relativistic addition of velocities, Variation of mass with velocity, Mass-Energy equivalence.	**8 Hours**
Text Books:	1. Elements of Properties of Matter, D. S. Mathur, S. Chand & Co.	
Reference Books:	1. F. A. Jenkins and H. E. White, Fundamentals of Optics, McGraw-Hill. 2. Concept of Modern Physics, Beiser, Tata McGraw-Hill. 3. R. Resnick, Introduction to Special Relativity, John Wiley, Singapore. *** Latest editions of all the suggested books are recommended.**	
Additional electronic reference material:	1. https://www.youtube.com/watch?v=toGH5BdgRZ4&list=PLD9DDFBDC338226CA 2. https://www.youtube.com/watch?v=CuqsU7B1MtU	

Course Code: **EAS213**	**Specialization- AI** **B.Tech.- Semester-II** **Engineering Chemistry**	**L-3** **T-1** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the concept of softening & purification of water.	
CO2.	**Understanding** calorific value& combustion, analysis of coal, Physical & Chemical properties of hydrocarbons & quality improvements.	
CO3.	**Understanding** the concept of lubrication, Properties of Refractory & Manufacturing of cements.	
CO4.	**Applying** the concepts of the mechanism of polymerization reactions, Natural and synthetic rubber& vulcanization.	
CO5.	**Applying** the concepts of spectroscopic & chromatographic techniques.	
Course Content:		
Unit-1:	**Water and Its Industrial Applications:** Sources, Impurities, Hardness and its units, Industrial water, characteristics, softening of water by various methods (External and Internal treatment), Boiler trouble causes effects and remedies, Characteristic of municipal water and its treatment, Numerical problem based on water softening method like lime soda, calgon etc.	**8 Hours**
Unit-2:	**Fuels and Combustion:** Fossil fuel and classification, calorific value, determination of calorific value by Bomb and Jumker's calorimeter, proximate and ultimate analysis of coal and their significance, calorific value computation based on ultimate analysis data, Combustion and its related numerical problems carbonization manufacturing of coke, and recovery of byproduct, knocking relationship between knocking and structure and hydrocarbon, improvement ant knocking characteristic IC Engine fuels, Diesel Engine fuels, Cetane Number.	**8 Hours**
Unit-3:	**Lubricants:** Introduction, mechanism of lubrication, classification of lubricant, properties and testing of lubricating Oil Numerical problem based on testing methods. Cement and Refractories: Manufacture, IS code, Setting and hardening of cement, Portland cement Plaster of Paris, Refractories. Introduction, classification and properties of refractories.	**8 Hours**
Unit-4:	**Polymers:** Introduction, types and classification of polymerization, reaction mechanism, Natural and synthetic rubber, Vulcanization of rubber, preparation, properties and uses of the following Polythene, PVC, PMMA, Teflon, Polyacrylonitrile, PVA, Nylon 6, Terylene, Phenol Formaldehyde, Urea Formaldehyde Resin, Glyptal, Silicones Resin, Polyurethanes, Butyl Rubber, Neoprene, Buna N, Buna S.	**8 Hours**
Unit-5:	**A. Instrumental Techniques in chemical analysis:** Introduction, Principle, Instrumentation and application of IR, NMR, UV, Visible, Gas Chromatography, Lambert and Beer's Law. **B. Water Analysis Techniques:** Alkalinity, Hardness (Complexometric), Chlorides, Free Chlorine, DO, BOD, and COD, Numerical Problem Based on above techniques.	**8 Hours**
Text Books:	1. Agarwal R. K., Engineering Chemistry, Krishna Prakashan.	
Reference Books:	1. Morrison & Boyd, Organic Chemistry, Prentice Hall	

	2. Barrow Gordon M., Physical Chemistry, McGraw-Hill. 3. Manahan Stanley E., Environmental Chemistry, CRC Press. *** Latest editions of all the suggested books are recommended.**	
Additional electronic reference material:	1. https://www.youtube.com/watch?v=RV-OyRTaIOI 2. https://www.youtube.com/watch?v=phhfkikb6Lw	

.

Course Code: **EEE217**	**Specialization- AI** **B.Tech.- Semester-II** **Basic Electrical Engineering**	**L-3** **T-1** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the basics of Network, AC Waveform and its characteristics.	
CO2.	**Understanding** the basic concept of Measuring Instruments, Transformers & three phase Power systems.	
CO3.	**Understanding** the basic concepts of Transformer.	
CO4.	**Understanding** the basic concept of power measurement using two wattmeter methods.	
CO5.	**Applying** the concept of Kirchhoff's laws and Network Theorems to analyze complex electrical circuits.	
Course Content:		
Unit-1:	**D.C. Network Theory:** Passive, active, bilateral, unilateral, linear, nonlinear element, Circuit theory concepts-Mesh and node analysis; Voltage and current division, source transformation, Network Theorems-Superposition theorem, Thevenin's theorem, Norton's theorem, and Maximum Power Transfer theorem, Star-delta & delta-star conversion.	**8 Hours**
Unit-2:	**Steady State Analysis of A.C. Circuits:** Sinusoidal and phasor representation of voltage and Current; Single phase A.C. circuit behavior of resistance, inductance and capacitance and their Combination in series & parallel; Power factor; Series and parallel resonance; Band width and Quality factor.	**8 Hours**
Unit-3:	**Basics of Measuring Instruments:** Introduction to wattmeter & Energy meter extension range of voltmeter and ammeter. **Three Phase A.C. Circuits:** Line and phase voltage/current relations; three phase power, power measurement using two wattmeter methods.	**8 Hours**
Unit-4:	**Single phase Transformer:** Principle of operation; Types of construction; Phasor diagram; Equivalent circuit; Efficiency and losses.	**8 Hours**
Unit-5:	**Electrical machines:** DC machines: Principle & Construction, Types, EMF equation of generator and torque equation of motor, applications of DC motors (simple numerical problems)	**8 Hours**
Text Books:	1. V. Del Toro, Principles of Electrical Engineering, Prentice-Hall International.	
Reference Books:	1. Fitzgerald A.E & Higginbotham., D.E., Basic Electrical Engineering, McGraw Hill. 2. A Grabel, Basic Electrical Engineering, McGraw Hill. 3. Cotton H., Advanced Electrical Technology, Wheeler Publishing. *** Latest editions of all the suggested books are recommended.**	
Additional electronic reference material:	1. https://nptel.ac.in/courses/108/108/108108076/ 2. https://sites.google.com/tmu.ac.in/dr-garima-goswami/home	

Course Code: **EEC211**	**Specialization- AI** **B.Tech.- Semester-II** **Basic Electronics Engineering**	**L-3** **T-1** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the concepts of electronic components like diode, BJT & FET.	
CO2.	**Understanding** the applications of pn junction diode as clipper, clamper, rectifier & regulator whereas BJT & FET as amplifiers	
CO3.	**Understanding** the functions and applications of operational amplifier-based circuits such as differentiator, integrator, and inverting, non-inverting, summing & differential amplifier.	
CO4.	**Understanding** the concepts of number system, Boolean algebra and logic gates.	
CO5.	**Applying** the knowledge of series, parallel and electromagnetic circuits.	
Course Content:		
Unit-1:	**p-n Junction:** Energy band diagram in materials, Intrinsic & Extrinsic Semiconductor, Introduction to PN-Junction, Depletion layer, V-I characteristics, p-n junction as rectifiers (half wave and full wave), calculation of ripple factor of rectifiers, clipping and clamping circuits, Zener diode and its application as shunt regulator.	**8 Hours**
Unit-2:	**Bipolar Junction Transistor (BJT):** Basic construction, transistor action; CB, CE and CCconfigurations, input/output characteristics, Relation between α, β & γ, Biasing of transistors: Fixed bias, emitter bias, potential divider bias.	**8 Hours**
Unit-3:	**Field Effect Transistor (FET):** Basic construction of JFET; Principle of working; concept of pinch-off condition & maximum drain saturation current; input and transfer characteristics; Characteristics equation; fixed and self-biasing of JFET amplifier; Introduction of MOSFET; Depletion and Enhancement type MOSFET- Construction, Operation and Characteristics.	**8 Hours**
Unit-4:	**Operational Amplifier (Op-Amp):** Concept of ideal operational amplifier; ideal and practical Op-Amp parameters; inverting, non-inverting and unity gain configurations, Applications of Op-Amp as adders, difference amplifiers, integrators and differentiator.	**8 Hours**
Unit-5:	**Switching Theory:** Number system, conversion of bases (decimal, binary, octal and hexadecimalnumbers), Addition & Subtraction, BCD numbers, Boolean algebra, De Morgan's Theorems, Logic gates and truth table-AND, OR & NOT,Seven segment display & K map.	**8 Hours**
Text Books:	1. Morris Mano M., Digital Design, Prentice Hall.	
Reference Books:	1. Sedra and Smith, Microelectronic Circuits, Oxford University Press. 2. Gayakwad, R A, Operational Amplifiers and Linear Integrated circuits, Prentice Hall of India Pvt. Ltd. 3. Chattopadhyay D and P C Rakshit, Electronics Fundamentals and Applications, New Age International. *** Latest editions of all the suggested books are recommended.**	
Additional electronic reference material:	**1.** https://www.youtube.com/watch?v=USrY0JspDEg **2.** https://www.youtube.com/watch?v=Hkz27cFW4Xs	

Course Code: IAI201	**Specialization- AI** **B.Tech.- Semester-II** **Programming in C**	**L-3 T-0 P-0 C-3**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the use of basic concepts involved in Computer Programming.	
CO2.	Understanding the concepts of design, implement, test, debug and document programs in C.	
CO3.	Understanding the concepts of pointers and its application in arrays.	
CO4.	Analyzing the use of functions and parameter passing options in it.	
CO5.	Creating a C program using function and pointer.	
Course Content:		
Unit-1:	**Basics of programming: Approaches** to Problem Solving, Concept of algorithm and flow charts, **Types of computer languages**:- Machine Language, Assembly Language and High Level Language, Concept of Assembler, Compiler, Loader and Linker	**8 Hours**
Unit-2:	**Fundamental data types**- Character type, integer, short, long, unsigned, single and double floating point, Storage classes- automatic, register, static and external, Operators and expression using numeric and relational operators, mixed operands, type conversion, logical operators, bit operations, assignment operator, operator precedence and associativity. **Fundamentals of C programming**: Structure of C program, writing and executing the first C program, components of C language. Standard I/O in C.	**8 Hours**
Unit-3:	**Conditional program execution:** Applying if and switch statements, nesting if and else, use of break and default with switch, program loops and iterations: use of while, do while and for loops, multiple loop variables, use of break and continue statements. **Pointers:** Introduction, declaration, applications	**8 Hours**
Unit-4:	**Arrays:** Array notation and representation, manipulating array elements, using multidimensional arrays. Structure, union, enumerated data types, **Functions:** Introduction, types of functions, functions with array, passing values to functions, recursive functions.	**8 Hours**
Unit-5:	**File Handling :** File handling, standard C preprocessors, defining and calling macros, conditional compilation, passing values to the compiler. **C Preprocessor-** #define, #include, #undef, Conditional compilation directives. **C standard library and header files**: Header files, string functions, mathematical functions, Date and Time functions	**8 Hours**
Text Books:	1. Programming in ANSI C by Balaguruswamy, 3rd Edition, 2005, Tata McGraw Hill.	
Reference Books:	1. Let us C by Yashwant Kanetka, 6th Edition, PBP Publication. 2. The C programming Language by Richie and Kenninghan, 2004, BPB Publication. *** Latest editions of all the suggested books are recommended.**	
Additional electronic	1. https://www.tutorialspoint.com/cprogramming/index.htm	

reference material	2. http://cslibrary.stanford.edu/101/EssentialC.pdf	

Course Code: **TMUGE201**	**Specialization- AI** **B.Tech.- Semester-II** **English Communication -II**	**L-2** **T-0** **P-2** **C-3**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Remembering & understanding the basics of English Grammar and Vocabulary.	
CO2.	Understanding the basics of Listening, Speaking & Writing Skills.	
CO3.	Applying correct vocabulary and tenses in sentence construction while writing and delivering presentations.	
CO4.	Analyzing different types of listening, role of Audience & Locale in presentation.	
CO5.	Drafting Official Letters, E-Mail & Paragraphs in correct format.	
Course Content:		
Unit-1:	**Functional Grammar** • Prefix, suffix and One words substitution • Modals • Concord	**10 Hours**
Unit-2:	**Listening Skills** • Difference between listening & hearing, Process and Types of Listening • Importance and Barriers to listening	**4 Hours**
Unit-3:	**Writing Skills** • Official letter and email writing • Essentials of a paragraph, • Developing a paragraph: Structure and methods • Paragraph writing (100-120 words)	**12 Hours**
Unit-4:	**Strategies & Structure of Oral Presentation** • Purpose, Organizing content, Audience & Locale, Audio-visual aids, Body langauge • Voice dynamics: Five P's - Pace, Power, Pronunciation, Pause, and Pitch. • Modes of speech delivery and 5 W's of presentation	**8 Hours**
Unit-5:	**Value based text reading:** Short Essay (Non- detailed study) • How should one Read a book? – Virginia Woolf	**6 Hours**
Text Books:	1. Singh R.P., An Anthology of English Essay, O.U.P. New Delhi.	
Reference Books:	1. Nesfield J.C. "*English Grammar Composition & Usage*" Macmillan Publishers 2. Sood Madan "*The Business letters"* Goodwill Publishing House, New Delhi 3. Kumar Sanjay &Pushplata "*Communication Skills*" Oxford University Press, New Delhi. *** Latest editions of all the suggested books are recommended.**	

Additional Electronic Reference Material	**1.**https://www.youtube.com/watch?v=A0uekze2GOU **2.**https://www.youtube.com/watch?v=JIKU_WT0Bls **3.**https://www.youtube.com/watch?v=3Tu1jN65slw **4.**https://youtu.be/sb6ZZ2p3hEM **5.**https://youtu.be/yY6-cgShhac **6.**https://youtu.be/cc4yXwOQsBk	

Methodologies:

1. Words and exercises, usage in sentences.
2. Language Lab software.
3. Sentence construction on daily activities and conversations.
4. Format and layout to be taught with the help of samples and preparing letters on different subjects.
5. JAM sessions and Picture presentation.
6. Tongue twisters, Newspaper reading and short movies.
7. Modern Teaching tools (PPT Presentation, Tongue-Twisters & Motivational videos with sub-titles) will be utilized.
8. Text reading : discussion in detail, critical appreciation by reading the text to develop students' reading habits with voice modulation.

Note:

- Class (above 30 students) will be divided in to two groups for effective teaching.
- For effective conversation practice, groups will be changed weekly.

Evaluation Scheme

Internal Evaluation			**External Evaluation**		**Total Marks**
40 Marks			**60 Marks**		**100**
20 Marks (Best 2 out of Three CTs) ***(From Unit- I, IV & V)***	10 Marks (Oral Assignments) ***(From Unit- II &IV)***	10 Marks (Attendance)	40 Marks (External Written Examination) ***(From Unit- I, IV & V)***	20 Marks (External Viva)* ***(From Unit- II &IV)***	

*Parameters of External Viva

Content	**Body Language**	**Communication skills**	**Confidence**	**TOTAL**
05 Marks	05 Marks	05 Marks	05 Marks	20 Marks

Note: External Viva will be conducted by 2-member committee comprising

a) One Faculty teaching the class

b) One examiner nominated by University Examination cell.

Each member will evaluate on a scale of 20 marks and the average of two would be the 20 marks obtained by the students.

Course Code: EAS262	**Specialization- AI** **B.Tech.- Semester-II** **Engineering Physics (Lab)**	**L-0** **T-0** **P-2** **C-1**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** of the operation of various models of optical devices.	
CO2.	**Understanding** types of Semiconductors using Hall experiments.	
CO3.	**Applying** the concept of interference, polarization & dispersion in optical devices through Newton's ring, Laser, polarimeter & spectrometer.	
CO4.	**Applying** the concept of resonance to determine the AC frequency using sonometer & Melde's apparatus.	
CO5.	**Applying** the concept of resolving & dispersive power by a prism.	
Course Content:	**Note: Select any ten experiments from the following list.**	
LIST OF EXPERIMENTS	**1.** To determine the wavelength of monochromatic light by Newton's ring. **2.** To determine the wavelength of monochromatic light by Michelson-Morley experiment. **3.** To determine the wavelength of monochromatic light by Fresnel's Bi-prism. **4.** To determine the Planck's constant using LEDs of different colours. **5.** To determine the specific rotation of cane sugar solution using Polarimeter. **6.** To verify Stefan's Law by electrical method. **7.** To study the Hall Effect and determine Hall coefficient and mobility of a given semiconductor material using Hall-effect set up. **8.** To determine the Frequency of an Electrically Maintained Tuning Fork by Melde's experiment. **9.** To compare Illuminating Powers by a Photometer. **10.** To determine the frequency of A.C. mains by means of a Sonometer. **11.** To determine refractive index of a prism material by spectrometer. **12.** To determine the Flashing & Quenching of Neon bulb. **13.** Determination of Cauchy's constant by using spectrometer. **14.** To study the PN junction characteristics. **15.** To determine the resolving power and dispersive power by a prism. **16.** To determine the value of Boltzmann Constant by studying Forward Characteristics of a Diode. **17.** Study the characteristics of LDR. **18.** To study the characteristics of a photo-cell.	
Text Books:	1. B.Sc.Practical Physics, Gupta and Kumar, Pragati Prakashan.	
Reference Books:	1. B.Sc.Practical Physics, Gupta and Kumar, Pragati Prakashan. 2. B.Sc. Practical Physics, C.L. Arora, S. Chand & Company Pvt. Ltd. *** Latest editions of all the suggested books are recommended.**	

Evaluation Scheme of Practical Examination:

Internal Evaluation (50 marks)

Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 4-point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (35 MARKS)				ON THE DAY OF EXAM (15 MARKS)		TOTAL INTERNAL (50 MARKS)
EXPERIMENT (5 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)	ATTENDANCE (10 MARKS)	EXPERIMENT (5 MARKS)	VIVA (10 MARKS)	

External Evaluation (50 marks)

The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Course Code: **EAS263**	**Specialization- AI** **B.Tech.- Semester-II** **Engineering Chemistry (Lab)**	**L-0** **T-0** **P-2** **C-1**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the concepts of Hardness of water.	
CO2.	**Analyzing** & estimating of various parameters of water.	
CO3.	**Analyzing** of Calorific value of Solid fuel by Bomb calorimeter & Liquid Fuels by Junkers Gas Calorimeter.	
CO4.	**Analyzing** of open & closed Flash point of oil by Cleveland & Pensky's Martens apparatus.	
CO5.	**Analyzing** of viscosity of lubricating oil using Redwood Viscometer.	
Course Content:	**Select any ten experiments from the following list.**	
LIST OF EXPERIMENTS	**1.** Determination of Total Hardness of a given water sample. **2.** Determination of mixed alkalinity (a) Hydroxyl & Carbonate (b) Carbonate & Bicarbonate **3.** To determine the pH of the given solution using pH meter and pH-metric titration. **4.** Determination of dissolved oxygen content of given water sample. **5.** To find chemical oxygen demand of waste water sample by potassium dichromate **6.** Determination of free chlorine in a given water sample. **7.** To determine the chloride content in the given water sample by Mohr's method. **8.** To prepare the Bakelite resin polymer. **9.** To determine the concentration of unknown sample of iron spectrophotometrically. **10.** To determine the viscosity of a given sample of a lubricating oil using Redwood Viscometer. **11.** To determine the flash & fire point of a given lubricating oil. **12.** Determination of calorific value of a solid or liquid fuel. **13.** Determination of calorific value of a gaseous fuel. **14.** Determination of % of O_2, CO_2, % CO in flue gas sample using Orsat apparatus. **15.** Proximate analysis of coal sample.	
Reference Books:	1. Agarwal R. K., Engineering Chemistry, Krishna Prakashan. *** Latest editions of all the suggested books are recommended.**	

Evaluation Scheme of Practical Examination:

Internal Evaluation (50 marks)

Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 4-point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (35 MARKS)				ON THE DAY OF EXAM (15 MARKS)		TOTAL INTERNAL (50 MARKS)
EXPERIMENT (5 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)	ATTENDANCE (10 MARKS)	EXPERIMENT (5 MARKS)	VIVA (10 MARKS)	

External Evaluation (50 marks)

The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Course Code: **EEE261**	**Specialization- AI** **B.Tech.- Semester-II** **Basic Electrical Engineering (Lab)**	**L-0** **T-0** **P-2** **C-1**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the concepts of Kirchoff & Voltage law.	
CO2.	**Understanding** the concepts of Thevenin & Norton theorem.	
CO3.	**Analyzing** the energy by a single-phase energy meter.	
CO4.	**Analyzing** the losses and efficiency of Transformer on different load conditions.	
CO5.	**Analyzing** the electrical circuits using electrical and electronics components on bread board.	
Course Content:	**Select any ten experiments from the following list.**	
List of Experiments	**1.** To verify the Kirchhoff's current and voltage laws. **2.** To study multimeter. **3.** To verify the Superposition theorem. **4.** To verify the Thevenin's theorem. **5.** To verify the Norton's theorem. **6.** To verify the maximum power transfer theorem. **7.** To verify current division and voltage division rule. **8.** To measure energy by a single-phase energy meter. **9.** To measure the power factor in an RLC by varying the capacitance **10.** To determine resonance frequency, quality factor, bandwidth in series resonance. **11.** To measure the power in a 3-phase system by two-wattmeter method **12.** To measure speed for speed control of D.C. Shunt Motor. **13.** To determine the efficiency of single-phase transformer by load test.	
Reference Books:	1. Fitzgerald A.E & Higginbotham., D.E., Basic Electrical Engineering, McGraw Hill. *** Latest editions of all the suggested books are recommended.**	

Evaluation Scheme of Practical Examination:

Internal Evaluation (50 marks)

Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 4-point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (35 MARKS)				ON THE DAY OF EXAM (15 MARKS)		TOTAL INTERNAL (50 MARKS)
EXPERIMENT (5 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)	ATTENDANCE (10 MARKS)	EXPERIMENT (5 MARKS)	VIVA (10 MARKS)	

External Evaluation (50 marks)

The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Course Code: EEC261	Specialization- AI B.Tech.- Semester-II **Basic Electronics Engineering(Lab)**	L-0 T-0 P-2 C-1
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the implementation of diode-based circuits.	
CO2.	**Understanding** the implementation of Operational amplifier-based circuits.	
CO3.	**Analyzing** the characteristics of pn junction diode & BJT.	
CO4.	**Analyzing** the different parameters for characterizing different circuits like rectifiers, regulators using diodes and BJTs.	
CO5.	**Analyzing** the truth tables through the different type's adders.	
Course Content:	**Minimum eight experiments should be performed-**	
List of Experiments	**1.** To study the V-I characteristics of p-n junction diode. **2.** To study the diode as clipper and clamper. **3.** To study the half-wave rectifier using silicon diode. **4.** To study the full-wave rectifier using silicon diode. **5.** To study the Zener diode as a shunt regulator. **6.** To study transistor in Common Base configuration & plot its input/output characteristics. **7.** To study the operational amplifier in inverting & non-inverting modes using IC 741. **8.** To study the operational amplifier as differentiator & integrator. **9.** To study various logic gates & verify their truth tables. **10.** To study half adder/full adder & verify their truth tables.	
Reference Books:	1. Sedra and Smith, Microelectronic Circuits, Oxford University Press. 2. Chattopadhyay D and P C Rakshit, Electronics Fundamentals and Applications, New Age International. *** Latest editions of all the suggested books are recommended.**	

Evaluation Scheme of Practical Examination:

Internal Evaluation (50 marks)

Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 4-point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (35 MARKS)				ON THE DAY OF EXAM (15 MARKS)		TOTAL INTERNAL (50 MARKS)
EXPERIMENT (5 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)	ATTENDANCE (10 MARKS)	EXPERIMENT (5 MARKS)	VIVA (10 MARKS)	

External Evaluation (50 marks)

The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Course Code: **EME261**	**Specialization- AI** **B.Tech.- Semester-II** **Engineering Drawing (Lab)**	**L-0** **T-0** **P-4** **C-2**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the concepts of Engineering Drawing.	
CO2.	**Understanding** how to draw and represent the shape, size & specifications of physical objects.	
CO3.	**Applying** the principles of projection and sectioning.	
CO4.	**Applying** the concepts of development of the lateral surface of a given object.	
CO5.	**Creating** isometric projection of the given orthographic projection.	
Course Content:	**All to be performed**	
List of Experiments	1. To write all Numbers (0 to 9) and alphabetical Letters (A to Z) as per the standard dimensions. 2. To draw the types of lines and conventions of different materials. 3. To draw and study dimensioning and Tolerance. 4. To construction geometrical figures of Pentagon and Hexagon 5. To draw the projection of points and lines 6. To draw the Orthographic Projection of given object in First Angle 7. To draw the Orthographic Projection of given object in Third Angle 8. To draw the sectional view of a given object 9. To draw the development of the lateral surface of given object **10.** To draw the isometric projection of the given orthographic projection	

Evaluation Scheme of Practical Examination:

Internal Evaluation (50 marks)

Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 4-point scale which would include the drawing sheet by the students and a Viva taken by the faculty concerned. The marks shall be given on the drawing sheet & regard maintained by the faculty.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (35 MARKS)				ON THE DAY OF EXAM (15 MARKS)		TOTAL INTERNAL (50 MARKS)
EXPERIMENT (5 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)	ATTENDANCE (10 MARKS)	EXPERIMENT (5 MARKS)	VIVA (10 MARKS)	

External Evaluation (50 marks)

The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

Drawing Sheet (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Note: The drawing sheet could be manual or in Auto CAD.

Course Code: **EME262**	**Specialization- AI** **B.Tech.- Semester-II** **Workshop Practice (Lab)**	**L-0** **T-0** **P-4** **C-2**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the concepts to prepare simple wooden joints using wood working tools.	
CO2.	**Applying** the techniques to produce fitting jobs of specified dimensions.	
CO3.	**Applying** the concepts to prepare simple lap, butt, T and corner joints using arc welding equipment.	
CO4.	**Applying** the concepts of black smithy and lathe machine to produce different jobs.	
CO5.	**Creating** core and moulds for casting.	
Course Content:	**Perform any ten experiments selecting at least one from each shop**	
List of Experiments	**Carpentry Shop**: 1. To prepare half-lap corner joint. 2. To prepare mortise & tenon joint. 3. To prepare a cylindrical pattern on woodworking lathe. **Fitting Bench Working Shop:** 1. To prepare a V-joint fitting 2. To prepare a U-joint fitting 3. To prepare a internal thread in a plate with the help of tapping process **Black Smithy Shop:** 1. To prepare a square rod from given circular rod 2. To prepare a square U- shape from given circular rod **Welding Shop:** 1. To prepare a butt and Lap welded joints using arc welding machine. 2. To prepare a Lap welded joint Gas welding equipment. 3. To prepare a Lap welded joint using spot welding machine. **Sheet-metal Shop:** 1. To make round duct of GI sheet using 'soldering' process. 2. To prepare a tray of GI by fabrication **Machine Shop:** 1. To study the working of basic machine tools like Lathe m/c, Shaper m/c, Drilling m/c and Grinding m/c. 2. To perform the following operations on Centre Lathe: Turning, Step turning, Taper turning, Facing, Grooving and Knurling 3. To perform the operations of drilling of making the holes on the given metallic work-piece (M.S.) by use of drilling machine. **Foundry Shop:** 1. To prepare core as per given size. 2. To prepare a mould for given casting.	

Evaluation Scheme of Practical Examination:

Internal Evaluation (50 marks)

Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 4-point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (35 MARKS)				ON THE DAY OF EXAM (15 MARKS)		TOTAL INTERNAL (50 MARKS)
EXPERIMENT (5 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)	ATTENDANCE (10 MARKS)	EXPERIMENT (5 MARKS)	VIVA (10 MARKS)	

External Evaluation (50 marks)

The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Course Code: IAI251	**Specialization- AI** **B.Tech.- Semester-II** **Programming in C (Lab)**	**L-0** **T-0** **P-2** **C-1**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the basic terminology used in computer programming	
CO2.	Understanding the concepts of compile and debug programs in C language.	
CO3.	Applying the procedure oriented paradigm to design C program.	
CO4.	Creating a C programs involving decision structures, loops and functions.	
CO5.	Creating a C programs using array and pointer.	
Course Content:		
List of Experiments	**Part A** **1.** Printing the reverse of an integer. **2.** Printing the odd and even series of N numbers. **3.** Get a string and convert the lowercase to uppercase and vice--versa using getchar() and putchar(). **4.** Input a string and find the number of each of the vowels appear in the string. **5.** Accept N words and make it as a sentence by inserting blank spaces and a full stop at the end. **6.** Printing the reverse of a string. **Part B** **1.** Searching an element in an array using pointers. **2.** Checking whether the given matrix is an identity matrix or not. **3.** Finding the first N terms of Fibonacci series. **4.** Declare 3 pointer variables to store a character, a character string and an integer respectively. **5.** Input values into these variables. Display the address and the contents of each variable. **6.** Define a structure with three members and display the same. **7.** Declare a union with three members of type integer, char, string and illustrate the use of union. **8.** Recursive program to find the factorial of an integer. **9.** Finding the maximum of 4 numbers by defining a macro for the maximum of two numbers. **10.** Arranging N numbers in ascending and in descending order using bubble sort. **11.** Addition and subtraction of two matrices. **12.** Multiplication of two matrices. **13.** Converting a hexadecimal number into its binary equivalent. **14.** Check whether the given string is a palindrome or not. **15.** Demonstration of bitwise operations. **16.** Applying binary search to a set of N numbers by using a function. **17.** Create a sequential file with three fields: empno, empname, empbasic. Print all the details in a neat format by adding 500 to their basic salary.	
Reference Books:	1. Programming in ANSI C by Balaguruswamy, 3rd Edition, 2005, Tata McGraw Hill.	

	2. Let us C by Yashwant Kanetka, 6th Edition, PBP Publication. 3. The C programming Language by Richie and Kenninghan, 2004, BPB Publication. *** Latest editions of all the suggested books are recommended.**	

Course Code: IAI301	Specialization- AI B.Tech.- Semester-III **Mathematics for Computer Science**	L-3 T-1 P-0 C-4
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the knowledge of computing and mathematics.	
CO2.	Understanding the computing requirements appropriate to the problem solution.	
CO3.	Understanding the concepts of functions and graph.	
CO4.	Understanding the basic principles of probability and random variable.	
CO5.	Applying mathematical foundations, algorithmic principles, and computer science theory in the modelling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.	
Course Content:		
Unit-1:	**Fundamentals:** Sets and subsets, operations on sets, Sequences. Logic: Propositions and Logical Operations, Conditional statements, Methods of proof, Mathematical Induction. Counting: Permutations and combinations, Pigeonhole Principle, Recurrence relations. Relations and Digraphs: Product sets and partitions, relations and digraphs, paths in relations and digraphs, properties of relations, equivalence relations, operations on relations, transitive closure and Warshall‟s algorithm.	**8 Hours**
Unit-2:	**Functions:** Functions for computer science, permutation functions, order relations and structures: partially ordered sets, extremal elements of partially ordered sets, lattices. **Graph Theory-I:** Graphs and graph models, graph terminology and special types of graphs, representing graphs and graph isomorphism, connectivity, Euler and Hamilton paths, Binary operations revisited, semi groups.	**8 Hours**
Unit-3:	**Graph Theory-II:** Coloring Graphs, K-coloring, Bipartite graphs, Planar graphs, Euler's formula, Hall's marriage theorem-A formal statement. **Statistical methods:** Correlation-Karl Pearson's, coefficient of correlation-problems. Regression analysis- lines of regression–problem. Curve fitting by the method of least squares- fitting the curves of the form, $y = ax + b$,$y = ax2 + bx + c$ and $y = ae bx$.	**8 Hours**
Unit-4:	**Probability Theory:** Basic concepts of probability, Axiomatic and frequency definition of probability, Addition and multiplication law of probability, conditional probability and Baye's .Theorem (without proofs).	**8 Hours**
Unit-5:	**Random Variables:** Random variables, types of random variables, probability function, and cumulative distribution function, discrete probability distributions (Binomial and Poisson) and Continuous probability distributions (Exponential and Normal).	**8 Hours**
Text Books:	1 Discrete and Combinatorial Mathematics, Ralph P Grimaldi, 5th	

	Edition. Pearson Education.	
Reference Books:	1. Discrete Mathematical Structures, Kolman, Busby &Ross : 5th Edition, 2006. 2. Discrete Mathematics for Computer Science, Gary Haggard & John SchlipfCengage, Thomson 2006. 3. Higher Engineering Mathematics, B.V.Ramana, 26th Reprint Edition McGraw Hill Education (India) Private Limited, 2016 *** Latest editions of all the suggested books are recommended.**	
Additional electronic reference material:	1. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-042j-mathematics-for-computer-science-fall-2010/video-lectures/ 2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-042j-mathematics-for-computer-science-spring-2015/readings/MIT6_042JS15_textbook.pdf	

Course Code: IAI302	Specialization- AI B.Tech.- Semester-III **Data Structure Using C++**	L-3 T-0 P-0 C-3
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding basic data structures such as arrays, linked lists, stacks and queue.	
CO2.	Understanding the time and space complexities of algorithms.	
CO3.	Understanding the concept of linked list.	
CO4.	Understanding Non-linear Data Structures such as trees.	
CO5.	Applying various algorithms for solving problems like sorting, searching, insertion and deletion of data.	
Course Content:		
Unit-1:	**Introduction to C++ and Data Structures :** Object oriented paradigm - Structured vs. Object Oriented Paradigm - Elements of Object Oriented Programming – Objects – Classes - Information and its Storage representation – Storage of Information – Data Structures – Types of Data Structures - Operations on data Structures. **Linear Data Structure Using Arrays and Pointers** Definition – Terminology – One dimensional Array – Memory Allocation – Operations – Applications - Array as an ADT - Sparse Matrices - Row and Column major representation – Representing Array using Pointers. **Sorting and Searching :** Sorting - Types of Sorting – Insertion – Shell – Heap – Merge – Quick sort – radix Sort. Searching – Linear Search – Binary Search – Case Study.	**8 Hours**
Unit-2:	**Stacks and Queues :** Stacks – Definition – Applications of Stacks – Representation of Stack – Representation of Stack as an ADT - Array representation. Operations on Stacks - Recursion – Evaluation of Arithmetic Expressions – Conversion of Infix to Postfix Notation – Towers of Hanoi problem. **Queues –** Definition – Representation of queues - Array representation – Operations of queues - Types of Queues – Circular queue – Definition – Operations – Applications - Deque – Definition – Operations – Applications - Priority queue - Definition – Operations – Applications – Case Study.	**8 Hours**
Unit-3:	**Linked Lists :** Definitions – Types – Single Linked lists – Representation as an ADT - Operations - Circular Linked list – Operation - Double Linked Lists – Operations - Circular double linked lists - Operations – Applications of Linked lists – Sparse Matrix Manipulation – Polynomial Representation and Manipulation – Case Study	**8 Hours**
Unit-4:	**Trees – Definitions and Concepts –** Types of Binary trees - Operations on Binary trees – Storage Representation and manipulation of Binary Trees – Linear - Linked and Threaded Storage Representation for Binary trees – Conversion of General trees to Binary trees – Sequential and other Representation of trees – Applications – Manipulation of Arithmetic Expressions. AVL Trees – Single & Double	**8 Hours**

	Rotation – Case Study	
Unit-5:	**Graphs :** Graphs and their Representation – Definition, Graph Terminology – Graph Abstract Data Types - Matrix Representation – List Structures – Other Representation - Operations – Traversals - Breadth First Search – Depth first Search – Spanning Trees – Applications – Topological Sorting – Case Study	**8 Hours**
Text Books:	1 Data Structures Using C++, VARSHA H. PATIL, Oxford University Press-2012.	
Reference Books:	1. Data Structures and Algorithm Analysis in C++, Mark Allen Weiss, Second Edition, Pearson Education Asia, 2002. 2. Data Structures, Algorithms and Applications in C++, SartajSahni, Second Edition, Universities Press India Private Limited, 2005. 3. Data Structures Using C++, D.S. MALIK, SECOND EDITION,Cengage Learning, 2009. *** Latest editions of all the suggested books are recommended.**	
Additional electronic reference material:	1. https://www.tutorialspoint.com/cplusplus/cpp_data_structures.htm 2. https://www.includehelp.com/data-structure-tutorial/ 3. https://www.youtube.com/watch?v=AT14lCXuMKI&list=PLdo5W4Nhv31bbKJzrsKfMpo_grxuLl8LU	

Course Code: IAI303	Specialization- AI B.Tech.- Semester-III **Introduction to Artificial intelligence**	L-3 T-0 P-0 C-3
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the basic principle of AI.	
CO2.	Understanding the structure of intelligent system.	
CO3.	Understanding the awareness of informed search and exploration methods.	
CO4.	Understanding the concept of gaming and know the decision making in checker.	
CO5.	Analyzing the problems that are amenable to solution by AI methods.	
Course Content:		
Unit-1:	**General Concept of AI:** Defining AI: AI what and what not?- Basic principle and concept of AI-The intellectual History of AI -Foundations of AI-Frontiers of artificial intelligence-Parallel and distributed AI--AI and the programming platform-Uses and application of AI. Introduction to agent-Agent performance –Example of Agents- Agent Faculties	**8 Hours**
Unit-2:	**Philosophy of AI and Intelligent System:** Can machine think?: 'Turning and testing-The Chinese room. Computation and representation-Applications era of AI-Computationalism-Ethics of AI-Impacts of AI, What is intelligence?-Structure of intelligent system-Biological brain -Basic neural model- Intelligent Agents- Rationality- Agent Environment- Agent architectures-the concept of rationality-The structure of agent-The impact of AI in human labor-AI and the social equality	**8 Hours**
Unit-3:	**Modern AI and Informed search:** Technology that precursors to AI era - The concept of bot-AI and Automation-Super intelligence and AI-paths to super intelligence-Forms of super intelligence-Future impacts of AI-AI programming platforms, State space search- Goal Directed Agent- Search Problem- illustration of search process- eight queens problem-tic tac toe - General state space search-Search Tree- Terminology of search tree-Informed search -Best-first Search-A* search-Hill climbing search-Simulated Annealing-Tabu search.	**8 Hours**
Unit-4:	**Constraint satisfaction problem and Adversarial Search:** Introduction to constraint satisfaction problem- Backtracking Search for constraint satisfaction problem- Local Search for Constraint Satisfaction Problems- The Structure of Problems-Constraint propagation- forward checking-Arc consistency, Introduction to Games- Two player game-Optimal Decisions in Games- Optimal strategies- The minimax algorithm- min max with Tic-Tac-Toe-Optimal decisions in multiplayer games- Alpha-Beta Pruning- min max with Alpha-Beta pruning-Imperfect. Real-Time Decisions-classical AI: checkers-Chess-Othello-Go-Backgammon-Application of AI algorithm in	**8 Hours**

	Video Game	
Unit-5:	**Uninformed search :** Search and AI -Define Uninformed Search- Depth first search (DFS)-Example of DFS-Depth Limited Search-algorithm with example-(BFS) Breadth first search – Example of Breadth first search-Properties of BFS-Pros and Cons of BFS-Low Cost First Search- example of low cost first search- Iterative deepening Search-Bidirectional search-Time and space complexities-Uniform cost search.	**8 Hours**
Text Books:	1 Artificial-Intelligence-By-Rich-And-Knight	
Reference Books:	1. D. Poole, Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010. 2. Padhy N.P.: "Artificial Intelligence and Intelligent Systems", 4th impression, Oxford University Press, 2007. 3. Kevin Warwick Artificial intelligence 4. Artificial intelligence A systems approach by M.Tim Jones *** Latest editions of all the suggested books are recommended.**	
Additional electronic reference material:	1. https://www.tutorialspoint.com/artificial_intelligence/index.htm 2. https://www.youtube.com/watch?v=JMUxmLyrhSk	

Course Code: IAI304	Specialization- AI B.Tech.- Semester-III **Computer Architecture and Organizations**	L-3 T-0 P-0 C-3
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the register transfer and micro-operation.	
CO2.	Understanding the basic computer organization.	
CO3.	Understanding the various modes of data transfer.	
CO4.	Understanding the system architecture of multiprocessor and multicomputer.	
CO5.	Analyzing the memory organization and I/O systems.	
Course Content:		
Unit-1:	**Register Transfer and Micro-operation :** Register Transfer Language, Register Transfer, Bus and Memory Transfer: Three state bus buffers, Memory Transfer, Arithmetic Micro-operations: Binary Adder, Binary Adder-Subtractor, Binary Incrementer, Logic Micro-operations: List of Logic micro Operations, Shift Micro-operations (excluding H/W implementation), Arithmetic Logic Shift Unit.	**8 Hours**
Unit-2:	**Basic Computer Organization :** Codes, Computer Registers: Common bus system, Computer Instructions: Instruction formats, Instruction Cycle: Fetch and Decode, Flowchart for Instruction cycle. Register reference instructions. Control Memory, Address Sequencing, Conditional branching, Mapping of instruction, Subroutines, Design of Control Unit	**8 Hours**
Unit-3:	**Central Processing Unit :** Central Processing Unit: Introduction, General Register Organization, Stack Organization: Register stack, Memory stack; Instruction Formats, Addressing Modes. CISC & RISC	**8 Hours**
Unit-4:	**Computer Arithmetic & I/O Organization :** Introduction, Addition and Subtraction, Multiplication Algorithms (Booth algorithm), Division Algorithms, Input – Output Organization: Peripheral devices, Input – Output interface, Introduction of Multiprocessors: Characteristics of multi-processors. Modes of Data Transfer, Priority Interrupt, Direct Memory Access	**8 Hours**
Unit-5:	**Memory Organization :** Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative, Memory, Cache Memory, Virtual Memory	**8 Hours**
Text Books:	1 Computer System Architecture by Morris Mano, PHI Publication	
Reference Books:	1 Fundamentals of Computer Organization and Architecture by Mostafa AB-EL-BARR and Hesham EL-REWNI, John Wiley and Sons 2 Fundamental Of computer Organization by Albert Zomaya, 2010	

	Edition 3 Computer Organization and Architecture by William Stallings, PHI Publication 4 Digital Computer Electronics: An Introduction to Microcomputers by Malvino, Tata McGraw Hill Publication *** Latest editions of all the suggested books are recommended.**	
Additional electronic reference material:	1 https://www.geeksforgeeks.org/computer-organization-and-architecture-tutorials/ 2 http://www.svecw.edu.in/Docs%5CITIIBTechIISemLecCOA.pdf	

Course Code: IAI305	Specialization- AI B.Tech.- Semester-III **OOPS WITH JAVA**	L-3 T-0 P-0 C-3
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding of Java-based software code of medium-to-high complexity.	
CO2.	Understanding of the basic principles of creating Java applications with graphical user interface (GUI).	
CO3.	Understanding of the fundamental concepts of computer science: structure of the computational process, algorithms and complexity of computation.	
CO4.	Understanding the basic approaches to the design of software applications.	
CO5.	Applying various programming concepts to create a Java application.	
Course Content:		
Unit-1:	**Introduction :** History, Overview of Java, Object Oriented Programming, A simple Program, Two control statements - if statement, for loop, using Blocks of codes, Lexical issues - White space, identifiers, Literals, comments, separators, Java Key words. Data types: Integers, Floating point, characters, Boolean, A closer look at Literals, Variables, Type conversion and casting, Automatic type promotion in Expressions Arrays. Operators: Arithmetic operators, The Bit wise operators, Relational Operators, Boolean Logical operators, Assignment Operator, Operator Precedence. Control Statements: Selection Statements - if, Switch: Iteration Statements - While, Do-while, for Nested loops, Jump statements.	**8 Hours**
Unit-2:	**Classes:** Class Fundamentals, Declaring objects, Assigning object reference variables, Methods, constructors, "this" keyword, finalize ( ) method A stack class, Over loading methods, using objects as parameters, Argument passing, Returning objects, Recursion, Access control, Introducing final, understanding static, Introducing Nested and Inner classes, Using command line arguments. Inheritance: Inheritance basics, Using super, method overriding, Dynamic method Dispatch, using abstract classes, using final with Inheritance.	**8 Hours**
Unit-3:	**Packages :** Definition, Access protection importing packages, Interfaces: Definition implementing interfaces. Exception Handling: Fundamental, Exception types, Using try and catch, Multiple catch clauses, Nested try Statements, throw, throws, finally, Java's Built - in exception, using Exceptions.	**8 Hours**
Unit-4:	**Multithreaded Programming :** The Java thread model, The main thread, Creating a thread, Creating multiple thread, Creating a thread, Creating multiple threads, Using isalive() and Join(), Thread - Priorities, Synchronization, Inter thread communication, suspending, resuming and	**8 Hours**

	stopping threads, using multi-threading. 1/0 basics, Reading control input, writing control output, Reading and Writing files, Applet Fundamentals, the AWT package, AWT Event handling concepts The transient and volatile modifiers, using instance of using assert.	
Unit-5:	**Unit V: JAVA Database Connectivity (JDBC)** Database connectivity: JDBC architecture, JDBC Drivers, the JDBC API: loading a driver, connecting to a database, Creating and executing JDBC statements, Handling SQL exceptions, Accessing result sets: Types of result sets, Methods of result set interface. An example JDBC application to query a database	**8 Hours**
Text Books:	1 The complete reference Java –2: V Edition by Herbert Schildt Pub. TMH.	
Reference Books:	1 Personality Development & Soft Skills,Barun K. Mitra,Oxford University Press. 2 Introduction to Java Programming (Comprehensive Version), Daniel Liang, Seventh Edition, Pearson 3 Core Java Volume-I Fundamentals, Eight Edition, Horstmann & Cornell, Pearson Education *** Latest editions of all the suggested books are recommended.**	
Additional electronic reference material:	1. https://www.javatpoint.com/java-tutorial 2. https://www.iitk.ac.in/esc101/share/downloads/javanotes5.pdf	

Course Code: TMUGE301	**Specialization- AI** **B.Tech.- Semester-III** **English Communication - III**	**L-2 T-0 P-2 C-3**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Remembering and understanding the English grammar and vocabulary.	
CO2.	Understanding the art of public speaking and strategies of reading comprehension.	
CO3.	Applying correct vocabulary and sentence construction during public speaking or professional writing.	
CO4.	Analyzing different types of sentences like simple, compound and complex.	
CO5.	Drafting notice, agenda and minutes of the meeting.	
CO6	Demonstrating speaking skills during common conversation and power point presentation.	
Course Content:		
Unit-1:	**English Grammar & Vocabulary :** Correction of Common Errors (with recap of English Grammar with its usage in practical context.) Synthesis : Simple , complex and compound sentence Commonly used Idioms & phrases (Progressive learning whole semester)	**14 Hours**
Unit-2:	**Speaking Skills :** Art of public speaking Common coversation Extempore Power Point Presentation (PPt) Skills: Nuances of presenting PPTs	**10 Hours**
Unit-3:	**Comprehension Skills :** Strategies of Reading comprehension: Four S's How to solve a Comprehension (Short unseen passage: 150-200 words)	**6 Hours**
Unit-4:	**Professional Writing :** Preparing Notice,Agenda & Minutes of the Meeting	**3 Hours**
Unit-5:	**Value based text reading: Short story :** The Barber's Trade Union – Mulk Raj Anand	**7 Hours**
Text Books:	1 Singh R.P., An Anthology of Short stories, O.U.P. New Delhi.	

Reference Books:	1 Allen, W. "Living English Structure" Pearson Education, New Delhi. 2 Joseph, Dr C.J. & Myall E.G. "A Comprehensive Grammar of Current English" Inter University Press, Delhi 3 Chaudhary, Sarla "Basic Concept of Professional Communication" Dhanpat Rai Publication, New Delhi. 4 Kumar Sanjay &Pushplata "Communication Skills" Oxford University Press, New Delhi. 5 Agrawal, Malti "Professional Communication" KrishanaPrakashan Media (P) Ltd. Meerut.	
Additional Electronic Reference Material:	1. https://www.youtube.com/watch?v=6xFaXIwwq0s&list=PLzJaFd3A7DZtnTdtOxvjO3GLPd1WVe6oq 2. https://www.youtube.com/watch?v=0AM35Nu5McY&list=PLwytTXNlljX6cEAsR1TsbKpEwGSJieaQ9	

Methodologies:

1. Idiom & Phrases and exercises, usage in sentences.
2. Language Lab software.
3. Power Point presentation.
4. Newspaper reading, short articles from newspaper to comprehend and short movies.
5. Modern Teaching tools (PPT Presentation & Motivational videos with sub-titles) will be utilized.
6. Text reading : discussion in detail, Critical appreciation by reading the text to develop students' reading habits with voice modulation.

Note:

- Class (above 30 students) will be divided in to two groups for effective teaching.
- For effective conversation practice, groups will be changed weekly.

Evaluation Scheme

Internal Evaluation			External Evaluation		Total Marks
40 Marks			60 Marks		100
20 Marks (Best 2 out of Three CTs) ***(From Unit- I, III,IV & V)***	10 Marks (Oral Assignments) ***(Unit –II)***	10 Marks (Attendance)	40 Marks (External Written Examination) ***(From Unit- I, III,IV & V)***	20 Marks (External Viva)* ***(Unit –II)***	

*Parameters of External Viva

Content	Body Language	Communication skills	Confidence	TOTAL
05 Marks	05 Marks	05 Marks	05 Marks	20 Marks

Note: External Viva will be conducted by 2-member committee comprising

a) One Faculty teaching the class

b) One examiner nominated by University Examination cell.

Each member will evaluate on a scale of 20 marks and the average of two would be the 20 marks obtained by the students.

Course Code: IAI351	Specialization- AI B.Tech.- Semester-III **Data Structure Using C++ (Lab)**	L-0 T-0 P-4 C-2
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding appropriate data structures as applied to specified problem definition	
CO2.	Applying various programming approaches to solve data structure problems.	
CO3.	Analyzing various data structure algorithms.	
CO4.	Creating appropriate searching technique for given problem.	
CO5.	Creating appropriate sorting technique for given problem.	
Course Content:	**Perform any ten experiments selecting at least one from each shop**	
List of Experiments	6 Manipulate data elements like adding, deleting and searching elements using Arrays. 7 Perform stack operations using Classes. 8 Evaluate postfix expression for simple binary arithmetic operations using stack. 9 Perform operations of a Circular Queue using classes and linked list. 10 Perform operations on Single Linked list using classes. 11 Perform operations on doubly linked list using classes. 12 Implement of Polynomial Manipulation using Linked list. 13 Construct a binary tree and perform all traversal operations. 14 Implement C++ program to perform graph traversals. 15 Implement C++ program for Quick Sort and Binary Search using classes.	

Course Code: IAI352	Specialization- AI B.Tech.- Semester-III **OOPS With Java (Lab)**	L-0 T-0 P-4 C-2
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the concepts of OOPs in Java	
CO2.	Understanding the concepts abstract classes and string operations.	
CO3.	Applying the various programming concepts to solve given problems.	
CO4.	Creating the Applet using java programs.	
CO5.	Creating the Client Server Communication using Socket Programming.	
Course Content:	**Perform any ten experiments selecting at least one from each shop**	
List of Experiments	1) Demonstrate Constructor Overloading and Method Overloading in JAVA. 2) Implement the following: i) An abstract class "Shape" with the following properties: an instance variable shape Name of type String, an abstract method area (), a toString () method that returns the name of the shape. ii) Create a subclass named "Sphere" which has radius and its area given by the formula 4*PI*r^2. iii) Create a subclass named "Rectangle" which has length and width and its area is length times width. iv) Create a subclass named "Triangle" which has base and height and its area is ½*base*height. v) Create an another class which displays the calculated area. 3) Perform the following operations: i) Check the length and capacity of String and StringBuffer objects ii) Reverse the contents of a string given on console and convert the resultant string in Upper Case. iii) Input a string from the console and append it to above resultant string. iv) Extract the substring from resultant string. 4) Create the following: i) A class "Account" with minimum balance 1000rs, deposit () method to deposit amount, withdraw () method to withdraw amount and also throws LessBalanceException if an account holder tries to withdraw money which makes the balance less than 1000rs.	

	ii) A class "LessBalanceException" which returns the statement that says "withdraw amount (__ rs) is not valid". iii) A class which creates 2 accounts through which both deposit and withdraw operations are performed. Appropriate action has to be taken for LessBalanceException. 5) Implement Linear Queue using user defined exception handling (also use 'throw' and 'throws' keyword) 6) Implement the concept of Producer Consumer using synchronized threads. 7) Create the following: i) Create an Interface for 'Stack' operations. ii) A class that implements the Stack interface and create a fixed length stack. iii) A class that implements the Stack interface and create a dynamic length stack. iv) A class that uses the above stacks through interface reference and does the stack Operations that demonstrates the runtime binding 8) Develop the following: i) Create a package named "Calculator". ii) Create some classes in the package representing some common operations like Addition, subtraction, multiplication and division. iii) Import and compile these classes in other program. 9) a) Write an Applet program to scroll the user specified message from left to right. b) Write an Applet program to pass parameters to Applet and display the same. 10) Using File I/O streams, write a program to demonstrate file operations. 11) Implement Client Server Communication using Socket Programming. 12) Write a Swing Application which uses: i) JTabbed Pane ii) Each Tab should use JPanel, which includes any one component given below in each Panel iii) ComboBox / List / Tree / Radiobutton	

Course Code: IAI353	Specialization- AI B.Tech.- Semester-III **Project**	L-0 T-0 P-2 C-1
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding methodologies and professional way of documentation and communication.	
CO2.	Understanding about software development cycle with emphasis on different processes -requirements, design, and implementation phases.	
CO3.	Analyzing a software project and demonstrate the ability to communicate effectively in speech and writing.	
CO4.	Creating a new model over the selected field of research that will be useful for future activities.	
CO5.	Creating a project that help to gain confidence and technical knowledge.	
Course Content:		
Guidelines for Seminar:	● **Selection of topic:** All students who are pursuing B.Tech shall submit the proposed topic of the seminar in the first week of the semester to the course coordinator. Care should be taken that the topic selected does not directly relate to the course of the courses being pursued. The course coordinator shall then forward the list to the concerned Seminar Committee. The topics will then be allocated to the students along with the name of the faculty guide. **Preparation of the seminar** 1. The student shall meet the guide for the necessary guidance for the seminar work. 2. During the next two to four weeks the student should read the primary literature germane to the seminar topic. Reading selection should continuously be informed to the guide. 3. After necessary collection of data and literature survey, the students must prepare a report. The report shall be arranged in the sequence consisting of the following:- a. Top Sheet of transparent plastic. b. Top cover. c. Preliminary pages. i. Title page ii. Certification page. iii. Acknowledgment. iv. Abstract. v. Table of Content. vi. List of Figures and Tables. d. Chapters (Main Material). e. Appendices, If any. f. Bibliography/ References. g. Back Cover (Blank sheet). h. Back Sheet of Plastic (May be opaque or transparent).	

	For Guide If you choose not to sign the acceptance certificate, please indicate reasons for the same from amongst those given below: i) The amount of time and effort put in by the student is not sufficient; ii) The amount of work put in by the student is not adequate iii) The report does not represent the actual work that was done / expected to be done; iii) Any other objection (Please elaborate) **General points for the seminar** 1. The report should be typed on A4 sheet. The Paper should be of 70-90 GSM. 2. Each page should have minimum margins as under a. Left 1.5 inches b. Right 0.5 Inches c. Top 1 Inch d. Bottom 1 Inch (Excluding Footer, If any) 3. The printing should be only on one side of the paper 4. The font for normal text should Times New Roman, 12 size for text and 14 size for heading and should be typed in double space. The references may be printed in Italics or in a different font. 5. The Total Report should not exceed 30 pages including top cover and blank pages. 6. One copy completed in all respect as given above is to be submitted to the guide. That will be kept in departmental/University Library. 7. The power point presentation should not exceed 15 minutes which include 5 minutes for discussion/Viva. Seminar will be evaluated out of total 100 marks. In Internal Evaluation marks will be awarded out of 50 and in external evaluation also marks will be awarded out of 50 on the basis of viva voce. Internal evaluation will be exercised by the Internal Evaluation Committee of college.	
Guidelines for Project :	Students will have to undergo industrial training of six weeks in any industry or reputed organization after the IV semester examination in summer. The evaluation of this training shall be included in the V semester evaluation. The student will be assigned a faculty guide who would be the supervisor of the student. The faculty would be identified before the end of the IV semester and shall be the nodal officer for coordination of the training. Students will prepare an exhaustive technical report of the training during the V semester which will be duly signed by the officer under whom training was undertaken in the industry/ organization. The covering format shall be signed by the concerned office in-charge of the training in the industry. The officer-in-charge of the trainee would also give his rating of the student in the standard University format in a sealed envelope to the Principal of the college. The student at the end of the V semester will present his report about the training before a committee constituted by the Director of the College which would	

	comprise of at least three members comprising of the Department Coordinator, Class Coordinator and a nominee of the Director. The students guide would be a special invitee to the presentation. The seminar session shall be an open house session. The internal marks would be the average of the marks given by each member of the committee separately in a sealed envelope to the Director. The marks by the external examiner would be based on the report submitted by the student which shall be evaluated by the external examiner and cross examination done of the student concerned. Not more than three students would form a group for such industrial training/ project submission. **The marking shall be as follows.** Internal: 50 Marks By the faculty guide - 25 marks By committee appointed by the director – 25 marks External: 50 Marks By officer-in-charge trainee in industry – 25 marks By external examiner appointed by the university – 25 marks	

Course Code: **TMUGA301**	**Specialization- AI** **B.Tech.- Semester-III** **Foundation in Quantitative Aptitude (Value Added Course)**	**L-2** **T-1** **P-0** **C-0**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Solving complex problems using Criss cross method, base method and square techniques.	
CO2.	Applying the arithmetical concepts of Average, Mixture and Allegation.	
CO3.	Evaluating the different possibilities of various reasoning based problems in series, Blood relation, Ranking and Direction.	
CO4.	Operationalizing the inter-related concept of Percentage in Profit Loss and Discount, Si/CI and Mixture/Allegation.	
Course Content:		
Unit 1:-	**Speed calculations** Squares till 1000,square root, multiplications: base 100, 200 300 etc., 11-19, crisscross method for 2X2, 3X3, 4X4, 2X3, 2X4 etc., cubes, cube root	**2 Hours**
Unit 2:-	**Percentages** Basic calculation, ratio equivalent, base, change of base, multiplying factor, percentage change, increment, decrement, successive percentages, word problems	**5 Hours**
Unit 3:-	**Profit Loss Discount** Basic definition, formula, concept of mark up, discount, relation with successive change, faulty weights	**5 Hours**
Unit 4:-	**SI and CI** Simple Interest, finding time and rate, Compound Interest, difference between SI and CI, Installments	**2 Hours**
Unit 5:-	**Averages** Basic Averages, Concept of Distribution, Weighted Average, equations	**2 Hours**
Unit 6:-	**Mixtures and allegations** Mixtures of 2 components, mixtures of 3 components, Replacements	**4 Hours**
Unit 7:-	**Number and alphabet series** Number series, alphabet series	**2 Hours**
Unit 8:-	**Blood relations** Indicating type, operator type, family tree type	**2 Hours**
Unit 9:-	**Ranking** Linear ranking, complex ranking	**1 Hours**
Unit 10:-	**Direction sense** Simple statements, shadow type	**1 Hours**
Unit 11:-	**Cubes and dices** Concept of cubes, rotation type, Dices, regular dices, irregular dices	**4 Hours**
Reference Books:	• R1:-Arun Shrama:- How to Prepare for Quantitative Aptitude • R2:-Quantitative Aptitude by R.S. Agrawal • R3:-M Tyra: Quicker Maths	

	• R4:-Nishith K Sinha:- Quantitative Aptitude for CAT • R5:-Reference website:- Lofoya.com, gmatclub.com, cracku.in, handakafunda.com, tathagat.mba, Indiabix.com • R6:-Logical Reasoning by Nishith K Sinha • R7:-Verbal and Non Verbal Reasoning by R.S. Agrawal *** Latest editions of all the suggested books are recommended.**	

Evaluation Scheme for Quantitative Aptitude Skill Enhancement:-

a. The students will be evaluated on the score of 100 for every semester. Detailed scheme for the course is as follows.

b. 20 marks best 2 out of CT1 + CT2 + CT3

c. 10 marks will be for Assignments.

d. 10 marks for attendance and practice sheets, at the end of semester, will be provided in the following manner.

e. 60 marks for final external exams.

S No	% Attendance <	Marks
1.	0-10	1
2.	10 -20	2
3.	20- 30	3
4.	30-40	4
5.	40-50	5
6.	50-60	6
7.	60 – 70	7
8.	70 – 80	8
9.	80 – 90	9
10.	90-100	10

From {CT 1, CT 2 and CT 3} Best 2 CT's Score (20) + Final External exam (60) + Attendance (10)+ Assignment(10) = 100 marks.

Course Code: IAI401	**Specialization- AI** **B.Tech.- Semester-IV** **Database Management System**	**L-3** **T-0** **P-0** **C-3**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the basic concepts of database management system.	
CO2.	Understanding the concepts DBMS and RDBMS.	
CO3.	Understanding various Structure Query Languages and various Normal forms to carry out Schema refinement.	
CO4.	Understanding various concurrency control protocols.	
CO5.	Creating Entity-Relationship Model for enterprise level databases.	
Course Content:		
Unit-1:	**Introduction:** Purpose of Database System –– Views of data – Data Models – Database Languages –– Database System Architecture – Database users and Administrator – Entity– Relationship model (E-R model) – E-R Diagrams -- Introduction to relational databases.	**8 Hours**
Unit-2:	**Relational Model:** The relational Model – The catalog- Types– Keys - Relational Algebra – Domain Relational Calculus – Tuple Relational Calculus - Fundamental operations – Additional Operations- SQL fundamentals.	**8 Hours**
Unit-3:	**Data Types:** Oracle data types, Data Constraints, Column level & table Level Constraints, working with Tables. Defining different constraints on the table, Defining Integrity Constraints in the ALTER TABLE Command, Select Command, Logical Operator, Range Searching, Pattern Matching, Oracle Function, Grouping data from Tables in SQL, Manipulation Data in SQL. Joining Multiple Tables (Equi Joins), Joining a Table to itself (self Joins), Sub queries Union, intersect & Minus Clause, Creating view, Renaming the Column of a view, Granting Permissions, - Updating, Selection, Destroying view Creating Indexes, Creating and managing User Integrity – Triggers - Security – Advanced SQL features –Embedded SQL– Dynamic SQL- Missing Information– Views – Introduction to Distributed Databases and Client/Server Databases.	**8 Hours**
Unit-4:	**Database Design:** Functional Dependencies – Non-loss Decomposition – Functional Dependencies – First, Second, Third Normal Forms, Dependency Preservation – Boyce Codd Normal Form-Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form.	**8 Hours**
Unit-5:	**Transactions:** Transaction Concepts - Transaction Recovery – ACID Properties – System Recovery – Media Recovery – Two Phase Commit - Save Points – SQL Facilities for recovery –Concurrency – Need for Concurrency – Locking Protocols – Two Phase Locking – Intent Locking –	**8 Hours**

	Deadlock- Serializability – Recovery Isolation Levels – SQL Facilities for Concurrency.	
Text Books:	1 Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Fifth Edition, Tata McGraw Hill, 2006	
Reference Books:	1 Raghu Ramakrishnan, "Database Management Systems", Third Edition, McGraw Hill, 2003. 2 RamezElmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Fourth Edition, Pearson/Addision Wesley, 2007. *** Latest editions of all the suggested books are recommended.**	
Additional Electronic Reference Material:	1 https://www.javatpoint.com/dbms-tutorial 2 http://www.ddegjust.ac.in/studymaterial/mca-3/ms-11.pdf	

Course Code: IAI402	**Specialization- AI** **B.Tech.- Semester-IV** **Operating System**	**L-3 T-0 P-0 C-3**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the fundamental concepts in Operating system	
CO2.	Understanding evolution of OS over the years and different components of OS	
CO3.	Understanding the significant functions of OS like Process management, storage and memory management etc.	
CO4.	Understanding the necessary information of the OS while developing programs, working with applications and etc.	
CO5.	Analysing the different type of Operating System and their working.	
Course Content:		
Unit-1:	**Introduction to Operating System:** Introduction, Objectives and Functions of OS, Evolution of OS, OS Structures, OS Components, OS Services, System calls, System programs, Virtual Machines.	**8 Hours**
Unit-2:	**Process Management:** Processes: Process concept, Process scheduling, Co-operating processes, Operations on processes, Inter process communication, Communication in client-server systems. Threads: Introduction to Threads, Single and Multi-threaded processes and its benefits, User and Kernel threads, Multithreading models, threading issues. CPU Scheduling: Basic concepts, Scheduling criteria, Scheduling Algorithms, Multiple Processor Scheduling, Real-time Scheduling, Algorithm Evaluation, Process Scheduling Models. Process Synchronization: Mutual Exclusion, Critical – section problem, Synchronization hardware, Semaphores, Classic problems of synchronization, Critical Regions, Monitors, OS Synchronization, Atomic Transactions Deadlocks: System Model, Deadlock characterization, Methods for handling Deadlocks, Deadlock prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.	**8 Hours**
Unit-3:	**Storage Management:** Memory Management: Logical and physical Address Space, Swapping, Contiguous Memory Allocation, Paging, Segmentation with Paging. Virtual Management: Demand paging, Process creation, Page Replacement Algorithms, Allocation of Frames, Thrashing, Operating System Examples, Page size and other considerations, Demand segmentation File-System Interface: File concept, Access Methods, Directory structure, File- system Mounting, File sharing, Protection and consistency semantics.	**8 Hours**
Unit-4:	**File-System Implementation:** File-System structure, File-System Implementations, Directory Implementation, Allocation Methods, Free-space Management, Efficiency and Performance, Recovery Disk Management: Disk Structure, Disk Scheduling, Disk Management, Swap-Space Management, Disk Attachment, stable-storage Implementation**.**	**8 Hours**
Unit-5:	**Protection and Security:** Protection: Goals of Protection, Domain of Protection, Access Matrix, and Implementation of Acess Matrix, Revocation of Access Rights, Capability-Based Systems, and Language – Based Protection. Security: Security Problem, User Authentication, One – Time Password, Program Threats, System Threats, Cryptography, Computer – Security Classifications.	**8 Hours**

Text Books:	1 Milan Milonkovic, Operating System Concepts and design, II Edition, McGraw Hill 1992.	
Reference Books:	1 William Stallings, Operating System, 4th Edition, Pearson Education. 2 H.M.Deitel, Operating systems, 2nd Edition ,Pearson Education 3 Nutt: Operating Systems, 3/e Pearson Education 2004. *** Latest editions of all the suggested books are recommended.**	
Additional Electronic Reference Material:	1. https://www.javatpoint.com/os-tutorial 2. http://mailamtamilartscollege.com/EContent/ComputerScience/OPERATING-SYSTEM.pdf	

Course Code: IAI403	**Specialization- AI** **B.Tech.- Semester-IV** **Python Programming**	**L-3 T-0 P-0 C-3**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the basic concepts of python programming.	
CO2.	Understanding programs using simple Python statements and expressions.	
CO3.	Understanding the concepts of control flow and functions in Python for solving problems.	
CO4.	Understanding Python data structures – lists, tuples & dictionaries	
CO5.	Applying various programming approaches in Python for solving problems.	
Course Content:		
Unit-1:	**Introduction to Python Environment :** History and development of Python, Why Python? Grasping Python's core philosophy, Discovering present and future development goals, Working with Python : Getting a taste of the language, Understanding the need for indentation, Working at the command line or in the IDE, Visualizing Power, Using the Python Ecosystem for Data Science, Accessing scientific tools using SciPy, Performing fundamental scientific computing using NumPy, Performing data analysis using pandas, Implementing machine learning using Scikit- learn, Plotting the data using matplotlib, Parsing HTML documents using Beautiful Soup, Setting Up Python for Data Science, Getting Continuum Analytics Anaconda, Getting Enthought Canopy Express, Getting pythonxy, Getting WinPython, Installing Anaconda on Windows, Linux and MAC.	**8 Hours**
Unit-2:	**Data Structures, Looping and Branching :** Working with Numbers and Logic, Performing variable assignments, Doing arithmetic, Comparing data using Boolean expressions, Creating and Using Strings, Interacting with Dates, Creating and Using Functions, Calling functions in a variety of ways, Using Conditional and Loop Statements, Making decisions using the if statement, Choosing between multiple options using nested decisions, Performing repetitive tasks using for, Using the while statement, Storing Data Using Sets, Lists, and Tuples : Performing operations on sets, Working with lists, Creating and using Tuples, Defining Useful Iterators, Indexing Data Using Dictionaries.	**8 Hours**
Unit-3:	**Data Management :** Working with Real Data, Working with Real Data, Uploading small amounts of data into memory, Streaming large amounts of data into memory, Sampling data, Accessing Data in Structured Flat- File Form, Sending Data in Unstructured File Form, Managing Data from Relational Databases, Interacting with Data from NoSQL Databases, Accessing Data from the Web, Juggling between NumPy and pandas, Validating Your Data, Removing duplicates, Manipulating Categorical Variables, Dealing with Dates in Your Data, Dealing with Missing Data, Slicing and Dicing: Filtering and Selecting Data, Concatenating and Transforming Working with HTML Pages, Working with Raw Text, Working with Graph Data.	**8 Hours**

Unit-4:	**Data Transformation :** Understanding classes in Scikit- learn, Playing with Scikit- learn, Defining applications for data science, Performing the Hashing Trick, Using hash functions, Demonstrating the hashing trick, Working with deterministic selection, Considering Timing and Performance, Benchmarking with timeit, Working with the memory profiler, Performing multicore parallelism, Demonstrating multiprocessing.	**8 Hours**
Unit-5:	**Python for Statistics :** Exploring Data Analysis, The EDA Approach, Defining Descriptive Statistics for Numeric Data, Measuring central tendency, Measuring variance and range, Working with percentiles, Defining measures of normality, Counting for Categorical Data, Understanding frequencies, Creating contingency tables, Creating Applied Visualization for EDA, Inspecting boxplots, Performing t- tests after boxplots, Observing parallel coordinates, Graphing distributions, Plotting scatterplots, Using covariance and correlation, Using nonparametric correlation, Considering chi- square for tables, Using the normal distribution, Creating a Z- score standardization, Transforming other notable distributions, Detecting Outliers in Data, Clustering, Reducing dimensionality.	**8 Hours**
Text Books:	1 Python for Data Science for Dummies - Luca Massaron and John Paul Mueller, John Wiley & Sons, Inc.	
Reference Books:	1 Python for Data Analysis - Wes McKinney, O'Reilly Media, Inc. 2 Data Science from Scratch - Joel Grus, O'Reilly Media, Inc. 3 Python Scripting for Computational Science - Hans Petter Langtangen *** Latest editions of all the suggested books are recommended.**	
Additional Electronic Reference Material:	1. https://www.tutorialspoint.com/python_data_science/index.htm 2. http://dl.booktolearn.com/ebooks2/computer/python/9781498742092_Data_Science_and_Analytics_with_Python_2b29.pdf	

Course Code: **IAI404**	**Specialization- AI** **B.Tech.- Semester-IV** **Computer Networks**	**L-3** **T-0** **P-0** **C-3**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the concepts of Network fundamentals.	
CO2.	Understanding the basics of Network Devices and their uses.	
CO3.	Understanding the concepts of various Network Layers and its importance.	
CO4.	Understanding the various Network Technologies and Topologies.	
CO5.	Analysing various Operating Systems and Troubleshooting Network.	
Course Content:		
Unit-1:	**Networking Fundamentals:** Basics of Network & Networking, Advantages of Networking, Types of Networks, Network Terms- Host, Workstations, Server, Client, Node, Types of Network Architecture- Peer-to-Peer & Client/Server, Workgroup Vs. Domain. Network Topologies, Types of Topologies, Logical and physical topologies, selecting the Right Topology, Types of Transmission Media, Communication Modes, Wiring Standards and Cabling- straight through cable, crossover cable, rollover cable, media connectors (Fibre optic, Coaxial, and TP etc.) Introduction of OSI model, Seven layers of OSI model, Functions of the seven layers, Introduction of TCP/IP Model, TCP, UDP, IP, ICMP, ARP/RARP, Comparison between OSI model & TCP/IP model. Overview of Ethernet Addresses	**8 Hours**
Unit-2:	**Basics of Network Devices :** Network Devices- NIC- functions of NIC, installing NIC, Hub, Switch, Bridge, Router, Gateways, And Other Networking Devices, Repeater, CSU/DSU, and modem, Data Link Layer: Ethernet, Ethernet standards, Ethernet Components, Point-to-Point Protocol(PPP),PPP standards, Address Resolution Protocol, Message format, transactions, Wireless Networking: Wireless Technology, Benefits of Wireless Technology, Types of Wireless Networks: Ad-hoc mode, Infrastructure mode, Wireless network Components: Wireless Access Points, Wireless NICs, wireless LAN standards: IEEE 802.11a, IEEE 802.11b, IEEE 802.11g, wireless LAN modulation techniques, wireless security Protocols: WEP,WPA, 802.1X, Installing a wireless LAN.	**8 Hours**
Unit-3:	**Basics of Network, Transport and Application Layers :** Network Layer: Internet Protocol (IP), IP standards, versions, functions, IPv4 addressing, IPv4 address Classes, IPv4 address types, Subnet Mask, Default Gateway, Public & Private IP Address, methods of assigning IP address, IPv6 address, types, assignment, Data encapsulation, The IPv4 Datagram Format, The IPv6 Datagram Format, Internet Control Message Protocol (ICMP), ICMPv4, ICMPv6, Internet Group Management Protocol (IGMP),Introduction to Routing and Switching concepts, Transport Layer: Transmission Control Protocol(TCP), User Datagram Protocol (UDP),	**8 Hours**

	Overview of Ports & Sockets, Application Layer: DHCP, DNS, HTTP/HTTPS, FTP, TFTP, SFTP, Telnet, Email: SMTP, POP3/IMAP, NTP.	
Unit-4:	**WAN Technology :** What Is a WAN?, WAN Switching, WAN Switching techniques Circuit Switching, Packet Switching etc., Connecting to the Internet : PSTN, ISDN, DSL, CATV, Satellite-Based Services, Last Mile Fiber, Cellular Technologies, Connecting LANs : Leased Lines, SONET/SDH, Packet Switching, Remote Access: Dial-up Remote Access, Virtual Private Networking, SSL VPN, Remote Terminal Emulation, Network security: Authentication and Authorization, Tunneling and Encryption Protocols, IPSec, SSL and TLS, Firewall, Other Security Appliances, Security Threats.	**8 Hours**
Unit-5:	**Network Operating Systems and Troubleshooting Network :** Network Operating Systems: Microsoft Operating Systems, Novell NetWare, UNIX and Linux Operating Systems, Macintosh Networking, Trouble Shooting Networks: Command-Line interface Tools, Network and Internet Troubleshooting, Basic Network Troubleshooting : Troubleshooting Model, identify the affected area, probable cause, implement a solution, test the result, recognize the potential effects of the solution, document the solution, Using Network Utilities: ping, traceroute, tracert, ipconfig, arp, nslookup, netstat, nbtstat, Hardware trouble shooting tools, system monitoring tools.	**8 Hours**
Text Books:	1 CCNA Cisco Certified Network Associate: Study Guide (With CD) 7th Edition (Paperback), Wiley India, 2011	
Reference Books:	1 Routing Protocols and Concepts CCNA Exploration Companion Guide (With CD) (Paperback), Pearson, 2008 2 CCNA Exploration Course Booklet: Routing Protocols and Concepts, Version 4.0 (Paperback), Pearson, 2010. *** Latest editions of all the suggested books are recommended.**	
Additional Electronic Reference Material:	1. https://www.javatpoint.com/types-of-computer-network 2.https://www.youtube.com/watch?v=UXMIxCYZu8o&ab_channel=GateLecturesbyRavindrababuRavula	

Course Code: TMUGE401	**Specialization- AI** **B.Tech.- Semester-IV** **English Communication – IV**	**L-2 T-0 P-2 C-3**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Remembering and understanding the English grammar and vocabulary.	
CO2.	Understanding the essentials of effective listening and speaking.	
CO3.	Understanding the corporate expectations and professional ethics.	
CO4.	Applying correct vocabulary and sentence construction during professional writing or job interviews.	
CO5.	Analyzing different types of interviews.	
CO6.	Drafting resume, C.V. or cover letter.	
Course Content:		
Unit-1:	**Vocabulary & Grammar :** ● Homophones and Homonyms ● Correction of Common Errors (with recap of English Grammar with its usage in practical context.) ● Transformation of sentences	**12 Hours**
Unit-2:	**Essence of Effective listening & speaking :** ● Listening short conversation/ recording (TED talks / Speeches by eminent personalities) Critical Review of these abovementioned	**5 Hours**
Unit-3:	**Professional Writing :** i. Proposal: Significance, Types, Structure & AIDA ii. Report Writing: Significance ,Types, Structure& Steps towards Report writing	**8 Hours**
Unit-4:	**Job Oriented Skills :** a) Cover Letter b) Preparing Rèsumè and Curriculum-Vitae c) Interview: Types of Interview, Tips for preparing for Interview and Mock Interview d) Corporate Expectation & Professional ethics: Skills expected in corporate world	**10 Hours**
Unit-5:	**Value based text reading: Short story** A Bookish Topic – R.K. Narayan	**5 Hours**
Text Books:	1 Singh R.P., An Anthology of Short stories, O.U.P. New Delhi	

Reference Books:	1 The content will be conveyed through Real life situations, Pair Conversation, Group Talk and Class Discussion. 2 Language Lab software. 3 Sentence transformation on daily activities and conversations. 4 Conversational Practice will be effectively carried out by Face to Face & Via Media (Audio-Video Clips) 5 Modern Teaching tools (PPT Presentation & Motivational videos with sub-titles) will be utilized. *** Latest editions of all the suggested books are recommended.**	
Additional Electronic Reference Material:	1. https://www.qqi.ie/Downloads/Clanwilliam%20Institute%20Writing%20Tutor%20service.pdf 2. https://www.ucm.es/data/cont/docs/119-2015-03-17 12.RocioSeguraAlonso2013.pdf	

Methodology:

1. The content will be conveyed through Real life situations, Pair Conversation, Group Talk and Class Discussion.
2. Language Lab software.
3. Sentence transformation on daily activities and conversations.
4. Conversational Practice will be effectively carried out by Face to Face & Via Media (Audio-Video Clips)
5. Modern Teaching tools (PPT Presentation & Motivational videos with sub-titles) will be utilized.

Note:

- Class (above 30 students) will be divided in to two groups for effective teaching.
- For effective conversation practice, groups will be changed weekly.
-

Evaluation Scheme

Internal Evaluation			External Evaluation		Total Marks
40 Marks			60 Marks		
20 Marks (Best 2 out of Three CTs) ***(Unit –I, III,IV & V)***	10 Marks (Oral Assignments) ***(Unit –II& IV)***	10 Marks (Attendance)	40 Marks (External Written Examination) ***(Unit –I, III,IV & V)***	20 Marks (External Viva)* ***(Unit –II& IV)***	**100**

*Parameters of External Viva

Content	Body Language	Communication skills	Confidence	TOTAL
05 Marks	05 Marks	05 Marks	05 Marks	20 Marks

Note*:External Viva will be conducted by 2-member committee comprising*

a) *One Faculty teaching the class*

b) *One examiner nominated by University Examination cell.*

c) *Each member will evaluate on a scale of 20 marks and the average of two would be the 20 marks obtained by the students.*

Course Code: **IAI451**	**Specialization- AI** **B.Tech.- Semester-IV** **Database Management System (Lab)**	**L-0** **T-0** **P-4** **C-2**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the database language commands to create simple database.	
CO2.	Understanding the database using queries to retrieve records.	
CO3.	Understanding PL/SQL Commands for processing database.	
CO4.	Applying the JOIN, UNION and GROUPBY techniques in DBMS operation.	
CO5.	Creating solutions using database concepts for real time requirements.	
Course Content:	**Perform any ten experiments selecting at least one from each shop**	
List of Experiments	1. Create User in Oracle Database and grant and revoke the privileges and use of commit save point role back command. 2. Create the following: ● Synonym sequences and Index ● Create alter and update views. 3. Create PL/SQL program using cursors, control structure, exception handling 4. Create following: ● Simple Triggers ● Package using procedures and functions. 5. Create the table for ● COMPANY database ● STUDENT database and Insert five records for each attribute. 6. Illustrate the use of SELECT statement 7. Conditional retrieval - WHERE clause 8. Query sorted - ORDER BY clause 9. Perform following: ● UNION, INTERSECTION and MINUS operations on tables. ● UPDATE, ALTER, DELETE, DROP operations on tables 10. Query multiple tables using JOIN operation. 11. Grouping the result of query - GROUP BY clause and HAVING clause 12. Query multiple tables using NATURAL and OUTER JOIN operation	

Course Code: **IC452**	**Specialization- AI** **B.Tech.- Semester-IV** **Python Programming (Lab)**	**L-0** **T-0** **P-4** **C-2**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding various solutions to simple computational problems using Python programs.	
CO2.	Applying conditional statements and loops in Python to Solving problems.	
CO3.	Applying various ML algorithms on given data sets.	
CO4.	Creating Python programs by defining functions and calling them.	
CO5.	Creating Python lists, tuples and dictionaries for representing compound data.	
Course Content:	**Perform any ten experiments selecting at least one from each shop**	
List of Experiments	1. Write and run a Python program that outputs the value of each of the following expressions: 5.0/9.0 5.0/9 5/9.0 5/9 9.0/5.0 9.0/5 9/5.0 9/5 Based on your results, what is the rule for arithmetic operators when integers and floating point numbers are used? 2. Write and run a Python program that asks the user for a temperature in Celsius and converts and outputs the temperature in Fahrenheit. (Use the formula given in the example above and solve for tempFin terms of tempC.) 3. Here is an algorithm to print out n! (n factorial) from 0! to 19!: 1. Set f = 1 2. Set n = 0 3. Repeat the following 20 times: a. Output n, "! = ", f b. Add 1 to n c. Multiply f by n	

Using a for loop, write and run a Python program for this algorithm.

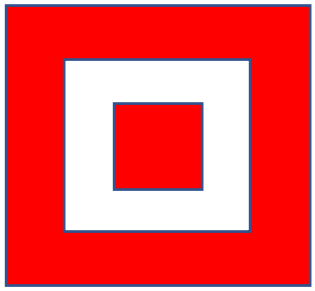
4. Modify the program above using a while loop so it prints out all of the factorial values that are less than 1 billion.

5. Modify the first program so it finds the minimum in the array instead of the maximum.

6. (Harder) Modify the first program so that it finds the index of the maximum in the array rather than the maximum itself.

7. Modify the bubble sort program so it implements the improvements discussed in class. (HINT: To exit the main loop if the array is already sorted, simply change the loop variable to equal the last value so the loop ends early.)

8. Draw the Target symbol (a set of concentric Squares, alternating red and white) in a graphics window that is 200 pixels wide by 200 pixels high. Hint: Draw the largest circle first in red, then draw the next smaller circle in white, then draw the next smaller circle in red. Graphical objects drawn later appear "on top of" graphical objects drawn earlier.



9. Try entering the following literal values at the prompt. (Hit ENTER after each)

-5
-4.2
4.5
4.14
0.90

Something odd should occur. Describe it on paper.

10. Reading from a CSV file of the given data using pandas library.

11. For the given data, plot the scatter matrix for males only, and for females only. Do you think that the 2 sub-populations correspond to gender?

12. For the given data, using python environment, apply, 1-sample t-test: testing the value of a population mean.

13. For the given data, using python environment, apply, 2-sample t-test: testing for difference across populations

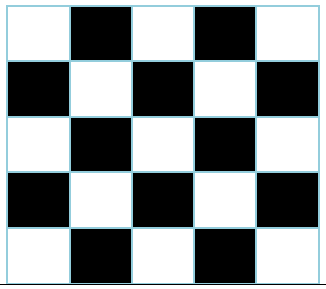
14. Generate simulated data from python, apply simple linear and multiple linear regression analysis.

15. Retrieve the estimated parameters from the model above. Hint: use tab-completion to find the relevant attribute.

16. Going back to the brain size + IQ data, test if the VIQ of male and female are different after removing the effect of brain size, height and weight.

17. Using matplotlib, visualize the simulated data with suitable statistical measures.

18. Create a 5 X 5 rectangle whose top left corner is at (row*5, col*5). (Where is the bottom right corner?) If the sum of the row and col numbers is even, set the fill color of the rectangle to white, otherwise set it to black. Then draw the rectangle.



Course Code: IAI405	**Professional Elective Course-I** **Specialization- AI** **B.Tech.- Semester-IV** **Exploratory Data Analysis**	**L-3 T-0 P-0 C-3**
Course Outcomes:	**On successful completion of the course, students will be able to:-**	
CO1.	Understanding the data and its types for the appropriate exploratory data analysis.	
CO2.	Understanding the importance of Exploratory Data Analysis over summary statistics.	
CO3.	Understanding the importance Univariate statistics in EDA	
CO4.	Applying Univariate statistical graphs for the better representation and interpretation.	
CO5.	Applying the various advanced graphs in Exploratory Data Analysis.	
Course Content:		
Unit-1:	**Introduction to Data and its types** Definition and importance of data, classification of data : based on observation – Cross Sectional, times series and panel data, based on measurement – ratio, interval, ordinal and nominal, based on availability – primary, secondary, tertiary, based on structural form – structured, semi structured and unstructured, based on inherent nature – quantitative and qualitative, concepts on sample data and population, small sample and large sample, statistic and parameter, types of statistics and its application in different business scenarios, frequency distribution of data.	**8Hours**
Unit-2:	**Introduction to Exploratory Data Analysis (EDA)** Definition of EDA, difference between EDA with classical and Bayesian Analysis, comparison of EDA with Classical data summary measures, goals of EDA, Underlying assumptions in EDA, importance of EDA in data exploration techniques, introduction to different techniques to test the assumptions involved in EDA, role of graphics in data exploration, introduction to unidimensional, bidimensional and multidimensional graphical representation of data	**8hours**
Unit-3:	**Data Preparation** Introduction to data exploration process for data preparation, data discovery, issues related with data access, characterization of data, consistency and pollution of data, duplicate or redundant variables, outliers and leverage data, noisy data, missing values, imputation of missing and empty places, with different techniques, missing pattern and its importance, handling non numerical data in missing places.	**8 Hours**

Unit-4:	**Univariate Data Analysis** Description and summary of data set, measure of central tendency – mean: Arithmetic, geometric and harmonic mean – Raw and grouped data, confidence limit of mean, median, mode, quartile and percentile, interpretation of quartile and percentile values, measure of dispersion, concepts on error, range, variance, standard deviation, confidence limit of variance and standard deviation, coefficient of variation, mean absolute deviation, mean deviation, quartile deviation, interquartile range, concepts on symmetry of data, skewness and kurtosis, robustness of parameters, measures of concentration	**8 Hours**
Unit-5:	**Bivariate Data Analysis** Introduction to bivariate distributions, association between two nominal variables, contingency tables, Chi-Square calculations, Phi Coefficient, scatter plot and its causal interpretations, correlation coefficient, regression coefficient, relationship between two ordinal variables – Spearman Rank correlation, Kendall's Tau Coefficients, measuring association between mixed combination of numerical, ordinal and nominal variables	**8Hours**
Text Books:	1. Exploratory Data Analysis – John W Tukey, Addison Wesley Publishing Company	
Reference Books:	1. Exploratory Data Analysis in Business and Economics - An Introduction Using SPSS, Stata and Excel – Thomas Cleff, Springer Publication. 2. Graphical Exploratory Data Analysis - S.H.C. du Toit A.G.W. Steyn R.H. Stumpf, Springer Publication	
Additional Electronic Reference Material:	1. https://www.youtube.com/watch?v=FLuqwQgSBDw&list=PLupD_xFct8mFDeCqoUAWZpUddeqmT28_L&ab_channel=AppliedAICourse 2. http://www.stat.cmu.edu/~hseltman/309/Book/chapter4.pdf	

Course Code: IAI406	**Professional Elective Course-I** **Specialization- AI** **B.Tech.- Semester-IV** **Time Series Analysis**	**L-3** **T-0** **P-0** **C-3**
Course Outcomes:	**On successful completion of the course, students will be able to:-**	
CO1.	Understanding the different elementary models related to time series analysis.	
CO2.	Understanding the importance of stationarity in building time series models.	
CO3.	Understanding about various methods that used in time series analysis.	
CO4.	Applying different model evaluation technique to identify better model to forecast.	
CO5.	Applying VAR model to the dynamic behavior of financial time series conditions.	
Course Content:		
Unit-1:	**Introduction to Time Series Analysis** Introduction to time series plot in history, time series data and cross sectional data, difference between time series and cross sectional data, time series and stochastic process, means, variances, covariance, stationarity, importance of stationarity in time series analysis, components of time series analysis: trend, seasonal, cyclical and irregular, white noise process, random walk, elementary time series models with zero mean, model evaluation techniques: Bias, MAD, MSE, MAPE.	**8Hours**
Unit-2:	**Univariate time series analysis - I** Models related to stationary data, Auto Regressive model, Moving Average model, Stationarity of data, concepts on unit root, impacts of unit root in estimating the model parameters, tests related to unit root: Dickey Fuller test, Augmented Dickey Fuller test, KPSS Test, The Phillips Peron Test, seasonal unit roots, periodic integration and unit root testing.	**8hours**
Unit-3:	**Univariate time series analysis – II** ARMA (p,q) process, ACF (Auto Correlation Function) and PACF (Partial Auto Correlation Function) of an ARMA (p,q) process, forecasting ARMA process, integration of non-stationary data, first order integration and second order integration, ARIMA (p,i,q), estimation of parameters of ARIMA model, Wald Test Statistic for significance of coefficients.	**8 Hours**
Unit-4:	**Spectral Analysis** Spectral densities, periodogram, he Spectral Representation and Spectral Distribution, Sampling Properties of the Sample Spectral Density, time invariant linear filters, the spectral density of ARMA (Auto Regressive Moving Average), smoothing the Spectral Density, Bias and variance, bandwidth, Confidence Intervals for the Spectrum, Leakage and Tapering, auto regressive spectrum estimation	**8 Hours**

Unit-5:	**Multivariate Time Series Analysis - VAREstimation** Introduction to multivariate time series analysis, Concepts of Vector Auto Regression, multivariate least square estimation, asymptotic properties of Lease square estimation, Introduction to Vector Error Correction Models, Cointegrated Processes (Johensen Co-integration technique), Common Stochastic Trends, Deterministic Terms in Cointegrated Processes, Forecasting Integrated and Cointegrated Variables, Introduction to Univariate GARCH models, multivariate GARCH, estimation of GARCH models.	**8Hours**
Text Books:	1. Introductory Econometrics A modern Approach - Jeffrey M. Wooldridge, South-Western Cengage Learning.	
Reference Books:	1. Introduction to Time Series and Forecasting– Peter J. Brockwell Richard A. Davis, Springer 2. Time Series Analysis with applications in R - Jonathan D. Cryer • Kung-Sik Chan, Second Edition, Springer 3. New Introduction to Multiple Time Series Analysis, Helmut Lütkepohl, Springer	
Additional Electronic Reference Material:	1. https://www.itl.nist.gov/div898/handbook/pmc/section4/pmc4.htm 2. https://towardsdatascience.com/the-complete-guide-to-time-series-analysis-and-forecasting-70d476bfe775	

Course Code: IAI407	**Professional Elective Course-I** **Specialization- AI** **B.Tech.- Semester-IV** **Internet Of Things**	**L-3 T-0 P-0 C-3**
Course Outcomes:	**On successful completion of the course, students will be able to:-**	
CO1.	Understanding the concepts of Internet of things and Internet of Everything.	
CO2.	Understanding about architecture view and strategy of deploying things using cloud.	
CO3.	Understanding the concepts How cloud plays an important role in IoT Infrastructure	
CO4.	Understanding the real time applications and what is future scope related to same.	
CO5.	Analyzing the Privacy and Security issue with IOT devices.	
Course Content:		
Unit-1:	**Introduction to IoT:** M2M to IoT-The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics. M2M to IoT – A Market Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The International driven global value chain and global information monopolies	**8 Hours**
Unit-2:	**IoT Technology Fundamentals & Architecture** M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, M2M and IoT Analytics, Knowledge Management IoT Architecture-State of the Art – Introduction, State of the art, **Architecture Reference Model-** Introduction, Reference Model, and architecture.	**8 Hours**
Unit-3:	**Cloud Computing Basics** Cloud computing components- Infrastructure-services- storage applications-database services – Deployment models of Cloud-Services offered by Cloud- Benefits, and Limitations of Cloud Computing – Issues in Cloud security- Cloud security services and design principle	**8 Hours**
Unit-4:	**IoT – Privacy, Security, and Governance** Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security	**8 Hours**

Unit-5:	**IoT Applications** Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth.	**8 Hours**
Text Books:	1. Vijay Madisetti and ArshdeepBahga, **"Internet of Things (A Hands-on-Approach)",** 1st Edition, PVT, 2014.	
Reference Books:	1. Francis daCosta, **"Rethinking the Internet of Things: A Scalable Approach to Connecting Everything",** 1st Edition, Apress Publications, 2013 2. Anthony T.Velte, Toby J.Velte, Robert Elsenpeter, "**Cloud Computing: A Practical Approach**", Tata McGraw Hill Edition, Fourth Reprint, 2010. 3. Kris Jamsa, "**Cloud Computing: SaaS, PaaS, IaaS, Virtualization, Business Models, Mobile, Security and more**", Jones & Bartlett Learning Company LLC, 2013. 4. "Internet of Things Applications - From Research and Innovation to Market Deployment " By Ovidiu Vermesan& Peter Friess, ISBN:987-87-93102-94-1, River Publishers ***Latest editions of all the suggested books are recommended.**	
Additional Electronic Reference Material:	1. https://books.google.co.in/books/about/Internet_of_Things.htmJPKGBAAAQBAJ&printsec=frontcover&source=kp_read_button&redir_esc=y#v=onepage&q&f=false 2. https://www.youtube.com/watch?v=LlhmzVL5bm8&vl=en&ab_channel=edureka%21	

Course Code: **TMUGA401**	**Specialization- AI** **B.Tech.- Semester-IV** **Analytical Reasoning** **(Value Added Course)**	**L-2** **T-1** **P-0** **C-0**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Applying the arithmetical concepts in Ratio Proportion Variation.	
CO2.	Employing the techniques of Percentage; Ratios and Average in inter related concepts of Time and Work, Time Speed and Distance.	
CO3.	Identifying different possibilities of reasoning based problems of Syllogisms, Logical Connectives, Deductive Logic and Venn diagram.	
CO4.	Examining the optimized approach to solve Visual Reasoning based problem.	
Course Content:		
Unit-1:	**Ratio, proportions and variations** Concept of ratios, proportions, variations, properties and their applications	**5 Hours**
Unit-2:	**Time and Work** Same efficiency, different efficiency, alternate work, application in Pipes and Cisterns	**5 Hours**
Unit-3:	**Time Speed Distance** Average speed, proportionalities in Time, Distance, trains, boats, races, circular tracks	**8 Hours**
Unit-4:	**Logs and Surds** Concept and properties of logs, surds and indices	**1 Hours**
Unit-5:	**Coding and decoding** Sequential coding, reverse coding, abstract coding	**2 Hours**
Unit-6:	**Syllogisms** Two statements, three statements	**4 Hours**
Unit-7:	**Logical connectives** 100-50 rule, sequential options, irregular options	**2 Hours**
Unit-8:	**Deductive Logic** Basic concept and applications	**1 Hours**
Unit-9:	**Venn diagram** Basic concept and applications	**1 Hours**
Unit-10:	**Visual Reasoning** Odd men out, sequential output	**1 Hours**
References Books:	• R1:-Arun Shrama:- How to Prepare for Quantitative Aptitude • R2:-Quantitative Aptitude by R.S. Agrawal • R3:-M Tyra: Quicker Maths • R4:-Nishith K Sinha:- Quantitative Aptitude for CAT • R5:-Logical Reasoning by Nishith K Sinha	

	• R6:-Verbal and Non Verbal Reasoning by R.S. Agrawal *** Latest editions of all the suggested books are recommended.**	
Additional Electronic Reference Material:	• Lofoya.com, gmatclub.com, cracku.in, handakafunda.com, tathagat.mba, Indiabix.com	

Evaluation Scheme for Quantitative Aptitude Skill Enhancement:-

a. The students will be evaluated on the score of 100 for every semester. Detailed scheme for the course is as follows.
b. 20 marks best 2 out of CT1 + CT2 + CT3
c. 10 marks will be for Assignments.
d. 10 marks for attendance and practice sheets, at the end of semester, will be provided in the following manner.
e. 60 marks for final external exams.

S No	% Attendance <	Marks
1.	0-10	1
2.	10 -20	2
3.	20- 30	3
4.	30-40	4
5.	40-50	5
6.	50-60	6
7.	60 – 70	7
8.	70 – 80	8
9.	80 – 90	9
10.	90-100	10

From {CT 1, CT 2 and CT 3} Best 2 CT's Score (20) + Final External exam (60) + Attendance (10)+ Assignment(10) = 100 marks.

Course Code: **IAI501**	**Specialization- AI** **B.Tech.- Semester-V** **Knowledge Representation and Reasoning**	**L-3 T-0 P-0 C-3**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the concepts of knowledge based systems intended for computer implementation.	
CO2.	Understanding theoretical knowledge about principles for logic-based representation and reasoning.	
CO3.	Understanding the concepts of knowledge-engineering process.	
CO4.	Understanding various approaches to handle uncertain or incomplete knowledge.	
CO5.	Applying various methods to design production systems, frames and inheritance systems.	
Course Content:		
Unit-1:	**The Key Concepts &Logical Agents:** Knowledge- Representation- Reasoning-Why knowledge representation and reasoning-Role of logic- Historical background of Logic-Representing knowledge in logic- Varieties of logic-Name-Type-Measures-Unity Amidst diversity. Knowledge Based Agents-Propositional Logic: Syntax -Semantics -A Simple Knowledge Base –Inference-Equivalence, Validity, And Satisfiability .Reasoning Patterns In Propositional Logic-Resolution-Forward And Backward Chaining .Effective Propositional Inference-A Complete Backtrack Lung Algorithm -Local-Search Algorithms-Hard Satisfiability Problems. Agents Based On Propositional Logic.	**8 Hours**
Unit-2:	**First Order Logic:** Syntax And Semantics Of First Order Logic-Models For First-Order Logic-Symbols And Interpretations –Terms-Atomic Sentences -Complex Sentences –Quantifiers-Equality .Using First-Order Logic-Assertions And Queries In First-Order Logic-The Kinship Domain -Numbers, Sets, And Lists-The Wumpus World .Knowledge Engineering In First-Order Logic-The Knowledge Engineering Process -The Electronic Circuits Domain .	**8 Hours**
Unit-3:	**Ontology &Processes and Contexts:** Ontological Engineering-Ontological categories,-Philosophical background,-Top-level categories,-Describing physical entities- Defining abstractions- Sets-Collections- Types and Categories- Space and Time. Processes: Times, Events and Situations, Classification of processes, Procedures, Processes and Histories, Concurrent processes, Computation, Constraint satisfaction, Change. Contexts: Syntax of contexts, Semantics of contexts, First-order reasoning in contexts, Modal reasoning in contexts, Encapsulating objects in contexts.	**8 Hours**
Unit-4:	**Inheritence, Defaults and Actions:** Inheritance Networks, Strategies for Defeasible Inheritance, A Formal Account of Inheritance Networks, Closed-World Reasoning, Circumscription, Default Logic, Autoepistemic Logic, Noncategorical Reasoning, The Situation Calculus, Explanation Closure, Complex Actions.	**8 Hours**

Unit-5:	**Statistical Reasoning & Knowledge Representation:** Introduction-Probability and Bayes theorem-Advantage and disadvantages of Bayes theorem -Rule based system-Bayes network-Dempster shafer theory-Fuzzy logic-knowledge representation issues-Symbolic reasoning under uncertainty-Non-monotonic reasoning introduction. **C**ategories and Objects -Actions, Situations. And Events -The Ontology Of Situation Calculus -Describing Actions In Situation Calculus-Solving The Representational Frame Problem -Solving The Inferential Frame Problem-Time And Event Calculus-Generalized Events-Processes-Intervals- Fluents And Objects-A Formal Theory Of Beliefs-Knowledge And Belief-Knowledge Time And Action-The Internet Shopping World-Reasoning Systems For Categories-Semantic Networks-Description Logics-Reasoning With Default Information.	**8 Hours**
Text Books:	1. "Artificial Intelligence A Modern Approach", Second Edition By Russell S., Norvig P.	
Reference Books:	1. Artificial-Intelligence-By-Rich-And-Knight. 2. F. Van Harmelen, V. Lifschitz, And B. Poter, Handbook Of Knowledge Representation, Elsevier, Amsterdam, 2008. 3. D. Poole, Artificial Intelligence: Foundations Of Computational Agents, Cambridge University Press, 2010. 4. Padhy N.P.: "Artificial Intelligence and Intelligent Systems",4th impression , Oxford University Press, 2007. *** Latest editions of all the suggested books are recommended.**	
Additional Electronic Reference Material:	1. https://web.stanford.edu/class/cs227/Lectures/lec01.pdf 2.https://www.cin.ufpe.br/~mtcfa/files/in1122/Knowledge%20Representation%20and%20Reasoning.pdf	

Course Code: **IAI502**	**Specialization- AI** **B.Tech.- Semester-V** **Natural Language Processing**	**L-3** **T-0** **P-0** **C-3**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the basic concepts of natural language processing and its important terminologies.	
CO2.	Understanding the key role of syntactic parsing and semantic analysis in natural language processing.	
CO3.	Understanding the importance of corpus creation in natural language processing.	
CO4.	Understanding the important statistical techniques used in natural language processing.	
CO5.	Applying various classification techniques for statistical data processing.	
Course Content:		
Unit-1:	**Introduction to Natural Language Processomg:** Introduction to text pre-processing, terminologies related with text processing, challenges of text pre-processing, tokenization, sentence segmentation, introduction to lexical analysis, finite state morphonology, finite state morphology, morphology vs lexical analysis, paradigm based lexical analysis.	**8 Hours**
Unit-2:	**Syntactic Parsing and Semantic Analysis:** Introduction to syntactic parsing, The Cocke–Kasami–Younger Algorithm, parsing as deduction, Implementing Deductive Parsing, LR Parsing, Constraint-based Grammars, Issues in Parsing, Basic Concepts and Issues in Natural Language Semantics, Theories and Approaches to Semantic Representation, Relational Issues in Lexical Semantics, Fine-Grained Lexical-Semantic Analysis.	**8 Hours**
Unit-3:	**Natural Language Generation:** Introduction to natural language generation, simple Examples of Generated Texts, The Components of a Generator: Components and level of representation, Approaches to Text Planning: The Function of the Speaker, Desiderata for Text Planning, Pushing vs. Pulling, Planning by Progressive Refinement of the Speaker's Message, Planning Using Rhetorical Operators, Text Schemas, The Linguistic Component: Surface Realization Components, Relationship to Linguistic Theory, Chunk Size, Assembling vs. Navigating, Systemic Grammars, Functional Unification Grammars	**8 Hours**
Unit-4:	**Corpus Creation:** Introduction and definition of corpus in natural language processing, corpus size, Balance, Representativeness, and Sampling, Data Capture and Copyright, Corpus Markup and Annotation, Multilingual Corpora, Multimodal Corpora, Corpus Annotation Types, Morphosyntactic Annotation, Treebanks: Syntactic, Semantic, and Discourse Annotation, The Process of Building Treebanks, application of Treebanks.	**8 Hours**
Unit-5:	**Statistical Techniques in Natural Language:** Introduction to statistics and its importance in natural language processing, general linear model, binary linear classification, one versus all method for multi-category classification, maximum likelihood estimation in parameter estimation in linear classification techniques, concepts of generative and discriminative models, introduction to sequence prediction model and its application in natural language processing.	**8 Hours**

Text Books:	1. Hand Book of Natural Language Processing, Second Edition – NITIN INDURKHYA FRED J. DAMERAU, CRC Press.	
Reference Books:	1. Mining Text Data - Charu C. Aggarwal, ChengXiang Zhai, Springer 2. Text Mining Classification, Clustering, and Applications - Ashok N. Srivastava, Mehran Sahami, CRC Press. *** Latest editions of all the suggested books are recommended.**	
Additional Electronic Reference Material:	1. https://www.youtube.com/watch?v=DhB9fE-TQow 2. https://builtin.com/data-science/introduction-nlp	

Course Code: **IAI503**	**Specialization- AI** **B.Tech.- Semester-V** **Theory of Automata and Compiler**	**L-3 T-0 P-0 C-3**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the concepts of compiler design and bootstrapping techniques.	
CO2.	Understanding the basic concepts of optimization and loop optimization techniques	
CO3.	Understanding the different options in PDA and CFG.	
CO4.	Understanding the importance of recursive functions.	
CO5.	Applying the various grammars to design computational machine.	
Course Content:		
Unit-1:	**Introduction to Compiler, Phases and passes, Bootstrapping:** Formal Language and Regular Expressions: Languages, Definition Languages regular expressions, Finite Automata DFA, NFA. Conversion of regular expression to NFA, NFA to DFA. Applications of Finite Automata to lexical analysis, lex tools. Context Free grammars and parsing: Context free grammars, derivation, parse trees, ambiguity LL(K) grammars and LL(1) parsing	**8 Hours**
Unit-2:	**S R Parsers:** Bottom up parsing handle pruning LR Grammar Parsing, LALR parsing, parsing ambiguous grammars, YACC programming specification. Semantics: Syntax directed translation, S-attributed and L-attributed grammars, Intermediate code – abstract syntax tree, translation of simple statements and control flow statements. Context Sensitive features – Chomsky hierarchy of languages and recognizers. Type checking, type conversions, equivalence of type expressions, overloading of functions and operations.	**8 Hours**
Unit-3:	**Push Down Automata (PDA):** Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack, Deterministic PDA, Equivalence of PDA and CFG, CFG to PDA and PDA to CFG, Two stack PDA.	**8 Hours**
Unit-4:	**Turing machines (TM):** Basic model, definition and representation, Instantaneous Description, Language acceptance by TM, Variants of Turing Machine, TM as Computer of Integer functions, Universal TM, Church's Thesis, Recursive and recursively enumerable languages, Halting problem, Introduction to Undecidability, Undecidable problems about TMs. Post correspondence problem (PCP), Modified PCP, Introduction to recursive function theory.	**8 Hours**
Unit-5:	**Code generation:** Machine dependent code generation, object code forms. Code optimization: Machine-Independent Optimizations, Loop optimization, DAG representation of basic blocks, value numbers and algebraic laws, Global Data-Flow analysis.	**8 Hours**
Text Books:	1. Aho, Sethi & Ullman, "Compilers: Principles, Techniques and Tools", Pearson Education	
Reference Books:	1. Mishra & Chandrasekhar, "Theory of Computer Sciences", PHI. 2. Martin, "Introduction to Languages & Theory of Computation", TMH.	

	3. V Raghvan, " Principles of Compiler Design", TMH 4. Hopcroft and Ullman, "Introduction to Automata Theory Languages and Computation",Addison Wesley. *** Latest editions of all the suggested books are recommended.**	
Additional Electronic Reference Material:	1. https://www.tutorialspoint.com/automata_theory/automata_theory_tutorial.pdf 2. https://www.cs.utexas.edu/~ear/cs341/automatabook/AutomataTheoryBook.pdf	

Course Code: **IAI504**	**Specialization- AI** **B.Tech.- Semester-V** **Digital Image Processing**	**L-3** **T-0** **P-0** **C-3**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the concepts of basic Image Processing Techniques for Solving Real Problems.	
CO2.	Understanding about Image Process and Analysis Algorithms.	
CO3.	Understanding about broad range of Fundamental Image Processing and Image Analysis Techniques and Concepts.	
CO4.	Applying various techniques to solve a range of Common Image Processing Problems.	
CO5.	Analyzing various image compression techniques.	
Course Content:		
Unit-1:	**Introduction:** Background, Digital Image Representation, Fundamental Steps in Image Processing, Elements of a Digital Image Processing System -Digital Image Fundamentals: Elements of Visual Perception, A Simple Image Model, Sampling and Quantization, Some Basic Relationships between Pixels, Imagining Geometry. Image File Formats: BMP, TIFF and JPEG. Colour Models (RGB, HSI, YUV)	**8 Hours**
Unit-2:	**Image Enhancement and Representation:** Spatial Domain Methods, Frequency Domain Methods, Some Simple Intensity Transformations, Histogram Processing, Image Subtraction, Image Averaging, Background-Smoothing Filters, Sharpening Filters, Lowpass Filtering, Highpass Filtering, Generation of Spatial Masks from Frequency Domain Specifications. Homomorphic Filtering, Detection of Discontinuities, Edge Linking using Hough Transform, Thresholding, Region based Segmentation, Split and Merge Technique, Image Representation and Description, Chain Code, Polygonal, Representation, Shape Number, Moments.	**8 Hours**
Unit-3:	**Image Segmentation and Binary Image Processing:** Segmentation: Mean Shift Segmentation – Active Contour Models – Geometric Deformable Models – Fuzzy Connectivity – 3D Graph Based Image Segmentation – Graph Cut Segmentation - Optimal Surface Segmentation. Shape Representation and Description: Hough Transform – Hadamard Transform - Region Identification – Contour Based and Region Based Shape Representation and Description – Shape Classes, Binary Morphological Operators, Hit-or-Miss Transformation, Boundary Extraction, Region Filling, Thinning and Thickening, Connected Component Labeling, Iterative Algorithm and Classical Algorithm.	**8 Hours**
Unit-4:	**Image Transform:** Introduction to the Fourier Transform, The Discrete Fourier Transform, Some Properties of the Two- Dimensional Fourier Transform Fast Fourier Transform(FFT), Discrete Hadamard Transform(DHT), Fast Hadamard Transform(FHT), Discrete Cosine Transform(DCT), Discrete Wavelet Transform(DWT), Fundamentals –	**8 Hours**

	Coding Redundancy, Inter-pixel Redundancy, Psych visual Redundancy, Fidelity Criteria.	
Unit-5:	**Image Restoration and Compression:** Model of Image Degradation/Restoration Process - Noise Models - Inverse Filtering – Least Mean Square Filtering - Constrained Least Mean Square Filtering. Edge Detection - Thresholding - Region Based Segmentation - Boundary Representation, Image Compression Models – The Source Encoder and Decoder, Lossless Compression Techniques: Run Length Coding, Arithmetic Coding, Huffman Coding, Differential PCM, Lossy Compression Techniques: Improved Gray Scale Quantization, Vector Quantization, JPEG, MPEG-	**8 Hours**
Text Books:	1. Digital Image Processing – by R.C. Gonzalez And R.E. Woods,, 2nd Ed., Prentice Hall Of India, New Delhi.	
Reference Books:	1. M. Sonka, V. Hlavac And R. Boyle, Image Processing Analysis And Machine Vision, Brooks/Colic, Thompson Learning, 1999. 2. Image Processing, Analysis And Machine Vision: Milan Sonka, Vaclav Hlavac, Roger Boyle (Thomson Brooks / Cole Edition). 3. Fundamentals Of Digital Image Processing: Anil K. Jain (Prentice Edition Hall Of India) *** Latest editions of all the suggested books are recommended.**	
Additional Electronic Reference Material:	1. https://www.tutorialspoint.com/dip/index.htm 2. http://imageprocessingplace.com/downloads_V3/root_downloads/tutorials/Image%20Processing-Introduction-Bryan-Mac-Namee.pdf	

Course Code: EHM501	**Specialization- AI** **B. Tech- Semester-V** **HUMAN VALUES & PROFESSIONAL ETHICS**	**L-3 T-0 P-0 C-3**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the importance of value education in life and method of self-exploration.	
CO2.	Understanding 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration.	
CO3.	Applying right understanding about relationship and physical facilities.	
CO4.	Analysing harmony in myself, harmony in the family and society, harmony in the nature and existence.	
CO5.	Evaluating human conduct on ethical basis.	
Course Content:		
Unit-1:	Understanding of Morals, Values and Ethics; Introduction to Value Education- need for Value Education. Self- Exploration–content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration. Continuous Happiness and Prosperity- basic Human Aspirations. Gender Issues: Gender Discrimination and Gender Bias (home & office), Gender issues in human values, morality and ethics.	**8 Hours**
Unit-2:	Conflicts of Interest: Conflicts between Business Demands and Professional Ethics. Social and Ethical Responsibilities of Technologists. Ethical Issues at Workplace: Discrimination, Cybercrime, Plagiarism, Sexual Misconduct, Fraudulent Use of Institutional Resources. Intellectual Property Rights and its uses. Whistle blowing and beyond, Case study.	**8 Hours**
Unit-3:	Harmony in the Family and Society- Harmony in Human-Human Relationship, Understanding harmony in the Family- the basic unit of human interaction. Understanding values in human-human relationship; meaning of Nyaya; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship. Understanding the meaning of Vishwas; Difference between intention and competence. Understanding the meaning of Samman and other salient values in relationship.	**8 Hours**
Unit-4:	Understanding Harmony in the Nature and Existence – Whole existence as	**8**

	Co-existence. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature. Understanding Existence as Coexistence (Sah-astitva) of mutually interacting units in all pervasive space. Holistic perception of harmony at all levels of existence.	**Hours**
Unit-5:	Implications of the above Holistic Understanding of Harmony on Professional Ethics. Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Competence in professional ethics: a) Ability to utilize the professional competence for augmenting universal human order b) Ability to identify the scope and characteristics of people friendly and eco-friendly production systems c) Ability to identify and develop appropriate technologies and management patterns for above production systems.	**8 Hours**
Text Books:	1. R R Gaur, R Sangal, G P Bagaria, A Foundation Course in Value Education.	
Reference Books:	1. Ivan Illich, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA 2. E.F. Schumacher, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain. 2. A Nagraj, Jeevan Vidya ek Parichay, Divya Path Sansthan, Amarkantak. 3. Sussan George, How the Other Half Dies, Penguin Press. Reprinted. 4. PL Dhar, RR Gaur, Science and Humanism, Commonwealth Purblishers. *** Latest editions of all the suggested books are recommended.**	
Additional Electronic Reference Material:	1. http://crectirupati.com/sites/default/files/lecture_notes/HVPE-MBA-K%20YAMUNA-LECTURE%20NOTES.pdf 2. https://soaneemrana.org/onewebmedia/Professional%20Ethics%20and%20Human%20Values%20by%20R.S%20NAAGARAZAN.pdf	

Course Code: **IAI551**	**Specialization- AI** **B.Tech.- Semester-V** **Natural Language Programming (Lab)**	**L-0** **T-0** **P-4** **C-2**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding how to tokenize the sentence into words for the further analysis	
CO2.	Applying normalization on the sentence to eliminate the unwanted punctuation.	
CO3.	Applying the visualization of the given text data with appropriate visual techniques.	
C04	Applying interpolation on data to get mix and match.	
C05	Creating an application for sentiment analysis of given data sets.	
Course Content:	**Minimum eight experiments should be performed-**	
List of Experiments	**Exercise – 1** 1. Tokenize the sentence into words for the further analysis (using Python Function) 2. Normalize the sentence to eliminate the unwanted punctuation, converting into lower case or upper case of the entire document, expanding abbreviation, numbers into words and canonicalization. 3. Apply similarity measures using Jaccard's Coefficient or Tanimoto coefficient 4. Apply similarity measures using the Smith Waterman distance. **Exercise – 2** 5. For the given data what is the maximum number of words used. Get the output for the frequently occurred word in the given data? 6. Visualize the given text data with appropriate visual techniques? 7. Get the word cloud for the given data and interpret where the management need to give highest attention to get the better income? **Exercise - 3** 8. Develop a back-off mechanism for Maximum Likelihood Estimate (MLE) 9. Apply interpolation on data to get mix and match **Exercise - 4** 10. Perform the sentiment analysis, classifying comments using a Bayesian analysis. **11.** Using ggplot2, plot the words which occurs more than 50 times. **12.** Come out with word cloud and interpret the same.	

Course Code: **IAI552**	**Specialization- AI** **B.Tech.- Semester-V** **Digital Image Processing (Lab)**	**L-0** **T-0** **P-4** **C-2**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the MATLAB to plot a sine wave and change its color, width and appearance through programming.	
CO2.	Applying the resizing of images zooming and shrinking.	
CO3.	Applying the different methods for edge detection on an image.	
C04	Analyzing the different levels of quantization.	
C05	Creating an application for Intensity measurement of self-driven Robot.	
Course Content:	**Minimum eight experiments should be performed-**	
List of Experiments	1. Introduction to MATLAB to plot a sine wave and change its color, width and appearance through programming. 2. To study different levels of quantization. 3. Resizing of images zooming and shrinking. 4. Image enhancement using point operation. 5. Equalization of image using histogram. 6. Transformation of image. 7. To study the logarithmic and power transformation technique. 8. To perform filtering using mean/average/low pass filter. 9. Read RGB image and extract the three color components of image. 10. Convert RGB into YIQ (NTSC) format and perform the histogram equalization of image. 11. To perform pseudo color processing. 12. To perform edge detection on an image using different methods. 13. To perform edge detection on video using different algorithms. 14. Intensity measurement for self-driven Robot.	

Course Code: **IAI553**	**Specialization- AI** **B.Tech.- Semester-V** **Industrial Training Seminar**	**L-0** **T-0** **P-2** **C-1**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the past and present of the disciplines by exploring their purpose, practice, and philosophy.	
CO2.	Understanding of advanced research methodologies in the field, including theory, interdisciplinary approaches, and the analysis of available primary sources.	
CO3.	Understanding historical and recent trends in theory and method and be able to identify and explain major trends and issues in industry and research.	
C04	Understanding the privileges and obligations associated with a career as a professional	
C05	Demonstrate through short written assignments and critical reviews the ability to synthesize and assess the arguments of scholarly articles and monographs at the level of professionals in the field.	
Course Content:		
	Students will have to undergo industrial training of minimum four weeks in any industry or reputed organization after the IV semester examination in summer. The evaluation of this training shall be included in the V semester evaluation. The student will be assigned a faculty guide who would be the supervisor of the student. The faculty would be identified before the end of the IV semester and shall be the nodal officer for coordination of the training. Students will prepare an exhaustive technical report of the training during the V semester which will be duly signed by the officer under whom training was undertaken in the industry/ organization. The covering format shall be signed by the concerned office in-charge of the training in the industry. The officer-in-charge of the trainee would also give his rating of the student in the standard University format in a sealed envelope to the Principal of the college. The student at the end of the V semester will present his report about the training before a committee constituted by the Director of the College which would comprise of at least three members comprising of the Department Coordinator, Class Coordinator and a nominee of the Director. The students guide would be a special invitee to the presentation. The seminar session shall be an open house session. The internal marks would be the average of the marks given by each member of the committee separately in a sealed envelope to the Director. The marks by the external examiner would be based on the report submitted by the student which shall be evaluated by the external examiner and cross examination done of the student concerned. Not more than three students would form a group for such industrial training/ project submission. **The marking shall be as follows.** Internal: 50 Marks By the faculty guide - 25 marks By committee appointed by the director – 25 marks External: 50 Marks By officer-in-charge trainee in industry – 25 marks By external examiner appointed by the university – 25 marks	

Course Code: IAI505	**Professional Elective Courses – II** **Specialization- AI** **B.Tech.- Semester-V** **Logic Programming using Prolog and Lisp**	L-3 T-0 P-0 C-3
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding about components and features of programming languages necessary for program development and maintenance across various applications.	
CO2.	Understanding skills to evaluate a language for its purposes, capabilities, limitations, environment requirements.	
CO3.	Understanding the phases and components of typical programming language translators.	
CO4.	Understanding language theory and understand its use in translation.	
CO5.	Applying several software tools to design a simple application.	
Course Content:		
Unit-1:	**Introduction to Prolog: Introduction:** characteristics of Prolog language- Propositional calculus- Rules –semantics- The logical Variable- Prolog search strategy: Quires and Disjunctions-unification-recursion –lists-the box model of execution. **Programming Technique and list processing:** The reversibility of prolog programming-list processing-Control and negation: General program schema- Parsing in prolog- Prolog syntax: Constants, Variables-Compound terms- Operator: Type of operators, Precedence, finding and solving the operator definitions-Advance feature of prolog.	**8 Hours**
Unit-2:	**Meta-Linguistic Abstraction, Types and Meta-Interpreters:** Meta-Interpreters, Types, and Unification, Types in prolog, Unification, Variable Binding, and Evaluation. Depth-First, Breadth-First and Best-First Search: Production System Search, Designing Alternative Search Strategies. **Machine Learning Algorithms in Prolog:** Machine Learning: Version Space Search, Explanation Based Learning in Prolog. Programming in Lisp: S-Expressions, Syntax of LISP, Lists and Recursive Search, Variables, Data types, High Order Functions, Logic Programming in LISP, Lisp-Shell.	**8 Hours**
Unit-3:	**Introduction to LISP:** Purpose – Data types- Scope and Extent- Type Specifiers- Program structure of lisp- Predicates: Logical Value, Equality predicates, Logical operators- Control Structures: Constants and Variables, Reference, Generalized variable, simple sequencing, variable binding, conditionals , Iteration, Mapping, Multiple values.	**8 Hours**
Unit-4:	**Semantic Networks, Inheritance and Machine Learning:** Sematic Nets, Inheritance, Object Oriented Lisp, Learning ID3 Algorithm, Implementing ID3 Algorithm-Macros – definition, Expansion, De-structuring-Declarations: declaration syntax, specifies, type declaration for forms-Symbols: the property list , print name, creating symbols- Packages: Consistency rule, translating, exporting and importing symbols, name conflicts , built in packages- Numbers: Precision, Contagion, and Coercion, Arithmetic Operations, logical operation son numbers- Characters in lisp-Sequences- Lists- Hash table.	**8 Hours**

Unit-5:	**Arrays:** creating array, access, functions on array, pointers- String Construction and Manipulation- Structures- Streams- Input/Output: Printed Representation of Lisp Objects, Input Functions, Output Functions, Querying the User- File System Interface: File Names, Opening and Closing Files, Renaming, Deleting, and Other, File Operations, Loading Files, Accessing directions- Loop. **Common Lisp Object System**: Interface Concepts- Functions in the Programmer Interface- Conditions: Introduction , changes in terminology, Survey of concepts, Program Interface to the Condition System- Java, Representation and Object-Oriented Programming, Problem Spaces and Search, A Logic- Based Reasoning System, An Expert System Shell	**8 Hours**
Text Books:	1. George F. Luger, William A. Stubblefield, Pearson Publishers, AI Algorithms, Data Structures, and Idioms in Prolog, Lisp and Java 6th Edition 2. Common LISP the language, Second Edition, by Guy L. Steele JR.	
Reference Books:	1. Logic, Programming and Prolog by Ulf Nilsson, Jan Maluszynski.Wiley; 2 edition (August 1995) 2. The Art of Prolog: Advanced Programming Techniques (Mit Press Series in Logic Programming) by Leon Sterling and Ehud Shapiro (Oct 1986) 3. Prolog Programming for Artificial Intelligence (4th Edition) (International Computer Science Series) by Ivan Bratko (Aug 31, 2011) 4. Paradigms of Artificial Intelligence Programming: Case Studies in Common Lisp by Peter Norvig (Oct 15, 1991) 5. Common LISP: The Language by Guy L. Steele (Mar 16, 1984) 6. Lisp 3rd Edition, Bertbold Klaus Paul Horn, Patrick Henry Winston 7. Artificial Intelligence Common LISP 1st Edition (Hardcover) by Noyes, James S. Noyer, James L. Noyes *** Latest editions of all the suggested books are recommended.**	
Additional Electronic Reference Material:	1. https://www.sjsu.edu/faculty/watkins/prolog.htm 2. https://www.geeksforgeeks.org/prolog-an-introduction/	

Course Code: IAI506	**Professional Elective Courses – II** **Specialization- AI** **B.Tech.- Semester-V** **Information Security**	**L-3 T-0 P-0 C-3**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding basic concepts and importance of information security	
CO2.	Understanding the threats of information security and analyze their impact.	
CO3.	Understanding about the importance of classifying information.	
CO4.	Applying various methods to securing network infrastructure.	
CO5.	Creating the security policies and access controls for an organization.	
Course Content:		
Unit-1:	**Introduction to Information Security:** Definition of Information Security, Evolution of Information Security; Basics Principles of Information Security; Critical Concepts of Information Security; Components of the Information System; Balancing Information Security and Access; Implementing IT Security, The system Development Life cycle, Security professional in the organization.	**8 Hours**
Unit-2:	**The Need for IT Security:** Business Needs-Protecting the functionality, Enabling the safe operations, Protecting the data, safe guarding the technology assets; Threats-compromises to Intellectual property, deliberate software attacks, Espionage and trespass, sabotage and vandalism; Attacks-Malicious Codes, Back Doors, Denial of Service and Distributed Denial of Service, Spoofing, sniffing, Spam, Social Engineering.	**8 Hours**
Unit-3:	**Risk Management:** Definition of risk management, risk identification, and risk control, Identifying and Accessing Risk, Assessing risk based on probability of occurrence and likely impact, the fundamental aspects of documenting risk via the process of risk assessment, the various risk mitigation strategy options, the categories that can be used to classify controls.	**8 Hours**
Unit-4:	**Network Infrastructure Security and Connectivity:** Understanding Infrastructure Security- Device Based Security, Media-Based Security, Monitoring and Diagnosing; Monitoring Network- Firewall, Intrusion Detection System, Intrusion Prevention system; OS and Network Hardening, Application Hardening; Physical and Network Security-Policies, Standards and Guidelines.	**8 Hours**
Unit-5:	**Information Asset Classification:** Classification of Information, Information Assets – Owner, Custodian, User, Information Classification in terms of Secret, Confidential, Private and Public, Declassification. Retention and Disposal of Information Assets. Provide Authorization for Access – Owner, Custodian and User	**8 Hours**
Text Books:	1. Mark Stamp's Information Security: Principles and Practice (WIND) Paperback – 2009 by Deven N. Shah, Wiley (2009)	
Reference Books:	1. Information Security: The Complete Reference by Mark Rhodes-Ousley, McGraw Hill Education; Second edition (1 May 2013) 2. Principles of Information Security by Michael E. Whitman, Cengage Learning India Private Limited; 5 edition (2015) 3. Cryptography and Network Security Principles and Practices, by William Stallings, Pearson Education; Seventh edition (30 June 2017) *** Latest editions of all the suggested books are recommended.**	

Additional Electronic Reference Material:	1. https://www.vssut.ac.in/lecture_notes/lecture1423183198.pdf 2.https://www.nisc.go.jp/security-site/campaign/files/aj-sec/handbook-all_eng.pdf	

Course Code: **IAI507**	**Professional Elective Courses – II** **Specialization- AI** **B.Tech.- Semester-V** **Computer Graphics**	**L-3** **T-0** **P-0** **C-3**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the basic concepts of graphics.	
CO2.	Understanding the various types of graphics and their importance.	
CO3.	Applying two dimensional transformations.	
CO4.	Applying three dimensional transformations.	
CO5.	Applying illumination and color models and clipping techniques to graphics.	
Course Content:		
Unit-1:	**Basics of Computer Graphics:** Basics of computer graphics- applications of computer graphics- Video Display devices, random scan display, raster scan display, graphics monitors and workstation, Input devices, hard copy devices, graphics software. **Mathematics for Computer Graphics** Coordinate Reference Frame- 2D Cartesian, 3D Cartesian-points and Vectors- Basis vector and the metric Tensor-Matrices –Matrix Multiplication, Matrix Transpose, Determinant of Matrix, Nonparametric representation, parametric representation- Numerical Methods- Solving linear equation.	**8 Hours**
Unit-2:	**Two & Three dimensionalGraphics:** Two dimensional geometric transformations, Matrix representation and homogeneous co-ordinate, Composite transformations; two dimensional viewing – viewing pipeline- viewing coordinate reference frame; window –to- viewport coordinate transform- Two dimensional viewing function; clipping operations-point, line and polygon clipping algorithm. Three Dimensional Concepts; Three dimensional object representations- polygon surfaces-polygon tables-plane equations- polygon meshes; curved line surfaces-Quadratic surfaces; Blobby objects; spline representations-Bezier curves and surfaces-B spline curves and surfaces	**8 Hours**
Unit-3:	**Illumination and Color Models:** Light sources-basic illumination models-halftone patterns and dithering techniques; properties of light- Standard primaries and chromaticity diagram; Intuitive color concepts-RGB color model-YIQ color model-CMY color model- HSV color model-HLS color model; Color selection.	**8 Hours**
Unit-4:	**Output primitives:** Points and lines, line drawing algorithms, loading the frame buffer, line function- circle generating algorithm, ellipse generating algorithms, pixel addressing and object geometric-filled area primitives-scan line polygon filling algorithm, Boundary fill algorithm.	**8 Hours**

Unit-5:	**Animations & Realism:** Animation Graphics: Design of Animation Sequences- animation function- raster animation-key frame systems-motion specification-morphing- tweening. Computer graphics realism: Tiling the plane-Recursively defined curves-koch curves-C curves-Dragons-Space filling curves-fractals- Grammar based model-fractals-turtle graphics-ray tracing.	**8 Hours**
Text Books:	1. John F . Hughes , Andries Van Dam , Morgan Mc Guire , David F.Sklar, James D, Foley, Steven K. Feiner and kurt Akeley, "Computer Graphics: Principle and practice" ,, 3rd Edition , Addison- Wesley professional, 2013(Unit I, II, III, IV)	
Reference Books:	1. Donald Hearn and M.pauline Baker , Warren Carithers, "Computer graphics with open GL", 4th Edition , pearson 2. Jeffery McConnell, "Computer Graphics: Theory into Practice", jones and Bartlett Publishers, 2006 3. Hill F S jr.., "Computer Graphics" , Maxwell Macmaillan", 1990 4. Peter Shirley , Michael Ashkhmin, Michael Gleicher , Stephen R Marschner, Erik Reinhard, Kelvin Sung and Ak Peters, Fundamental of Computer Graphics, CRC press, 2010 5. William M. Newman and Robert F.Sproull, "Principle of Interactive Computer Graphics", Mc Graw Hill. *** Latest editions of all the suggested books are recommended.**	
Additional Electronic Reference Material:	1. https://www.javatpoint.com/computer-graphics-tutorial 2. https://www.geeksforgeeks.org/computer-graphics-2/	

Course Code: **TMUGA501**	**Specialization- AI** **B.Tech.- Semester-V** **Modern Algebra and Data Management (Value Added Course)**	**L-2 T-1 P-0 C-0**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Applying the concepts of modern mathematics Divisibility rule, Remainder Theorem, HCF /LCM in Number System.	
CO2.	Relating the rules of permutation and combination, Fundamental Principle of Counting to find the probability.	
CO3.	Applying calculative and arithmetical concepts of ratio, Average and Percentage to analyze and interpret data.	
CO4.	Correlating the various arithmetic concepts to check sufficiency of data.	
Course Contents:		
Unit:1	**Number theory** Classification of Numbers, Divisibility Rules, HCF and LCM, Factors, Cyclicity(Unit Digit and Last Two digit), Remainder Theorem, Highest Power of a Number in a Factorial, Number of trailing zeroes	**10 Hours**
Unit:2	**Data interpretation** Data Interpretation Basics, Bar Chart, Line Chart, Tabular Chart, Pie Chart, DI tables with missing values	**6 Hours**
Unit:3	**Data Sufficiency** Introduction of Data Sufficiency, different topics based DS	**5 Hours**
Unit:4	**Permutations and combinations** Fundamental counting, and or, arrangements of digits, letters, people in row, identical objects, rank, geometrical arrangements, combination: - basic, handshakes, committee, selection of any number of objects, identical and distinct, grouping and distribution, de-arrangements	**6 Hours**
Unit:5	**Probability** Introduction, Probability based on Dice and Coins, Conditional Probability, Bayes Theorem	**3 Hours**
References:	• R1:-Arun Shrama:- How to Prepare for Quantitative Aptitude • R2:-Quantitative Aptitude by R.S. Agrawal • R3:-M Tyra: Quicker Maths • R4:-Nishith K Sinha:- Quantitative Aptitude for CAT • R5:-Reference website:- Lofoya.com, gmatclub.com, cracku.in, handakafunda.com, tathagat.mba, Indiabix.com	

	• R6:-Logical Reasoning by Nishith K Sinha • R7:-Verbal and Non Verbal Reasoning by R.S. Agrawal *** Latest editions of all the suggested books are recommended.**	

Evaluation Scheme for Quantitative Aptitude Skill Enhancement:-

f. The students will be evaluated on the score of 100 for every semester. Detailed scheme for the course is as follows.

g. 20 marks best 2 out of CT1 + CT2 + CT3

h. 10 marks will be for Assignments.

i. 10 marks for attendance and practice sheets, at the end of semester, will be provided in the following manner.

j. 60 marks for final external exams.

S No	% Attendance <	Marks
1.	0-10	1
2.	10 -20	2
3.	20- 30	3
4.	30-40	4
5.	40-50	5
6.	50-60	6
7.	60 – 70	7
8.	70 – 80	8
9.	80 – 90	9
10.	90-100	10

From {CT 1, CT 2 and CT 3} Best 2 CT's Score (20) + Final External exam (60) + Attendance (10)+ Assignment(10) = 100 marks.

Course Code: **TMUGS501**	**Specialization- AI** **B.Tech.- Semester-V** **Managing Self** **(Mandatory Value Added Course)**	**L-2** **T-1** **P-0** **C-0**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Utilizing effective verbal and non-verbal communication techniques in formal and informal settings	
CO2.	Understanding and analyzing self and devising a strategy for self growth and development.	
CO3.	Adapting a positive mindset conducive for growth through optimism and constructive thinking.	
CO4.	Utilizing time in the most effective manner and avoiding procrastination.	
C05.	Making appropriate and responsible decisions through various techniques like SWOT, Simulation and Decision Tree.	
C06.	Formulating strategies of avoiding time wasters and preparing to-do list to manage priorities and achieve SMART goals.	
Course Content:		
Unit-1:	**Personal Development:** Personal growth and improvement in personality Perception Positive attitude Values and Morals High self-motivation and confidence Grooming	**10 Hours**
Unit-2:	**Professional Development:** Goal setting and action planning Effective and assertive communication Decision making Time management Presentation Skills Happiness, risk taking and facing unknown	**8 Hours**
Unit-3:	**Career Development:** Resume Building Occupational Research Group discussion (GD) and Personal Interviews	**12 Hours**
References:	i. Robbins, Stephen P., Judge, Timothy A., Vohra, Neharika, Organizational Behaviour (2018), 18th ed., Pearson Education ii. Tracy, Brian, Time Management (2018), Manjul Publishing House iii. Hill, Napolean, Think and grow rich (2014), Amazing Reads iv. Scott, S.J., SMART goals made simple (2014), Createspace Independent Pub v. Rathgeber, Holger, Kotter, John, Our Iceberg is melting (2017), Macmillan vi. Burne, Eric, Games People Play (2010), Penguin UK	
Additional Electronic Reference	i. https://www.hloom.com/resumes/creative-templates/ ii. https://www.mbauniverse.com/group-discussion/topic.php iii. https://www.indeed.com/career-advice/interviewing/job-interview-	

Material	tips-how-to-make-a-great-impression	

Evaluation Scheme: Faculty led Continuous Evaluation

- Evaluation of **"Managing Self"** and **"Managing Work and Others"** will follow the continuous evaluation method.
- Students will be evaluated on the score of 100 on the pattern prescribed by the University for Conduction of Practical Courses.

a) Internal: 50 marks for Internal evaluation following the continuous evaluation method, which includes:

1. 40 marks for Class Performance (Every class activity will carry 8 marks; each students can participate in maximum of 5 activities)

2. 10 marks for Attendance and involvement in the activities

b) External: 50 marks for External evaluation at the time of external exams (Based on Observations, GDs and PIs and other assessment tools).

Course Code: **IAI601**	**Specialization- AI** **B.Tech.- Semester-VI** **Artificial Neural Networks**	**L-3 T-0 P-0 C-3**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the basic concepts of neural networks and its components.	
CO2.	Understanding neural network learning and adaption techniques.	
CO3.	Understanding the detailed concepts of single layer perceptron neural networks.	
CO4.	Applying the various methods to solve neural network problems.	
CO5.	Analyzing the different field of application on neural network models.	
Course Content:		
Unit-1:	**Introduction to Neural Network System:** Introduction to biological neurons and their artificial models, history of artificial neural systems development, Simple Memory and Restoration of Patterns, basic concepts related to neural networks: three layers of neural network systems, units, connections, site, mode, perceptron, single layer and multiple layer perceptron, McCulloch-Pitts Neuron Model, Neuron Modelling for Artificial Neural System, Models of neural networks: feedforward and feedback networks, neural processing.	**8 Hours**
Unit-2:	**Neural Network Learning and Adaptation:** Introduction to neural network learning and adaptation, Learning as approximation or Equilibria Encoding, concepts of supervised and unsupervised learning, neural network learning rules : Hebbian learning rule, perceptron learning rule, delta learning rule, Widrow-Hoff Learning Rule, correlation learning rule, Winner- Take-All learning rule, Outstar learning rule, summary and comparison of artificial neural network learning rules.	**8 Hours**
Unit-3:	**Single Layer Perceptron Classifiers:** Introduction to single layer perceptron, classification model, features and decision tree, discriminant functions, linear machine and minimum distance classification, non-parametric training concepts, training and classification using the discrete perceptron, single layer continuous perceptron neural networks for linearly separable classification, multi category single layer perceptron neural networks.	**8 Hours**
Unit-4:	**Multilayer feed forward Neural Networks:** Introduction to multilayer perceptron neural networks, linearly non separable pattern classification, delta learning rule for multilayer perceptron networks, generalized delta learning rule, Feedforward recall and error Back-Propagation training, training errors, Multilayer Feedforward Networks as Universal Approximators, Learning Factors: Initial Weights, cumulative weight adjustments vs incremental updating, learning constant and momentum method, classifying and expert layered networks, Character Recognition Application, expert systems applications, learning time sequences.	**8 Hours**
Unit-5:	**Single-Layer Feedback Neural Networks:** Introduction to single layer feedback neural networks, basic concepts of dynamic systems, Mathematical Foundations of Discrete-Time and gradient type Hopfield Networks, Transient Response of Continuous-Time Networks, Relaxation Modelling in Single-Layer Feedback Networks, Summing Network with Digital Outputs, Minimization of the Traveling Salesman Tour Length.	**8 Hours**

Text Books:	1. Introduction to Artificial Neural Systems – Jacek M Zurada, West Publishing Company.	
Reference Books:	1. An introduction to neural networks - Kevin Gurney, UCL Press. 2. PRINCIPLES OF ARTIFICIAL NEURAL NETWORKS, 2nd Edition - Daniel Graupe, World Scientific Publishing Co. Pte. Ltd. *** Latest editions of all the suggested books are recommended.**	

Course Code: IAI602	**Specialization- AI** **B.Tech.- Semester-VI** **Big Data Analytics**	**L-3 T-0 P-0 C-3**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the concept of BigData	
CO2.	Understanding the concept of Hadoop	
CO3.	Understanding the concept of storage layer and processing layer of Hadoop	
CO4.	Analyzing the internals of MapReduce and YARN.	
CO5.	Analyzing the different modes and distribution of Hadoop	
Course Content:		
Unit-1:	**Understanding BigData:** Defining Data, Types of Data, Structured Data, Semi Structured Data, Unstructured Data, How data being Generated, Different source of Data Generation, Rate at which Data is being generated, Different V's, Volume, Variety, Velocity, Veracity, Value, How single person is contributing towards BigData, Significance for BigData, Reason for BigData, Understanding RDBMS and why it is failing to store BigData. Future of BigData, BigData use cases for major IT Industries.	**8 Hours**
Unit-2:	**Introduction to Hadoop:** What is Hadoop, Apache Community, Cluster, Node, Commodity Hardware, Rack Awareness, History of Hadoop, Need for Hadoop, How is Hadoop Important, Apache Hadoop Ecosystem, Different Hadoop offering , Hadoop 1.x Architecture, Apache Hadoop Framework, Master- Slave Architecture, Advantages of Hadoop.	**8 Hours**
Unit-3:	**Storage Unit:** Hadoop Distributed File System, Design of HDFS, HDFS Concept, How files are stored in HDFS, Hadoop File system, Replication factor, Name Node, Secondary Name Node, Job Tracker, Task tracker, Data Node, FS Image, Edit-logs, Check-pointing Concept, HDFS federation, HDFS High availability Architectural description for Hadoop Cluster, When to use or not to use HDFS, Block Allocation in Hadoop Cluster, Read operation in HDFS, Write operation in HDFS, Hadoop Archives, Data Integrity in HDFS, Compression & Input Splits.	**8 Hours**
Unit-4:	**Processing Unit:** What is MapReduce, History of MapReduce, How does MapReduce works, Input files, Input Format types Output Format Types, Text Input Format, Key Value Input Format, Sequence File Input Format, Input split, Record Reader, MapReduce overview, Mapper Phase, Reducer Phase, Sort and Shuffle Phase, Importance of MapReduce Data Flow, Counters, Combiner Function, Partition Function, Joins, Map Side Join, Reduce Side Join, MapReduce Web UI, Job Scheduling, Task Scheduling, Fault Tolerance, Writing MapReduce Application, Driver Class, Mapper Class, Reducer Class, Serialization, File Based Data Structure, Writing a simple MapReduce program to Count Number of words, MapReduce Work Flows	**8 Hours**
Unit-5:	**YARN & Hadoop Cluster:** YARN, YARN Architecture, YARN Components, Resource Manager, Node Manager, Application Master, Concept of Container, Difference between Hadoop 1.x and 2.x Architecture, Execution of Job in Yarn Cluster, Comparing and Contrasting Hadoop with Relational Databases Cluster Specification, Cluster Setup and Installation, Creating Hadoop user, Installing Hadoop, SSH Configuration, Hadoop Configuration, Hadoop daemon properties, Different modes of Hadoop, Standalone Mode, Pseudo Distributed Mode, Fully Distributed Modes,	**8 Hours**

Text Books:	1. Hadoop: The Definitive Guide, By: Tom White, O'REILLY	
Reference Books:	1. Hadoop for Dummies, By: Dirk deRoos, Paul C. Zikopoulos, Bruce Brown, Rafael Coss, and Roman B. Melnyk, A Wiley brand 2. Hadoop in Action, Writer: Chuck Lam Published By: Manning Publications *** Latest editions of all the suggested books are recommended.**	
Additional Electronic Reference Material:	1. https://ethz.ch/content/dam/ethz/special-nterest/gess/computational-social-sciencedam/documents/education/Spring2017/Data_science/course4.pdf 2. https://vivomente.com/wp-content/uploads/2016/04/big-data-analytics-white-paper.pdf	

Course Code: IAI603	**Specialization- AI** **B.Tech.- Semester-VI** **Machine Learning**	**L-3 T-0 P-0 C-3**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the different machine learning techniques and its application.	
CO2.	Understanding the importance of simple linear regression in predicting new observations.	
CO3.	Understanding the importance of assumptions in estimating the parameters in simple linear regression analysis.	
CO4.	Applying the non-linear model for the new observation predictions and its importance in business.	
CO5.	Analyzing the various classification and regression algorithms.	
Course Content:		
Unit-1:	**Introduction to Machine Learning:** Introduction to Machine learning – Statistical Learning – types of Machine Learning –learning models: geometric, probabilistic and logistic models, introduction to supervised, unsupervised and reinforcement learning, Generalized Linear Model, difference between Generalized and General Linear Model, Link Functions and Linear Predictors, Parameter Estimation and Inference in the GLM, Prediction and Estimation with the GLM, Residual Analysis in the GLM : Raw and deviance residual, introduction to over dispersion, concepts on Poisson Regression.	**8 Hours**
Unit-2:	**Supervised Learning –Regression Analysis:** Introduction to parametric machine learning method, assumptions of parametric machine learning methods, linear model and its assumptions, simple linear regression, parameter estimation, properties of regression parameters, testing the significance of regression parameters, estimation of σ^2, Interval Estimation of the Mean Response, prediction of new observations, Confidence interval for β_0, β_1 and σ^2, Multiple linear Regression analysis, parameter estimation, and significance of coefficients, assumptions of multiple linear regression parameters.	**8 Hours**
Unit-3:	**Classification Techniques – Logistic Regression:** Introduction to logistic regression, assumptions involved in logistic regression, concepts on odds and odds ratio, maximum likelihood estimation, binomial logistic regression, parameter estimation, properties of logistic regression coefficients, logistic regression for correlated data, model accuracy testing, confusion matrix, Receiver Operating Characteristic Curve, area under curve, likelihood ratio test, concepts and interpretation of Pseudo R square tests, Hosmer-Lemeshow Test, Wald Test, prediction using better fit model and interpretation.	**8 Hours**
Unit-4:	**Classification Techniques – Decision Tree:** Introduction to decision tree algorithms, classification tree, characteristics of classification tree – size and hierarchical nature of tree, training and testing data set, induction algorithms, probability estimation in decision tree – Laplace correction and no match method, stopping criteria for tree development, pruning techniques and pruned tree, evaluation of decision tree classifiers, generalization error, F measure, Confusion matrix, ROC curve, Hit Rate Curve, Lift curve, McNemar's Test, Resample paired t test, K-fold cross validated paired t test, prediction using better model, Decision tree ensembles methods.	**8 Hours**
Unit-5:	**Kernel Models:** Introduction to kernel methods, basics of Support Vector Machine (SVM) and Support Vector Regression (SVR), SVM : classification margin, Maximum margin hyper plane, primal form, dual form, soft margin, SVR : regression tube, primal form, dual form, kernel trick, kernel functions, linear, polynomial, radial and sigmoidal kernel functions, kernel prediction and kernel	**8 Hours**

	based algorithm for SVM and SVR.	
Text Books:	1. C.M. Bishop. "Pattern Recognition and Machine Learning", Springer.	
Reference Books:	1. Introduction to Linear Regression Analysis, Fifth Edition - DOUGLAS C. MONTGOMERY, ELIZABETH A. PECK, G. GEOFFREY VINING, A JOHN WILEY & SONS, INC., PUBLICATION. 2. Introduction to Machine Learning - Ethem Alpaydm, The MIT Press. *** Latest editions of all the suggested books are recommended.**	
Additional Electronic Reference Material:	1. https://expertsystem.com/machinelearningdefinition/#:~:text=Machine%20learning%20is%20an%20application,use%20it%20learn%20for%20themselves.	

Course Code: IAI604	Specialization- AI B.Tech.- Semester-VI **Genetic Algorithms & Applications**	L-3 T-0 P-0 C-3
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the fundamental concepts of Genetic algorithms.	
CO2.	Understanding the GA operators and implement them to solve different types of GA Problems.	
CO3.	Understanding about the way the GA is used and the domain of application.	
CO4.	Applying various genetic operators to solve genetic algorithms problems.	
CO5.	Analyzing various genetic algorithms and their applications.	
Course Content:		
Unit-1:	**Introduction to Genetic Algorithm:** Robustness of Traditional Optimization and Search methods – Goals of optimization-GA versus Traditional methods – Simple GA – GA at work –Similarity templates (Schemata) – Learning the lingo - **Mathematical foundations:** The fundamental theorem - Schema processing at work. – The 2-armed & k-armed Bandit problem. – The building Block Hypothesis. – Minimal deceptive problem.	**8 Hours**
Unit-2:	**Basic idea and concept of genetic algorithm & Genetic programming:** Introduction- definition and terminology-genetic operations on binary string-examples on genetic operations on binary string-the schema theorem-variants in genetic algorithm- Evolutionary strategies- Evolutionary programming Data Representation-Manipulating programs-Tuning of fuzzy set -classifier system-Holland classifier system0 Fuzzy classifier system of the Michigan type- Real coded GAs-Evolutionary Strategies - Evolutionary Programming	**8 Hours**
Unit-3:	**GA operators:** Data structures – Reproduction- Roulette-wheel Selection – Boltzman Selection – Tournament Selection-Rank Selection – Steady –state selection –Crossover mutation – A time to reproduce, a time to cross. – Get with the Main program. – How well does it work. – Mapping objective functions to fitness forum. – Fitness scaling. Coding – A Multi parameter, Mapped, Fixed – point coding – Discretization – constraints	**8 Hours**
Unit-4:	**Canonical Evolutionary Algorithms:** Introduction-Evolution Strategies-Genetic Algorithms-**Unified View of Simple EAs:** Population Size-Selection-Reproductive Mechanisms **Evolutionary Algorithms as Problem Solvers:** Simple EAs as Parallel Adaptive Search-EA-based Optimization-Constrained Optimization-**Evolutionary Computation Theory:** Analyzing EA Dynamics-overlapping and non-overlapping GA models-Self-adapting EAs- Summary. **Applications Of GA:** The rise of GA – GA application of Historical Interaction. – Dejung & Function optimization –Current applications of GA -**Advanced operators & techniques in genetic search:** Dominance, Diploidy & abeyance – Inversion & other reordering operators. – Other mine-operators – Niche & Speciation – Multi objective optimization – Knowledge-Based Techniques. – GA & parallel processes – Real life problem.	**8 Hours**
Unit-5:	**Introduction to genetics-based machine learning:** Genetics – Based Machine learning – Classifier system – Rule & Message system –Apportionment of credit: The bucket brigade – Genetic Algorithm – A simple classifier system in Pascal. – Results using the simple classifier system. **Applications of genetics-based machine learning:** The Rise of GBMC – Development of CS-1, the first classifier system. – Smitch's Poker player. – Other	**8 Hours**

	Early GBMC efforts. –Current Applications	
Text Books:	1. David E. Gold Berg, "Genetic Algorithms in Search, Optimization & Machine Learning", Pearson Education, 2001	
Reference Books:	1. Goldberg D.E. Genetic Algorithms in Search, Optimization and Machine Learning. Pearson Education Asia 2002 2. K. Deb, Multi-Objective Optimization Using Evolutionary Algorithms, Wiley and Sons, 2009. 3. M. Mitchell, An introduction to genetic algorithms, MIT Press, 1996. 4. L. D. Davis, Evolutionary algorithms, Springer-Verlag, 1999. 5. K. Srinivasa Raju and D. Nagesh Kumar. Multicriterion Analysis in Engineering and Management. PHI Learning Pvt. Ltd., New Delhi, India 2010. *** Latest editions of all the suggested books are recommended.**	
Additional Electronic Reference Material:	1. https://www.tutorialspoint.com/genetic_algorithms/genetic_algorithms_	

Course Code: EHM601	**Specialization- AI** **B.Tech.- Semester-VI** **Entrepreneurship**	**L-3 T-1 P-0 C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding knowledge and skills needed to run a business successfully	
CO2.	Understanding the financing and accounting.	
CO3.	Understanding the basic support to Entrepreneurs.	
CO4.	Applying current information, theories, models, techniques and practices in all of the major business disciplines.	
CO5.	Analyzing situations and constructing and selecting viable solutions to solve problems.	
Course Content:		
Unit-1:	**Entrepreneurship:** Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.	**8 Hours**
Unit-2:	**Motivation:** Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Self-Rating, Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, Objectives.	**8 Hours**
Unit-3:	**Business:** Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.	**8 Hours**
Unit-4:	**Financing and Accounting:** Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, Management of working Capital, Costing, Break Even Analysis, Taxation – Income Tax, Excise Duty – Sales Tax.	**8 Hours**
Unit-5:	**Support to Entrepreneurs:** Sickness in small Business – Concept, Magnitude, Causes and Consequences, Corrective Measures – Business Incubators – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.	**8 Hours**
Text Books:	1. Khanka. S.S., "Entrepreneurial Development" S. Chand & Co. Ltd., Ram Nagar, New Delhi.	
Reference Books:	**1.** Hisrich R D, Peters M P, "Entrepreneurship" 8th Edition, Tata McGraw-Hill. **2.** Mathew J Manimala, "Entrepreneurship theory at cross roads: paradigms and praxis" 2nd Edition Dream tech. **3.** Rajeev Roy, 'Entrepreneurship', Oxford University Press. **4.** EDII "Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development", Institute of India, Ahmadabad. *** Latest editions of all the suggested books are recommended.**	
Additional Electronic Reference Material:	1. https://nptel.ac.in/courses/110/106/110106141/ 2. https://www.youtube.com/watch?v=QoqohmccTSc	

Internal Evaluation	External Evaluation	Total Marks
50 Marks	**50 Marks**	**100**
The Internal evaluation will be performed by the internal faculty on the basis of the below mentioned parameters: • Problem Identification • Data Collection and Data Analysis • Case study • Proposal of innovative Business idea	External evaluation will be performed by the external examiner on the basis of following parameters: • Report • Presentation • VIVA	

Course Code: **IAI651**	**Specialization- AI** **B.Tech.- Semester-VI** **Machine Learning (Lab)**	**L-0** **T-0** **P-4** **C-2**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Implementing the linear regression line on given table taking ozone as dependent variable.	
CO2.	Applying prediction on 21st day of ozone level in the air with given factors.	
CO3.	Understanding the autocorrelation of error produced from the fitted line.	
CO4.	Implementing appropriate regression line with suitable predictors.	
CO5.	Comparing different regression lines and comment on regression coefficients.	
Course Content:	**Minimum eight experiments should be performed-**	

List of Experiments

Exercise – 1

Consider the following table on Air Quality

S.No	Ozone	Solar R	Wind	Temp	Month	Day
1	41	190	7.4	67	5	1
2	36	118	8	72	5	2
3	12	149	12.6	74	5	3
4	18	313	11.5	62	5	4
5	27	192	14.3	56	5	5
6	28	193	14.9	66	5	6
7	23	299	8.6	65	5	7
8	19	99	13.8	59	5	8
9	8	19	20.1	61	5	9
10	24	194	8.6	69	5	10
11	7	152	6.9	74	5	11
12	16	256	9.7	69	5	12
13	11	290	9.2	66	5	13
14	14	274	10.9	68	5	14
15	18	65	13.2	58	5	15
16	14	334	11.5	64	5	16
17	34	307	12	66	5	17
18	6	78	18.4	57	5	18
19	30	322	11.5	68	5	19
20	11	44	9.7	62	5	20

1. Summarize the above table in R or Python.
2. Create the above table in data frame format in R or python without importing from outer source.
3. Find the linear regression line on given table taking ozone as dependent variable.
4. Predict 21st day of ozone level in the air with given

	factors. 5. Find the autocorrelation of error produced from the fitted line 6. Analyse multicollinearity among independent variables and find the suitable solution to remove multicollinearity. 7. Find the variance among error terms and comment on the equal variance among error terms in the output. 8. Estimate the presence of autocorrelation using Durbin – Watson test statistic. **Exercise – 2** 1. Estimate appropriate regression line with suitable predictors. Compare different regression lines and comment on regression coefficients. 2. Estimate the significance of regression coefficients using ANOVA and compare with F and partial t test. 3. Model fit using R Square and Adjusted R square values. 4. Estimate Cook Statistic and Press Statistic for diagnostic checking 5. Post model statistical testing for the better fit and error free prediction. 6. Normality testing on error terms of fitted model **Exercise - 3** 1. Plot residual versus Fitted values using plot command 2. Plot residual versus Observed using Plot command 3. Plot observed versus and fitted values using plot command 4. Find out the leverage value in the fitted values using which.max command. 5. Interpret the residual summary from the lm( ) command. 6. Find out the VIF values using inbuilt function available in R or Python.	

Course Code: IAI652	**Specialization- AI** **B.Tech.- Semester-VI** **Big Data Analytics (Lab)**	**L-0** **T-0** **P-2** **C-1**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the infrastructure of Hadoop.	
CO2.	Applying various setting to configure Hadoop ecosystem.	
CO3.	Applying various command used in Hadoop environment.	
CO4.	Creating the single node Hadoop cluster	
CO5.	Creating the Mapper Class, Reducer Class and Driver Class for map reduce word count Job.	
Course Content:	**Minimum eight experiments should be performed-**	
List of Experiments	1. Prepare infrastructure for setting up single node Hadoop cluster. 2. Install all the software to set up single node Hadoop cluster. 3. Configuration of single node Hadoop cluster 4. You need to find the location of below Hadoop configuration file and understand the purpose of different attributes mentioned in below xml files. • hdfs-site.xml • core-site.xml • yarn-site.xml 5. You need to perform 20 basics Hadoop commands on single node Hadoop cluster. 6. *(Faculty will share commands)* 7. Install IDE to code and compile map reduce framework. 8. You need to program Mapper Class, Reducer Class and Driver Class for map reduce word count Job. 9. You need to find out word count job for the given input file provided by faculty. 10. You need to trouble shoot log file generated in experiment Number 08 and note all the steps involved in job execution 11. You need execute word count job based on 0 reducer, 2 reducer, Default reducer & 4 reducer and observe different outputs.	

Course Code: **IAI606**	**Professional Elective Courses – III** **Specialization- AI** **B.Tech.- Semester-VI** **Dimensionality Reduction and Model Validation**	**L-3** **T-0** **P-0** **C-3**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the different dimension reduction techniques for parametric and non-parametric models.	
CO2.	Understanding validation technique for regression analysis and find the better fit model.	
CO3.	Applying principle component analysis for data dimension reduction.	
CO4.	Applying nonlinear dimension reduction technique to reduce unimportant variables.	
CO5.	Applying factor analysis for data dimension reduction for data science project.	
Course Content:		
Unit-1:	**Introduction to Dimensionality Reduction:** Introduction to dimensionality reduction – basic concepts of dimensionality reduction, linearity of variables, assumptions of linearity among variables, correlation, important techniques to data dimension reduction techniques: missing values, lower variance, decision trees, decision tree ensembles, high correlation and backward feature elimination, forward feature construction, factor analysis, principle component analysis, importance of data dimension reduction technique in data science.	**8 Hours**
Unit-2:	**Dimensionality Reduction – I:** General purpose and description of principle component analysis, extraction of principle components, meaning of eigen values and Eigen vectors in principle component analysis, extraction techniques, orthogonal and oblique rotation of linear combination of variables, determination of number of principle components : cumulative per cent variance explained, average method, Kaisers rule, Broken stick method, Scree plot, using all the preliminaries of PCA for dimension reduction.	**8 Hours**
Unit-3:	**Dimensionality Reduction – II:** Random forest and its importance in reducing dimension reduction, fundamental equation of factor analysis, factor model estimation and application in dimension reductions, extraction of factors, orthogonal rotations, communality, variance and covariance, factor scores and importance of factor score in deciding the number of factors, oblique rotation, difference between orthogonal and oblique rotation, application of factor analysis for dimension reduction.	**8 Hours**
Unit-4:	**Dimensionality Reduction – III:** Introduction to linear discriminant analysis, general purpose and description, fundamental equation of discriminant analysis, application of discriminant analysis for dimension reduction, relationship between PCA, Factor analysis and Discriminant analysis, introduction to independent component analysis, concept of blind source separation, introduction to mixing and unmixing signals, application of independent component analysis in dimension reduction analysis.	**8 Hours**
Unit-5:	**Non Linear Dimensionality Reduction:** Introduction to high dimensional data, Expected functions: Estimation of the number of latent variables, embedding for dimensionality reduction, Embedding for latent variable separation, Hard vs. Soft dimensionality reduction, Traditional vs. Generative model, Linear vs. nonlinear model, Distance preservation : spatial distances, graph distances : Geodesic distance and graph distances,	**8 Hours**

	Isomap, Curvilinear distance analysis, Kernel PCA, Semi definite embedding, Topology Preservation : Self-Organizing maps, Generative Topographic Mapping, Locally linear embedding, Laplacian Eigen maps, Isotop.	
Text Books:	1. Introduction to Linear Regression Analysis, Fifth Edition - Douglas C. Montgomery, Elizabeth A. Peck, G. Geoffrey Vining, A John Wiley & Sons, Inc., Publication.	
Reference Books:	1. Dimensionality Reduction with Unsupervised Nearest Neighbors, Volume 51 - Oliver Kramer, Springer Science + Business Media, LLC. 2. Nonlinear Dimensionality Reduction - John A. Lee Michel Verleysen, Springer Science + Business Media, LLC. 3. Fundamentals of mathematical statistics – SC Gupta and VK Kapoor, Sultan Chand & Sons Publication, New Delhi 4. Using Multivariate Statistics, Sixth Edition - Barbara G. Tabachnick, Linda S. Fidell, Pearson Education 5. Applied Regression Analysis, Third Edition – Norman R Draper, Harry Smith, Wiley Publication. *** Latest editions of all the suggested books are recommended.**	
Additional Electronic Reference Material:	1. https://machinelearningmastery.com/dimensionality-reduction-for-machine-learning/	

Course Code: **IAI607**	**Professional Elective Courses – III** **Specialization- AI** **B.Tech.- Semester-VI** **Logic Programming and Uncertainty in Artificial Intelligence**	**L-3** **T-0** **P-0** **C-3**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding sources of uncertainty.	
CO2.	Understanding concept of Bayesian Networks and Naïve Bayes Classifier.	
CO3.	Applying probability formulae to solve basic probability problems.	
CO4.	Analyzing the various problem associated with Petri Nets.	
CO5.	Creating a prolog program to for data prediction.	
Course Content:		
Unit-1:	**Uncertainty:** Acting under Uncertainty- Basic Probability Notation: prior probability-conditional probability- the axioms of probability- Bayes' Rule and Its Use- Representing Knowledge in an Uncertain Domain- The Semantics of Bayesian Networks- Efficient Representation of Conditional Distributions- Exact Inference in Bayesian Networks: The variable elimination algorithm, Clustering algorithms- Direct sampling methods- Rule-based methods.	**8 Hours**
Unit-2:	**Knowledge base & Representations:** Introduction-Knowledge-Based Systems- Knowledge Representation: Semantic Nets, Rules, Frames, Scripts, Logic, RDF- Reasoning and Inference: Predicate Logic, Description Logics, Inference Methods, Resolution, ECLiPSe-specific Language features, Structure, Iteration, Loops, I/O. Data and knowledge: Data representation and data items in traditional databases, Data representation and data items in relational databases. Rules: Logical operations, Syntax and semantics of rules, Data log rule sets ,The dependence graph of data log rule sets, Objects, Frames ,Semantic nets.	**8 Hours**
Unit-3:	**Qualitative Reasoning and Petri Nets:** Sign and interval calculus, Qualitative simulation: Constraint type qualitative differential equations, The solution of QDEs: the qualitative simulation algorithm: Initial data for the simulation, Steps of the simulation algorithm, Simulation results. Qualitative physics, Signed directed graph (SDG) models, The Notion of Petri nets, The firing of transitions, Special cases and extensions, The state-space of Petri nets The use of Petri nets for intelligent control, The analysis of Petri nets: Analysis Problems for Petri Nets, Analysis techniques.	**8 Hours**
Unit-4:	**Bayesian Probability:** Introduction- Foundations- Resolution by independence- certainty factor model- epistemic probability- Dempster Shafer theory of evidence- Vague and approximate concepts- Automated theorem proving- overview of formal logic- Non-monotonic logics- Heuristic models of argumentation	**8 Hours**
Unit-5:	**Tools for Representation and Reasoning:** The Lisp programming language: The fundamental data types in Lisp, Expressions and their evaluation, some useful Lisp primitives, some simple examples in Lisp, The Prolog programming language: The elements of Prolog programs, The execution of Prolog programs Built-in predicates, and Some simple examples in Prolog. Expert system shells: Components of an expert system shell, Basic functions and services in an expert system shell.	**8 Hours**

Text Books:	1. Representing Uncertain Knowledge An Artificial Intelligence Approach by Paul KrauseDominic Clark	
Reference Books:	1. Engineering of Knowledge-Based Systems. Avelino J. Gonzalez, Douglas D. Dankel, Prentice Hall (2000), ISBN-10: 0130189731. 2. Expert Systems: Principles and Programming, Fourth Edition.Joseph C. Giarratano, Gary D. Riley, 2004, ISBN-10: 0534384471 *** Latest editions of all the suggested books are recommended.**	
Additional Electronic Reference Material:	1. https://www.public.asu.edu/~cbaral/papers/sum11.pdf	

Course Code: **IAI608**	**Professional Elective Courses – III** **Specialization- AI** **B.Tech.- Semester-VI** **Recommender System**	**L-3 T-0 P-0 C-3**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the basic concepts of recommender systems in data science.	
CO2.	Understanding the different data mining techniques used in recommender system.	
CO3.	Understanding the content based recommender system usage in business scenario.	
C04.	Analyzing content based and neighborhood based recommender system.	
C05.	Analyzing different algorithms used for Context-Aware Recommender Systems.	
Course Content:		
Unit-1:	**Introduction to Recommender System:** Introduction to recommender system, understanding recommender system, kinds of recommender systems: collaborative filtering recommender system, content based recommender system, knowledge based recommender system, hybrid system, application and evaluation techniques, recommender and human computer interaction, recommender system as multi-disciplinary field, emerging topics and challenges in recommender system.	**8 Hours**
Unit-2:	**Data Mining Techniques in Recommender System:** Introduction to Data mining techniques, data pre-processing, data mining techniques used in recommender system: similarity measures, sampling, Dimensionality reduction techniques, denoising, k – means clustering, support vector machine, ensemble methods, rule based classifiers, ANN, Bayesian Classifiers, association rule mining.	**8 Hours**
Unit-3:	**Content Based Recommender System:** Introduction to content based Recommender System, High Level Architecture of Content-based Systems, advantages and drawbacks of Content-based Filtering, item representation, methods for learning user profiles, trends and future research : Role of user generated content in the Recommendation Process, beyond Over-specializion: Serendipity.	**8 Hours**
Unit-4:	**Neighbourhood based Recommender System:** Introduction to neighbourhood based recommender system, definition, overview of recommendation approaches, advantages of neighbourhood based recommender system, neighbourhood-based recommendation: user-based Rating Prediction, user- based classification, regression vs classification, item-based recommendation, comparison of user-based and item-based recommendation, components of Neighbourhood Methods : Rating normalization, similarity weight computation, neighbourhood selection.	**8 Hours**
Unit-5:	**Context-Aware and Social Tagging Recommender Systems:** Introduction to context aware recommender systems, definition of context, modelling contextual information in recommender system, obtaining contextual information, paradigms for Incorporating Context in Recommender Systems : contextual pre filtering, post filtering and modelling, case Study of Combining Multiple Pre-Filters: Algorithms and experimental results, additional issues related to context aware recommender systems, Introduction to Social tagging recommender systems: Folksonomy , the Traditional Recommender Systems Paradigm, multi-Mode recommendations, real World Social Tagging Recommender Systems, tag acquisition.	**8 Hours**

Text Books:	1. Recommender Systems An Introduction - DIETMAR JANNACH, MARKUS ZANKER, ALEXANDER FELFERNIG, GERHARD FRIEDRICH, Cambridge University Press	
Reference Books:	1. Building a Recommendation System with R - Suresh K. Gorakala, Michele Usuelli, PACKT Publishing. 2. Recommender Systems for the Social Web – Jose J. Pazos Arias, Ana Fernandez Vilas, Rebeca P. D´ıaz Redondo, Springer Science + Business Media, LLC *** Latest editions of all the suggested books are recommended.**	
Additional electronic reference material:	1. https://towardsdatascience.com/introduction-to-recommender-systems-6c66cf15ada	

Course Code: IAI609	**Professional Elective Courses – IV** **Specialization- AI** **B.Tech.- Semester-VI** **Client & Server Side Scripting**	**L-3 T-0 P-0 C-0**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the concepts of server side scripting.	
CO2.	Understanding the basic Server web architecture.	
CO3.	Understanding the CGI and GUI Programming.	
C04.	Applying HTML and CSS to design a web page.	
C05.	Creating a GUI application using python programming.	
Course Content:		
Unit-1:	**HTML:** Introduction to Html, Html Document structure, Html Editors, Html element/tag & attributes, Designing simple page - Html tag, Head tag, Body tag; More Html tags - Anchor tag, Image tag, Table tag, List tag, Frame tag, Div tag ; Html forms - Input type, Text area, Select , Button, Images. **Introduction to CSS**: Syntax, Selectors, Embedding CSS to Html, Formatting fonts, Text & background colour, Inline styles, External and Internal Style Sheets, Borders & boxing	**8 Hours**
Unit-2:	**JavaScript:** Introduction to JS, Embedding JS into Html, Variables, Data types, Operators, Conditional statements, Looping statements, Strings, Arrays, Math Object, Date Object, Functions, Objects, Event Handling	**8 Hours**
Unit-3:	**HTML 5 & CSS3:** Introduction to HTML5, CSS3, New features, Local storage, Web SQL database, Web Sockets, Server events, Canvas, Audio & Video, Geolocation, Microdata, Drag and Drop. Browser life cycle and browser rendering stages. Service workers.	**8 Hours**
Unit-4:	**CGI and GUI Programming in Python:** Classes and Objects, Regular Expressions, CGI Programming, Database Access Networking, Sending Email, Multithreading, XML Processing, GUI Programming, Extending and Embedding Python.	**8 Hours**
Unit-5:	**Introduction to Ruby on Rails:** MVC Architecture, How to install, Framework, Directory structure, Features, Basic Rails Application Setting up the database, Active records, Migrations, Controllers, Routes, Views, Layouts, Scaffolding, AJAX, Uploading files, sending Email , real World Social Tagging Recommender Systems, tag acquisition.	**8 Hours**
Text Books:	1. Adrian W. West, " Practical Web Design for Absolute Beginners", APress Publications, 2016	
Reference Books:	1. Thomas Powell, "HTML & CSS: The Complete Reference", McGraw Hill, Fifth Edition, 2010 2. Professional Ruby on Rails by Noel Rappin, Wiley India Pvt Ltd 3. Learn Ruby on Rails: Book one, by Daniel Kehoe 4. Professional Ruby on Rails by Noel Rappin, Wiley India Pvt Ltd 5. Learn Ruby on Rails: Book one, by Daniel Kehoe *** Latest editions of all the suggested books are recommended.**	
Additional electronic reference material:	1. https://www.cs.ucy.ac.cy/courses/EPL344/slides2019/EPL344.lectures.14.pdf 2. https://www.w3schools.com/html/html_scripts.asp	

Course Code: IAI610	**Professional Elective Courses – IV** **Specialization- AI** **B.Tech.- Semester-VI** **Mobile Applications Development**	**L-3 T-0 P-0 C-0**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the basics of mobile networks.	
CO2.	Understanding the different concepts needed for the proper functioning of a mobile device.	
CO3.	Understanding the concepts of Mobile platform and NW environment	
C04.	Understanding the concepts of Web Architecture, Standards and Tools.	
C05.	Analyzing different types of applications, the importance of mobile operating system and features.	
Course Content:		
Unit-1:	**Mobile Application Principles:** Mobile Application Development Paradigm, What is an application?, Mobile Application, Programming rules and Challenges. Mobile Programming Tools, Mobile Application Evolution, Thin Client, Fat Client, Future of Mobile App Development	**8 Hours**
Unit-2:	**Mobile Programming Languages and Practices:** Mobile App Programming in Java, Introduction to Java, Java Compiler, Java Interpreter, Advantages of Java, Disadvantages of Java, Programming Methodology. Mobile App Programming in C++, Introduction to C++, Symbian C++, and Microsoft embedded VC++. Mobile Programming best practices, User Analysis, Organizational Analysis	**8 Hours**
Unit-3:	**Mobile platform and NW environment:** Mobile App Testing Environment, OTA App Provisioning, Mobile Applications: What is Web App?, Context of Mobile Applications, Pros and Cons of Mobile Web App, SIM based Mobile App Development, What is SIM?, SIM as a Platform, SIM as Service Differentiator, Introduction to UI, Principles for UI development	**8 Hours**
Unit-4:	**Architecture:** World Wide Web, Basics of WWW, Web Application, Web Application Architecture, Web Server, Web Server Features, Web Application Server, Web Technologies and Standards: HTTP, HTML, HTML Tags, CSS (Cascading Style Sheets), XML, introduction to Cookies. Dynamic Web Pages and CGI Script, Java Script and Java Script Features, Java Servlets, Java Web Components, J2EE MVC Framework, PHP, AJAX and AJAX Standards	**8 Hours**
Unit-5:	**Web Architecture, Standards and Tools:** Mobile Internet Access, Mobile Web browser Evolution, Mobile Web Standards and development time, WAP and WAP Standards, XHTML, WML and WMLScript, Mobile Web Development Approaches. Content Adaption and Adaption Strategies, How to recognize end user device, Device Detection in PHP. Tools Available for mobile web development, Conversion Engines, Emulators, Mobile Web Checkers	**8 Hours**

Text Books:	1. Mobile Applications: Architecture, Design, and Development by Valentino Lee, Heather Schneider and Robbie Schell, Pearson Education, 2004.	
Reference Books:	1. Professional Mobile Application Development by Jeff McWherter, Scott Gowell, 2012 2. Mobile Computing Principles: Designing and Developing Mobile Applications by Reza B'Far, Cambridge University, 2005 *** Latest editions of all the suggested books are recommended.**	
Additional electronic reference material:	1. https://www.cs.cmu.edu/~bam/uicourse/830spring09/BFeiginMobileApplicationDevelopment.pdf	

Course Code: IAI611	**Professional Elective Courses – IV** **Specialization- AI** **B.Tech.- Semester-VI** **Cloud Computing**	**L-3 T-0 P-0 C-3**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the concept of cloud, various types of clouds and their working	
CO2.	Understanding the need for migration on cloud and identify the economic considerations involved	
CO3.	Understanding the Standards, Organizations and Groups associated with Cloud Computing	
C04.	Understanding the importance of IT governance in cloud computing	
C05.	Analyzing the various Jurisdictional Issues Raised by Virtualization and Data Location.	
Course Content:		
Unit-1:	**Fundamentals of Cloud Computing:** Cloud Computing Basics – History of Cloud Computing, Characteristics of Cloud Computing, Need for Cloud computing, Advantages and Possible Disadvantages of cloud computing, Cloud Deployment Models – Public, Private, Hybrid, Community, Other deployment Models. Evolving Data Center into Private Cloud, Datacenter Components, Extracting Business value in Cloud Computing – Cloud Security, Cloud Scalability, Time to Market, Distribution over the Internet, Cloud Computing Case Studies.	**8 Hours**
Unit-2:	**Cloud Delivery Models:** Introduction to Cloud Services, **Infrastructure as a Service (IaaS)** – Overview, Virtualization, Container, Pricing Models, Service Level Agreements, Migrating to the Cloud, IaaS Networking options, Virtual Private Cloud(VPC), IaaS Storage – File and Object storage, Data Protection, IaaS security, Benefits, Risks and Examples of IaaS. Platform as a Service (PaaS) – Overview, IaaS vs PaaS, PaaS Examples, benefits and risks. Software as a Service (SaaS) – Introducing SaaS, SaaS Examples – Office 365, Google G Suite, Salesforce.com , Evaluating SaaS – user and vendor perspective, Impact of SaaS, Benefits and risks of SaaS. Other Services on Cloud, Cloud Delivery Models Considerations	**8 Hours**
Unit-3:	**Cloud Platforms:** Introducing Cloud Platforms, Evaluating cloud platforms, Cloud Platform technologies – Amazon Web Services, Microsoft Azure, Google Cloud Platform, Salesforce.com, Impact of Cloud platforms. Private Cloud Platforms – Introducing Private clouds – Microsoft Azure stack, Open stack, AWS Greengrass, Impact of Private clouds **Cloud Migration** : Delivering Business Processes from the Cloud: Business process examples, Broad Approaches to Migrating into the Cloud, The Seven-Step Model of Migration into a Cloud, Efficient Steps for migrating to cloud., Risks: Measuring and assessment of risks, Company concerns Risk Mitigation methodology for Cloud computing, Case Studies	**8 Hours**
Unit-4:	**Cloud Computing - Challenges, Risk and Mitigation:** Cloud Storage, Application performance, Data Integration, Security. **Ensuring Successful Cloud Adoption**: Designing a Cloud Proof of Concept, Vendor roles and capabilities, moving to the Cloud. Impact of Cloud on IT Service Management. **Risks and Consequences of Cloud Computing** – Legal Issues, Compliance Issues, Privacy and Security.	**8 Hours**
Unit-5:	**Managing the Cloud:** Managing and Securing Cloud Services, Virtualization and the Cloud, Managing Desktops and devices on the cloud, SOA and Cloud computing, Managing the Cloud environment, Planning for the Cloud – Economic Cost Model and Leveraging the Cloud, Cloud computing resources, Cloud Dos and Don'ts.	**8 Hours**

Text Books:	1. Kirk Hausman, Susan L. Cook, Telmo Sampaio, " CLOUD ESSENTIALS CompTIA® Authorized Courseware for Exam CLO-001", John Wiley & Sons Inc., 2013	
Reference Books:	1. Erl," Cloud Computing: Concepts, Technology & Architecture", Pearson Education, 2014 2. Srinivasan, "Cloud Computing: A Practical Approach for Learning and Implementation "Pearson Education, 2014. *** Latest editions of all the suggested books are recommended.**	
Additional electronic reference material:	1. https://www.tutorialspoint.com/cloud_computing/cloud_computing_tutorial.pdf 2. https://studytm.files.wordpress.com/2014/03/hand-book-of-cloud-computing.pdf	

Course Code: **TMUGA601**	**Specialization- AI** **B.Tech.- Semester-VI** **Advance Algebra and Geometry (Value Added Course)**	**L-2** **T-1** **P-0** **C-0**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Implementing the rules of different geometrical concepts in Lines and Angles, Triangles, Area and volumes of different figures.	
CO2.	Recognizing the rules of Crypt-arithmetic and relate them to find out the solutions.	
CO3.	Illustrating the different Algebraic expressions in Quadratics, progressions etc.	
CO4.	Employing the concept of higher level reasoning in Clocks, Calendars and Puzzle Problems.	
CO5.	Correlating the various arithmetic and reasoning concepts in checking sufficiency of data.	
Course Contents		
Unit:1	**Geometry and Mensuration** Lines and Angles, Triangles – Areas, Similar Triangles, Circles, Polygons, 2D Mensuration , 3D Mensuration	**3 Hours**
Unit:2	**Functions** Introduction to Functions, Even and Odd Functions, Recursive	**2 Hours**
Unit:3	**Crypt Arithmetic** Introduction of Crypt Arithmetic, Mathematical operations using Crypt Arithmetic, Company Specific Pattern	**4 Hours**
Unit:4	**Quadratics** Introduction of Quadratic Equation, Relationship between equations, Maxima and Minima of Quadratic Equations, Range	**2 Hours**
Unit:5	**Heights and Distance** Basic concept, Word problems	**2 Hours**
Unit:6	**Progressions and special series** Introduction to AP, GP and HP, Common terms in Progressions, Arithmetic Geometric Progression, Sum of convergent series	**3 Hours**
Unit:7	**Set theory** Introduction , Venn Diagrams basics, Venn Diagram – 3 sets, 4-Group Venn Diagrams	**2 Hours**
Unit:8	**Data Sufficiency** Introduction, Blood relation based, direction based, ranking based	**4 Hours**
Unit:9	**Problem Solving** Introduction, Puzzle based on 3 variable, Puzzle based on 4 variable	**4 Hours**
Unit:10	**Clocks and calendars** Introduction , Angle based , faulty Clock, Interchange of hands, Introduction of Calendars, Leap Year , Ordinary Year	**4 Hours**
References Book:	R1:-Arun Shrama:- How to Prepare for Quantitative Aptitude R2:-Quantitative Aptitude by R.S. Agrawal R3:-M Tyra: Quicker Maths	

	R4:-Nishith K Sinha:- Quantitative Aptitude for CAT R5:-Reference website:- Lofoya.com, gmatclub.com, cracku.in, handakafunda.com, tathagat.mba, Indiabix.com R6:-Logical Reasoning by Nishith K Sinha R7:-Verbal and Non Verbal Reasoning by R.S. Agrawal	

Evaluation Scheme for Quantitative Aptitude Skill Enhancement:-

The students will be evaluated on the score of 100 for every semester. Detailed scheme for the course is as follows.

a. 20 marks best 2 out of CT1 + CT2 + CT3
b. 10 marks will be for Assignments.
c. 10 marks for attendance and practice sheets, at the end of semester, will be provided in the following manner.
d. 60 marks for final external exams.

S No	% Attendance <	Marks
1.	0-10	1
2.	10 -20	2
3.	20- 30	3
4.	30-40	4
5.	40-50	5
6.	50-60	6
7.	60 – 70	7
8.	70 – 80	8
9.	80 – 90	9
10.	90-100	10

From {CT 1, CT 2 and CT 3} Best 2 CT's Score (20) + Final External exam (60) + Attendance (10)+ Assignment(10) = 100 marks.

Course Code: TMUGS601	**Specialization- AI** **B.Tech.- Semester-VI** **Managing Work and Others**	**L-2** **T-1** **P-0** **C-0**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Communicating effectively in a variety of public and interpersonal settings.	
CO2.	Applying concepts of change management for growth and development by understanding inertia of change and mastering the Laws of Change.	
CO3.	Analyzing scenarios, synthesizing alternatives and thinking critically to negotiate, resolve conflicts and develop cordial interpersonal relationships.	
CO4.	Functioning in a team and enabling other people to act while encouraging growth and creating mutual respect and trust.	
C05.	Handling difficult situations with grace, style, and professionalism.	
Course Content:		
Unit-1:	**Intrapersonal Skills:** Creativity and Innovation Understanding self and others (Johari window) Stress Management Managing Change for competitive success Handling feedback and criticism	**10 Hours**
Unit-2:	**Interpersonal Skills:** Conflict management Development of cordial interpersonal relations at all levels Negotiation Importance of working in teams in modern organisations Manners, etiquette and net etiquette	**8 Hours**
Unit-3:	**Interview Techniques:** Job Seeking Group discussion (GD) Personal Interview	**12 Hours**
Text Books:	1. Steinburg, Scott, Nettiquette Essentials (2013), Lulu.com	
References Books:	1. Robbins, Stephen P., Judge, Timothy A., Vohra, Neharika, Organizational Behaviour (2018), 18th ed., Pearson Education 2. Burne, Eric, Games People Play (2010), Penguin UK 3. Carnegie, Dale, How to win friends and influence people (2004), RHUK 4. Rathgeber, Holger, Kotter, John, Our Iceberg is melting (2017), Macmillan	
Additional electronic reference material:	1. https://www.hloom.com/resumes/creative-templates/ 2. https://www.mbauniverse.com/group-discussion/topic.php 3. https://www.indeed.com/career-advice/interviewing/job-interview-tips-how-to-make-a-great-impression	

Evaluation Scheme: Faculty led Continuous Evaluation

- Evaluation of **"Managing Self"** and **"Managing Work and Others"** will follow the continuous evaluation method.
- Students will be evaluated on the score of 100 on the pattern prescribed by the University for Conduction of Practical Courses.

c) Internal: 50 marks for Internal evaluation following the continuous evaluation method, which includes:

1. 40 marks for Class Performance (Every class activity will carry 8 marks; each students can participate in maximum of 5 activities)

2. 10 marks for Attendance and involvement in the activities

d) External: 50 marks for External evaluation at the time of external exams (Based on Observations, GDs and PIs and other assessment tools).

Course Code: IAI701	**Specialization- AI** **B.Tech.- Semester-VII** **Fuzzy Logic and application**	**L-3 T-0 P-0 C-3**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding of the basic mathematical elements of the theory of fuzzy sets.	
CO2.	Understanding the concepts of fuzzy relations and the properties of these relations.	
CO3.	Understanding the concepts of fuzzy inference in the area of artificial intelligence.	
CO4.	Applying basic fuzzy inference and approximate reasoning.	
CO5.	Applying basic fuzzy system modelling methods for decision making.	
Course Content:		
Unit-1:	**Introduction :-**Background, Uncertainty and imprecision, Statistics and random processes, Uncertainty in information, Fuzzy sets and membership, Chance versus ambiguity, Classical sets -operations on classical sets to functions, Fuzzy sets-fuzzy set operations, Properties of fuzzy sets. Sets as points in hyper cubes.	**8 Hours**
Unit-2:	**Classical Relations and Fuzzy Relations** :- Cartesian product, Crisp relations-cardinality of crisp relations, Operations on crisp relations, Properties of crisp relations, Compositions, Fuzzy relations-cardinality of fuzzy relations, Operations on fuzzy relations, Properties of fuzzy relations, Fuzzy Cartesian product and composition, Non interactive fuzzy sets, Tolerance and equivalence relations-crisp equivalence relation, Crisp tolerance relation, Fuzzy tolerance, Max-min Method, other similarity methods.	**8 Hours**
Unit-3:	**Membership Functions, Fuzzy-To-Crisp Conversions and Arithmetic:-** Features of the membership function, Standards forms and boundaries, fuzzification, Membership value assignments-intuition, Inference, Rank ordering, Angular fuzzy sets- Neural networks, Genetic algorithms, Inductive reasoning, Lambda- cuts for fuzzy sets, Lambda-cuts for fuzzy relations, Defuzzification methods. Extension principle-crisp functions, Mapping and relations, Functions of fuzzy sets-extension principle, Fuzzy transform (Mapping), Practical considerations, and Fuzzy numbers Interval analysis in Arithmetic, Approximate methods of extension-vertex method, DSW algorithm, Restricted DSW algorithm, Comparisons, Fuzzy vectors	**8 Hours**
Unit-4:	**Classical Logic, Fuzzy Logic and Rule Based Systems** :- Classical Predicate Logic – Tautologies, Contradictions, Equivalence, Exclusive OR and Exclusive NOR, Logical Proofs, Deductive Inferences. Fuzzy Logic, Approximate Reasoning, Fuzzy Tautologies, Contradictions, Equivalence and Logical Proofs, Other forms of the Implication Operation, Other forms of the Composition Operation, Fuzzy Rule-Based Systems: Natural Language, Linguistic Hedges, Rule-Based Systems - Canonical Rule Forms, Decomposition of Compound Rules, Likelihood and Truth Qualification, Aggregation of Fuzzy Rules, Graphical Techniques of Inference	**8 Hours**

Unit-5:	**Fuzzy Decision Making and Classification:-** Fuzzy Synthetic Evaluation, Fuzzy Ordering, Preference and consensus, Multi objective Decision Making, Fuzzy Bayesian Decision Method, Decision Making under Fuzzy States and Fuzzy Actions, Classification Equivalence Relations - Crisp Relations, Fuzzy Relations. Cluster Analysis, Cluster Validity, c-Means Clustering - Hard c-Means (HCM), Fuzzy c-Means (FCM). Classification Metric, Hardening the Fuzzy c-Partition, Similarity Relations from Clustering.	**8 Hours**
Text Books:	1. G.J. Klir And T.A. Folger, Fuzzy Sets, Uncertainty And Information, Prentice Hall Of India, 1998.	
Reference Books:	1. H.J. Zimmerman, Fuzzy Set Theory And Its Applications, 4th Ed., Kluwer Academic Publishers, 2001. 2. G.J. Klir And B.Yuan, Fuzzy Sets And Fuzzy Logic: Theory And Applications, Prentice Hall Of India, 1997. 3. H.Nguyen And E.Walker, A First Course In Fuzzy Logic, 2nd Ed., Chapman And Hall/CRC, 1999. 4. J. Yen And R. Lengari, Fuzzy Logic: Intelligence, Control And Information, Pearson Education,1999. ***Latest editions of all the suggested books are recommended.**	
Additional electronic reference material:	1. http://iauctb.ac.ir/Files/fuzzy%20logic%20with%20engineering%20application-3rdEdition.pdf	

Course Code: IAI702	**Specialization- AI** **B.Tech.- Semester-VII** **Deep Learning**	**L-3** **T-0** **P-0** **C-3**
Course Outcomes:	**On successful completion of the course, students will be able to:-**	
CO1.	Understanding about Deep learning and Machine learning basics.	
CO2.	Understanding the concepts of deep network.	
CO3.	Applying pre trained model to solve deep learning problems.	
CO4.	Applying various deep learning methods to morph and search images.	
CO5.	Analyzing various deep learning algorithms use to solve NLP problems.	
Course Content:		
Unit-1:	**Applied Math & Machine Learning Basics:-**Introduction-Linear Algebra: Linear Equations- Matrices And Elementary Row Operations- Vector Spaces- Linear Transformations- Orthogonality- Eigenvalues and Eigen vectors. Probability- Random Variable- Probability distribution: Discrete variable and probability mass function-Continuous Variable and Probability density function. Marginal probability-Conditional Probability- Chain rule for Conditional Probability – Independence and conditional independence –Expectation Covariance and variance- Common probability Distributions- Bayes' rule. How Machine Learning Works: Regression- Classification- Clustering- Underfitting and overfitting-Optimization- Convex Optimization- Gradient Descent- Stochastic Gradient Descent- Quasi- Newton Optimization Method-Generative vs Discriminative model- Logistic Regression- Evaluating models: Confusion metrics.	**8 Hours**
Unit-2:	**Unit II: Foundations to neural networks and optimization** Foundations of Neural Networks- what is NN- Comparison between Artificial and biological nn- characteristic of nn- Historical development- Hodgkin –Huxley Neuron Model- Integrate and fire neuron model- spiking neural model- NN and activation functions- NN architecture. Optimization: Linear regression- Linear Classification- gradient descent-Overfitting problem and model validation- Model Regularization- Stochastic gradient descent- Gradient descent extensions-Linear model and optimization.	**8 Hours**
Unit-3:	**Feedforward and Associative Memory Network:-**Single layer feedforward NN: Single layer perceptron- Classification model,	**8 Hours**

	feature and decision regions- Discriminant function- Non Parametric Training Concept- Training and classification using discrete perceptron algorithm- Perceptron convergence theorem- Single layer Continuous perceptron network for linearly separable classification. Multilayer feedforward NN: generalized delta learning rule- delta learning rule for multiperceptron layer- Backpropagation- Algorithm for error back propagation- Kolmogorov's theorem. Associative Memory Network: Algorithm for pattern association- Delta rule- Hetero Associative memory Neural Network- Auto associative memory network- Recurrent linear Auto Associator-Bidirectional Associative Memory- Linear Associator – Storage Algorithm	
Unit-4:	**Deep Learning for images:-**Image Classification: The data-driven approach -K-nearest neighbor -Linear Classification. Convolutional Neural Networks: History -Convolution and pooling -ConvNets outside vision. Training Neural Networks: Activation functions- initialization- dropout- batch normalization- Update rules- ensembles- data augmentation- transfer learning. CNN Architectures: AlexNet- VGG- GoogLeNet- ResNet.	**8 Hours**
Unit-5:	**Deep learning for sequences:-** RNN and Backpropagation- Generating names with RNNs-Modern RNNs-How to use RNNs- LSTM, GRU models- Application to NLP- Application to Speech recognition. Application of ANN: Unsupervised representation learning: Linear factor model- Autoencoder-Word Embeddings: Generative adversarial networks: Representation Leraning- Structured probabilistic model for Deep learning- Monte Carlo Methods- Deep generative models- Application of Neural Network	**8 Hours**
Text Books:	1. Deep Leraning by Ian Goodfellow and YoshuaBengio and Aaron Courville (MIT press)	
Reference Books:	1. Chris Bishop's Pattern recognition and machine learning 2. Deep Learning Methods and Applications by Deng & Yu's monograph 3. Deep Learning with Python By J. Brownlee ***Latest editions of all the suggested books are recommended.**	
Additional electronic reference material:	1. http://dee plearning.net/tutorial/deeplearning.pdf 2. https://d2l.ai/d2l-en.pdf	

Course Code: IAI703	Specialization- AI B.Tech.- Semester-VII **Expert System**	L-3 T-0 P-0 C-3
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the concepts of Knowledge representation.	
CO2.	Applying the methodology to transfer human knowledge into an expert system.	
CO3.	Applying CLIPS for the implementation of an expert system.	
CO4.	Analyzing various Expert System tools.	
CO5.	Creating a rule based expert system.	
Course Content:		
Unit-1:	**Knowledge base and representation:-** Logical Agents: Knowledge Based Agents-Propositional Logic: Syntax -Semantics -A Simple Knowledge Base – Inference-Equivalence, Validity, And Satisfiability .Reasoning Patterns In Propositional Logic-Resolution-Forward And Backward Chaining .Effective Propositional Inference-A Complete Backtrack Lung Algorithm -Local-Search Algorithms-Hard Satisfiability Problems. Agents Based On Propositional Logic-Knowledge and knowledge representation - Knowledge representation using predicate logic- Procedural representation- Semantic networks.	**8 Hours**
Unit-2:	**Rule-based, Fuzzy Logic and Applications:-**Introduction-rules as a knowledge representation technique- structure of rule based expert system-characteristics of expert system- forward chaining and backward chaining – conflict resolution, Role of fuzzy logic – fuzzy set and fuzzy logic- basic structure of fuzzy system for modelling and control- Types of Fuzzy Systems for Modelling and Control - Uncertainty - fuzzy logic and belief nets-Neuro fuzzy expert system-Fuzzy reasoning scheme- expert system shell.– Applications Of Fuzzy Logic	**8 Hours**
Unit-3:	**Machine learning, data-base mining and Text Mining:-**Data Mining: introduction –data mining functionalities: Relational database –Data warehouse-transactional DB-classification and prediction- Cluster analysis-Data warehouse architecture- Decision-Theoretic Expert System- Web mining: -Data Mining and Knowledge Discovery: The KDD process and methodology, Overview of data mining techniques- Web Usage Mining Process and Techniques - Web Mining Applications: Data integration for e-commerce, Web personalization and recommender systems, Web content and structure mining, Web data warehousing, Overview of text mining- Definition- General Architecture– Algorithms– Core Operations – Pre-processing– Types of Problems- basics of document classification- information retrieval- clustering and organizing documents- information extraction- prediction and evaluation-Textual information to numerical vectors -Collecting documents- document standardization- tokenization- lemmatization- vector generation for prediction-sentence boundary determination -evaluation performance	**8 Hours**
Unit-4:	**Real time expert system and Inconsistencies and Uncertainties:-**The architecture of real-time expert systems: The real-time subsystem, The intelligent subsystem Synchronization and communication between real-time	**8 Hours**

	and intelligent subsystems: Synchronization and communication primitives, Priority handling and time-out. Data exchange between the real-time and the intelligent subsystems: Loose data exchange, The blackboard architecture. Software engineering of real-time expert systems: The software lifecycle of real-time expert systems, Special steps and tool, An Example of A Real-Time expert System, Introduction, Truth Maintenance Systems, Default Reasoning and the Closed World Assumption, Predicate Completion and Circumscription, Modal and Temporal Logics. Probabilistic Reasoning: Introduction, Bayesian Probabilistic Inference, Possible World Representations, Dumpster-Shafer Theory, Ad-Hoc Methods.	
Unit-5:	**Building Expert Systems in Prolog:-**Expert system feature- Applications- Prolog inference engine: The bird identification system, User interface, A simple shell- Backward chaining with uncertainty: certainty factors, MYCINs certainty factor, Rule format, Inference Engine- Forward chaining- Frames-Integration: Foops (frames and Oops)- prototyping.	**8 Hours**
Text Books:	1. J. Giarratano and G. Riley, "Expert Systems -- Principles and Programming". 4th Edition, PWS Publishing Company, 2004.	
Reference Books:	1. Durkin, J., Expert systems Design and Development, Macmillan, 1994 2. Elias M. Awad, Building Expert Systems, West Publishing Company 1996 3. Peter Jackson, Introduction to Expert Systems, Addison Wesley Longman, 1999.ISBN 0-20187686-8. 4. Gonzalez and D. Dankel, "The Engineering of Knowledge-Based Systems'', Prentice Hall, 1994. 5. Nikolopoulos, "Expert Systems", Marcel Dekker Inc. 1997. ISBN 08247 9927 5. 6. Nils J.Nilsson: Principles of Artificial Intelligence- Narosa Publishing house. 7. Artificial Intelligence : A Modern Approach, Stuart Rusell, Peter Norvig, Pearson Education ***Latest editions of all the suggested books are recommended.**	
Additional electronic reference material:	1. http://www0.cs.ucl.ac.uk/staff/D.Gorse/teaching/1009/1009.ai.pdf	

Course Code: IAI751	**Specialization- AI** **B.Tech.- Semester-VII** **Mini Project(Lab)**	**L-0** **T-0** **P-8** **C-4**
Course Outcomes:	**By the end of this course a student should be able to:-**	
CO1.	Understand methodologies and professional way of documentation and communication.	
CO2.	Understanding practical knowledge within the chosen area of technology for project development.	
CO3.	Applying technical knowledge to solve the real-life problems.	
CO4.	Analyzing programming projects with a comprehensive and Systematic approach.	
CO5.	Developing effective communication skills for presentation of project related activities.	
Course Content:	The students will undertake a mini project as part of their seventh semester. The students can do independent projects or can take up projects in groups of two or more depending on the complexity of the project. The maximum group size will be four and in case of team projects there should be a clear delineation of the responsibilities and work done by each project member. The projects must be approved by the mentor assigned to the student. The mentors will counsel the students for choosing the topic for the projects and together they will come up with the objectives and the process of the project. From there, the student takes over and works on the project.	
Bridge Course	The bridge course ensures that all the students have the correct prerequisite knowledge before their industry interface. The purpose of a bridge course is to prepare for a healthy interaction with industry and to meet their expectations. It would be difficult to establish standards without appropriate backgrounds and therefore to bridge this gap, students are put through a week mandatory classroom participation where faculty and other experts will give adequate inputs in application based subjects, IT and soft skills.	**8 Hours**
The Project	Each student will be allotted a Faculty Guide and an Industry Guide during the internship/project work. Students need to maintain a Project Diary and update the project progress, work reports in the project diary. Every student must submit a detailed project report as per the provided template. In the case of team projects, a single copy of these items must be submitted but each team member will be required to submit an individual report detailing their own contribution to the project. Each student/group should be allotted a supervisor and periodic internal review shall be conducted which is evaluated by panel of	**8 Hours**

	examiners.	
Project Evaluation Guidelines	The Project evaluator(s) verify and validate the information presented in the project report. The break-up of marks would be as follows: 1. Internal Evaluation 2. External Assessment 3. Viva Voce	**8 Hours**
Internal Evaluation	Internal Evaluator of project needs to evaluate Internal Project work based on the following criteria: ● Project Scope , Objectives and Deliverables ● Research Work, Understanding of concepts ● Output of Results and Proper Documentation ● Interim Reports and Presentations– Twice during the course of the project	**8 Hours**
External Evaluation	The Project evaluator(s) perform the External Assessment based on the following criteria. ● Understanding of the Project Concept ● Delivery Skill ● The Final Project Report ● Originality and Novelty	**8 Hours**
Course Outcomes	By the end of this course a student should be able to: ● acquire practical knowledge within the chosen area of technology for project development ● identify, analyse, formulate and handle programming projects with a comprehensive and systematic approach ● contribute as an individual or in a team in development of technical projects ● Develop effective communication skills for presentation of project related activities	

Course Code: IAI752	**Specialization- AI** **B.Tech.- Semester-VII** **Deep Learning LAB**	**L-0** **T-0** **P-2** **C-1**
Course Outcomes:	At the end of the course, students will be able to:-	
CO1.	Understanding the fundamentals of deep learning.	
CO2.	Understand the concept of PCA and Mathematics behind it.	
CO3.	Applying various deep learning algorithms on given data set	
CO4.	Applying binary classification using Python on given data set.	
CO5.	Creating an application for age detection using deep learning methods.	
Course Content:		
	Exercise – 1 1. Describe PCA and Mathematics behind it. 2. Apply PCA on the MNIST dataset. (Use the sci-kit learn library or try writing PCA yourself. **Exercise - 2** 1. Binary classification using Python and interpret and predict the output for given data. 2. Use gradient descent to optimize the following functions: maximize J = log(x) + log(1-x), 0 < x < 1 maximize J = sin(x), 0 < x < pi minimize J = 1 - x^2 - y^2, 0 <= x <= 1, 0 <= y <= 1, x + y = 1 **Exercise - 3** 1. Age detection using deep learning procedure with Python.	**8 Hours**

Course Code: **IAI753**	**Specialization- AI** **B.Tech.- Semester-VII** **Industrial Tranning Seminar**	**L-0** **T-0** **P-2** **C-1**
Course Outcomes:	After completion of this course students will be able to-	
CO1.	Understanding the past and present of the disciplines by exploring their purpose, practice, and philosophy.	
CO2.	Understanding of advanced research methodologies in the field, including theory, interdisciplinary approaches, and the analysis of available primary sources.	
CO3.	Understanding the privileges and obligations associated with a career as a professional	
CO4.	Understanding historical and recent trends in theory and method and be able to identify and explain major trends and issues in industry and research.	
CO5.	Applying technical skill to solve industry problems.	
Course Content:		
	Students will have to undergo industrial training of minimum four weeks in any industry or reputed organization after the VI semester examination in summer. The evaluation of this training shall be included in the VII semester evaluation. The student will be assigned a faculty guide who would be the supervisor of the student. The faculty would be identified before the end of the VI semester and shall be the nodal officer for coordination of the training. Students will prepare an exhaustive technical report of the training during the VII semester which will be duly signed by the officer under whom training was undertaken in the industry/ organization. The covering format shall be signed by the concerned office in-charge of the training in the industry. The officer-in-charge of the trainee would also give his rating of the student in the standard University format in a sealed envelope to the Principal of the college. The student at the end of the VII semester will present his report about the training before a committee constituted by the Director of the College which would comprise of at least three members comprising of the Department Coordinator, Class Coordinator and a nominee of the Director. The students guide would be a special invitee to the presentation. The seminar session shall be an open house session. The internal marks would be the average of the marks given by each member of the committee separately in a sealed envelope to the Director. The marks by the external examiner would be based on the report submitted by the student which shall be evaluated by the external examiner and cross examination done of the student concerned. Not more than three students would form a group for such industrial training/ project submission. The marking shall be as follows. **Internal: 50 Marks** By the faculty guide - 25 marks By committee appointed by the director – 25 marks **External: 50 Marks** By officer-in-charge trainee in industry – 25 marks By external examiner appointed by the university – 25 marks	**8 Hours**

Course Code: IAI704	**Professional Elective Courses – V** **Specialization- AI** **B.Tech.- Semester-VII** **Embedded System**	**L-3 T-0 P-0 C-3**
Course Outcomes:	**On successful completion of the course, students will be able to:-**	
CO1.	Understanding the Embedded Systems/IOT and their applications.	
CO2.	Understanding the role of Hardware in IOT.	
CO3.	Understanding the basics to intermediate knowledge of Open source hardware	
CO4.	Applying the various tools and methods to solve IOT problems.	
CO5.	Creating small scale applications using open source platform (Arduino-Hardware/Software)	
Course Content:		
Unit-1:	**Introduction to Arduino and Programming:-** Introduction to Embedded Systems, Microprocessor vs Microcontroller, different microcontroller architecture, History of AVR Microcontrollers, The Arduino Platform, Block diagram, Architecture, Arduino Boards Pin functions, Overview of main features such as – I/O ports, timers, interrupts Serial port, PWM, ADC etc, Arduino Schematics, Concept of C-Language, C vs Embedded C, Introduction to Arduino IDE, Writing, Saving, Compiling and Uploading Sketches., Hello world program	**8 Hours**
Unit-2:	**Digital & Analog I/O Programming:-** Digital Output Programming by discrete LED interface, Timer & delay time function, 7-segment LED programming, Buzzer interface, and programming. Digital Input Programming by interfacing Switches, Analog out (PWM) programming using RGB-LED interface. Analog Input Programming using POT.	**8 Hours**
Unit-3:	**Sensors & Actuators Interfacing:-** Interfacing of Analog Sensors, Interfacing of Digital Sensors, Data Logger using Arduino Serial Monitor, Sensor condition based event triggering.	**8 Hours**
Unit-4:	**Conditions, loops, switch-case, functions and Protocols:-** If-Else conditions based programming, while –loop, Function-prototype, declaration, and calling, declaring local and global variables, condition based switch-case, Debugging & Debug Environment, Debug via Serial terminal, RS-232 & UART protocol communication, Reading & Writing using Serial, SPI Protocol with Arduino, I2C Protocol and sensor Interfacing.	**8 Hours**
Unit-5:	**Programmable Peripherals Interfacing and Applications:-** Peripherals Interface & Programming: 16x2 Alphanumeric LCD Interface, 4x4 keypad interface, H-bridge & DC motor Interface, Case	**8 Hours**

	Studies and Application development – Smart Electric Board, Wireless Robot, Person Counter Light Control etc.	
Text Books:	1. Getting Started with Arduino", by Massimo Banzi.	
Reference Books:	1. "Beginning with Arduino", by Michael McRoberts, 2. "Arduino Cookbook", by Michael Margolis, ***Latest editions of all the suggested books are recommended.**	
Additional electronic reference material:	1. https://www.tutorialspoint.com/embedded_systems/embedded_systems_tutorial.pdf	

Course Code: IAI705	**Professional Elective Courses-V** **Specialization- AI** **B.Tech.- Semester-VII** **Probabilistic Graphical Models**	**L-3 T-0 P-0 C-3**
Course Outcomes:	**On successful completion of the course, students will be able to:-**	
CO1.	Understanding the different elementary models related to Probabilistic graphical techniques.	
CO2.	Understanding the important application of undirected graphical models.	
CO3.	Understanding the use of Gaussian Network models.	
CO4.	Applying inference techniques on probabilistic graphical models.	
CO5.	Analyzing the different representation techniques for probabilistic graphical models.	
Course Content:		
Unit-1:	**Introduction to Probabilistic Graphical Models:-** Introduction and definition, Structured Probabilistic Models, Probabilistic Graphical Models, Representation, Inference, Learning, Probability Distributions, Basic Concepts in Probability, Random Variables and Joint Distributions, Querying a Distribution, Continuous Spaces, Expectation and Variance, Graphs: Nodes and Edges, Subgraphs, Paths and Trails, Cycles and Loops.	**8 Hours**
Unit-2:	**The Bayesian Network Representation:-** Exploiting Independence Properties : Independent Random Variables, The Conditional Parameterization, The Naive Bayes Model, Bayesian Networks: Basic Independencies in Bayesian Networks, Graphs and Distributions, Independencies in Graphs: D-separation, Soundness and Completeness, An Algorithm for d-Separation, I-Equivalence, From Distributions to Graphs: Minimal I-Maps, Perfect Maps, Finding Perfect Maps.	**8 Hours**
Unit-3:	**Undirected Graphical Models:-** Parameterization: Factors, Gibbs Distributions and Markov Networks, Reduced Markov Networks, Markov Network Independencies: Basic Independencies, From Distributions to Graphs, Bayesian Networks and Markov Networks: From Bayesian Networks to Markov Networks, From Markov Networks to Bayesian Networks, Chordal Graphs, Partially Directed Models: Conditional Random Fields, Chain Graph Models, Local Probabilistic Models: Hybrid Models, Conditional Bayesian Networks.	**8 Hours**

Unit-4:	**Gaussian Network Models:-** Introduction to Temporal Models, Basic Assumptions, Dynamic Bayesian Networks, State-Observation Models, Template Variables and Template Factors, Directed Probabilistic Models for Object-Relational Domains, Undirected Representation, Structural Uncertainty, Multivariate Gaussians, Operations on Gaussians, Independencies in Gaussians, Gaussian Bayesian Networks, Gaussian Markov Random Fields.	**8 Hours**
Unit-5:	**Inference on Probabilistic Graphical Models:-** Exact Inference: Variable Elimination : Analysis of complexity, Analysis of Exact Inference, Analysis of Approximate Inference, Variable Elimination: The Basic Ideas, Dealing with Evidence, Complexity and Graph Structure: Variable Elimination, Simple Analysis, Graph-Theoretic Analysis, Independence of Causal Influence, Context-Specific Independence, Exact Inference: Clique Trees, Variable Elimination and Clique Trees, Message Passing: Sum Product, Belief Update, Constructing a Clique Tree, Introduction to Inference as Optimization, MAP inference, Particle-Based Approximate Inference, Inference in Hybrid Networks.	**8 Hours**
Text Books:	1-Probabilistic Graphical Models, Principles and Techniques - Daphne Koller, Nir Friedman, The MIT Press	
Reference Books:	1. Learning Probabilistic Graphical Models in R - David Bellot, PACKT Publishing **2.** Mastering Probabilistic Graphical Models Using Python - Ankur Ankan, Abinash Panda, PACKT Publishing ***Latest editions of all the suggested books are recommended.**	
Additional electronic reference material:	1. https://djsaunde.github.io/read/books/pdfs/probabilistic20models.pdf	

Course Code: IAI706	**Professional Elective Course-V** **Specialization- AI** **B.Tech.- Semester-VII** **Pattern Recognition**	**L-3 T-0 P-0 C-3**
Course Outcomes:	**On successful completion of the course, students will be able to:-**	
CO1.	Understanding the basic concept of ML and also the applications of ML.	
CO2.	Understanding Parameter Estimation and Supervised Learning methods.	
CO3.	Understanding the concept of kernel methods and how it works in Support vector machines.	
CO4.	Applying different Functions and Syntactic Approach to solve Pattern Recognition Problems.	
CO5.	Analyzing the tree based models and Classification methods.	
Course Content:		
Unit-1:	**Introduction to Pattern Recognition Systems:-** The Design Cycle-Learning And Adaptation-Supervised Learning- Unsupervised Learning-Reinforcement Learning-Linear Model For Classification-Discriminant Function(Two Class And Multiclass)-Least Square For Classification-Fisher's Linear Discriminant Analysis For Two And Multiple Class-Probabilistic Generative Models – Maximum Likelihood Solution	**8 Hours**
Unit-2:	**Parameter Estimation and Supervised Learning:-**Maximum Likelihood Estimation - The Bayes Classifier - Learning The Mean Of A Normal Density - General Bayesian Learning - Nonparametric Technic – Density Estimation - Parzen Windows - K-Nearest Neighbor Estimation - Estimation Of Posterior Probabilities - Nearest-Neighbor Rule - K-Nearest Neighbor Rule.	**8 Hours**
Unit-3:	**Kernel Methods:-**Constructing Kernels – Kernel Density Estimators - Nearest Neighbor Methods – Gaussian Processes And Classification – Sparse Kernel Machines - Support Vector Machines – Maximum Margin Classifiers - Multi-Class Support Vector Machine. Graphical Models: Bayesian Networks - Generative Models - Linear Gaussian Models - Conditional Independence.	**8 Hours**
Unit-4:	**Gaussian Mixture Models and Expectation Maximization:-** K-Means Clustering - Mixtures Of Gaussian -Expectation Maximum For Gaussian Mixtures. Continuous Latent Variables: Principal Component Analysis - Applications Of Principal Component Analysis -PCA For Higher Dimensional Data - Factor Analysis. Sequential Data: Markov Models – Hidden Markov Models - Maximum Likelihood For HMM–Forward-Backward Algorithm. Combining Models.	**8 Hours**
Unit-5:	**Tree Based Models:-**Tree based model- Pros and Cons- Pruning-Learning- Type of learning- Classification-Classification Models-	**8 Hours**

	Introduction to decision tree algorithms, classification tree, characteristics of classification tree – size and hierarchical nature of tree, training and testing data set, induction algorithms, probability estimation in decision tree – Laplace correction and no match method, stopping criteria for tree development, pruning techniques and pruned tree, evaluation of decision tree classifiers, generalization error, F measure, Confusion matrix, ROC curve, Hit Rate Curve, Lift curve, McNemar's Test, Resample paired t test, K-fold cross validated paired t test, prediction using better model. Classification Methods: Information Gain: ID3-C4.5-C5-J 48. Gini Index: SPRINT-SLIQ. Decision Tree Advantages and Disadvantages-Application of decision tree- Classification and Regression Trees (CART).	
Text Books:	1. "Pattern Recognition And Machine Learning",. Christopher M. Bishop , Springer, 2006.	
Reference Books:	1. Syntactic Pattern Recognition And Applications, Fu K.S., Prentice Hall, Eaglewood Cliffs 2. Pattern Recognition: Techniques And Applications by RajjanShinghal : Oxford University Press, 2008, 3. Pattern Classification and Scene Analysis, John Wiley, Duda& Hart P.E. 4. Syntactic Pattern Recognition - An Introduction by Addison Wesley Gonzalez R.C. & Thomson M.G. ***Latest editions of all the suggested books are recommended.**	
Additional electronic reference material:	1. http://users.isr.ist.utl.pt/~wurmd/Livros/school/Bishop-%20Pattern%20Recognition%20And%20Machine%20Learning%20-%20Springer%20%202006.pdf	

Course Code: IAI707	**Professional Elective Courses – VI** **Specialization- AI** **B.Tech.- Semester-VII** **Data Mining**	**L-3 T-0 P-0 C-3**
Course Outcomes:	**On successful completion of the course, students will be able to:-**	
CO1.	Understanding the difference between CRISP –DM and KDD process of data mining.	
CO2.	Understanding the data pre-processing technique for the data mining.	
CO3.	Understanding the different data classification techniques and its practical use in data mining project.	
CO4.	Understanding the basic concepts of text mining and able to cluster the text using statistical programming language.	
CO5.	Applying association rule mining for the appropriate data set and conclude the results for decision making process.	
Course Content:		
Unit-1:	**Introductiont to data mining:-**Data mining, evolution of data mining, definition and concepts, introduction to data mining process, data mining methodology, over view of CRISP-DM and KDD process, over view of data mining algorithms, organization of data, Univariate and multivariate data distributions, distance measures and similarity measures, attribute selection, data cleaning and integrity, data split, test data, training data, validation data, mistakes in data mining, myths about data mining.	**8 Hours**
Unit-2:	**DataPreparation:-**Introduction, feature extraction and portability, data type portability, discretization and binarization, text to numeric data, Time Series to Discrete Sequence Data, Time Series to Numeric Data, Discrete Sequence to Numeric Data, Data Cleaning: Handling Missing Entries, Handling Incorrect and Inconsistent Entries, Scaling and Normalization, Data Reduction and Transformation, Dimensionality Reduction with Axis Rotation, Dimensionality Reduction with Type Transformation	**8 Hours**
Unit-3:	**Application Pattern Mining:-**Introduction, The Frequent Pattern Mining Model, Association Rule Generation Framework, Frequent Itemset Mining Algorithms: Brute Force Algorithms, Apriori Algorithms, Enumeration-Tree Algorithms, Enumeration-Tree-Based Interpretation of Apriori, Tree Projection and Depth Project,Vertical Counting Methods, Recursive Suffix-Based Pattern Growth Methods, Alternative Models: Interesting Patterns, Statistical Coefficient of Correlation, Chi Square Measure, Interest Ratio, Symmetric Confidence Measures, Cosine Coefficient on Columns, Jaccard Coefficient and the Min-hash Trick, Collective Strength, Relationship to Negative Pattern	**8 Hours**

	Mining, Useful Meta-algorithms.	
Unit-4:	**DataClassification:-**Introduction, feature selection for classification, Filter models: Gini Index, Entropy, Fisher Score, Fisher Linear Discriminant, Wrapper models and embedded models, Decision Trees: Stopping criteria, Pruning of tree, Rule-Based Classifiers: Rule Generation from Decision Trees, Sequential Covering Algorithms, Rule Pruning, Probabilistic Classifiers: Naïve Bayes Classification and logistic regression, Support vector Machine and Neural Networks	**8 Hours**
Unit-5:	**Text Mining:-**Definition of text mining, general architecture of text mining, text mining operations, Text mining query languages, application of text categorization, document representation, machine learning and classifier evaluation, clustering task in text mining and its interpretation, word cloud, customization of word cloud.	**8 Hours**
Text Books:	1. "Data Mining the Text Book – Charu C Aggarwal, Springer.	
Reference Books:	1. Applied Data Mining Statistical Methods for Business and Industry - PAOLO GIUDICI, John Wiley & Sons Ltd. 2. Data Mining, Third Edition– Ian H. Witten, Eibe Frank, Mark A. Hall, ELSEVIER. ***Latest editions of all the suggested books are recommended**	
Additional electronic reference material:	1. https://www.tutorialspoint.com/data_mining/data_mining_tutorial.pdf	

Course Code: IAI708	**Professional Elective Course-VI** **Specialization- Data Science** **B.Tech.- Semester-VII** **Reinforcement Learning**	**L-3 T-0 P-0 C-3**
Course Outcomes:	**On successful completion of the course, students will be able to:-**	
CO1.	Understanding what constitute the main component of a Reinforcement Learning method.	
CO2.	Understanding contemporary Reinforcement learning methods.	
CO3.	Understanding sequential decision making under uncertainty.	
CO4.	Applying machine learning algorithms to solving relational and first order logical Markov decision problem.	
CO5.	Applying the reinforcement learning to solve gamming problems.	
Course Content:		
Unit-1:	**Reinforcement Learning and Markov Decision Process** Introduction- Reinforcement Learning - Examples OF Reinforcement Learning-Elements of Reinforcement Learning- Example: Tic-Tac-Toe - History of Reinforcement Learning -Learning Sequential decision Making-A Formal Frame Work on Markov Decision Process and Policies-Value Function and Bellman Equations-Solving Markov Decision Process-Dynamic Programing Model Based Solution Technique-Reinforcement Learning Model Free Solution Technique	**8 Hours**
Unit-2:	**Efficient Solution Framework:-**Introduction- The Batch Reinforcement Learning Problem- Foundations of Batch Reinforcement Learning Algorithms- Batch Reinforcement Learning Algorithms: Kernel-Based Approximate Dynamic Programming- Fitted Q Iteration- Least-Squares Policy Iteration- Identifying Batch Algorithms. Theory of Batch Reinforcement Learning- Neural Fitted Q Iteration (NFQ)- Batch Reinforcement Learning for Learning in Multi-agent Systems- Deep Fitted Q Iteration. Least-Squares Methods for Approximate Policy Evaluation- Least-Squares Policy Iteration- Performance Guarantees.	**8 Hours**
Unit-3:	**Constructive- Representational :-**Reinforcement learning in continuous state and action space: Function Approximation-Approximate Reinforcement Learning.- Solving Relational and first-order logical Markov decision: Introduction to sequential decision in relational Reinforcement Learning- model based solution techniques-model free solution- Hierarchical Approaches- Approaches to hierarchical reinforcement learning – Evolutionary computation for Reinforcement Learning: Neuro-evolution - Hybrids-Coevolution.	**8 Hours**

Unit-4:	**Probabilistic Model For Self and Other** Bayesian Reinforcement Learning: Model free Bayesian Reinforcement Learning - Model based Bayesian Reinforcement Learning- Partially observable Markov decision process: Decision making in partially observable environments- model based techniques-Predictively defined representation of state: PSRs- Learning a PSR model- Game theory and multi agent Reinforcement Learning – Reinforcement Learning in Repeated games- Sequential games.	**8 Hours**
Unit-5:	**Domain and Background:-** Reinforcement Learning in games- challenges of applying Reinforcement Learning to games- Reinforcement Learning in Robotics: challenges in robot REINFORCEMENT LEARNING- Foundations of Robotic Reinforcement Learning- tractability through simulation, representation and prior knowledge.	**8 Hours**
Text Books:	1. Reinforcement Learning: An Introduction, Second Edition by Richard S. Sutton and Andrew G. Barto	
Reference Books:	1. Richard S. Sutton and Andrew G. Barto. Introduction to Reinforcement Learning, 2nd Edition, MIT Press. 2017 2. Neuro Dynamic Programming. Dimitri Bertsikas and John G. Tsitsiklis. Athena Scientific. 1996. ***Latest editions of all the suggested books are recommended.**	
Additional electronic reference material:	1. https://web.stanford.edu/class/psych209/Readings/Sutton 2. BartoIPRLBook2ndEd.pdf	

Course Code: **IAI709**	**Professional Elective Course-VI** **Specialization- AI** **B.Tech.- Semester-VII** **Design Thinking**	**L-3 T-0 P-0 C-3**
Course Outcomes:	**On successful completion of the course, students will be able to:-**	
CO1.	Understanding the ethical and social dilemmas and obligations of the practice of design.	
CO2.	Understanding complex and unstructured problem-solving challenges in unfamiliar domains	
CO3.	Applying new methods that lead innovation in creative and collaborative settings.	
CO4.	Analyzing common adoption barriers in individuals, groups and organizations.	
CO5.	Developing a design theory from independent and qualitative research and observations.	
Course Content:		
Unit-1:	**Design Thinking:-** Foundations of Human Centered Design, Barriers to Innovation and Adoption, Learning by Doing, Understanding Needs in Context.	**8 Hours**
Unit-2:	**Design Needs and Interventions:-** The Ethics of Design Interventions, Design Needs in Education, Engineering and Health & Society.	**8 Hours**
Unit-3:	**Empathy in Design** Discovering Explicit and Latent Needs, Qualitative Research: Watching and Listening, Point of View & Problem Reframing, Developing Grounded Theory, Design for Usability	**8 Hours**
Unit-4:	**Ideation, Experimentation and Evolution** Generating and Developing Ideas, Creativity as Teaching and Learning, Prototyping and testing Learning Through Things & Interactions, Express, Test, Cycl	**8 Hours**
Unit-5:	**Design Documentation** Representing Design Knowledge, Diffusion of Innovation, Design as research	**8 Hours**
Text Books:	1. Design Thinking: Integrating Innovation, Customer Experience, and Brand Value, by Thomas Lockwood, Allworth Press, 2010.	
Reference Books:	1. Design Thinking: Understand – Improve – Applyedited by Hasso Plattner, Christoph Meinel, Larry Leifer, Springer Science & Business Media, 2010 ***Latest editions of all the suggested books are recommended.**	
Additional	1. https://www.tutorialspoint.com/hi/design_thinking/	

electronic reference material:	2. design_thinking_tutorial.pdf	

Course Code: IAI851	**Specialization- AI** **B.Tech.- Semester-VIII** **Industry Internship**	**L-0 T-0 P-28 C-14**
CO1.	Understanding to take initiatives, communicate, work in a team and manage a project within a given time frame.	
CO2.	Understanding the use of interpretation and application of an appropriate international engineering standard in a specific situation.	
CO3.	Applying prior acquired knowledge in problem solving.	
CO4.	Analyzing a given engineering problem and use an appropriate problem solving methodology.	
CO5.	Analyzing sources of hazards, and identify appropriate health & safety measures.	
Course Content:		
	The students will undertake a project as part of their final semester. The students can do independent projects or can take up projects in groups of two or more depending on the complexity of the project. The maximum group size will be four and in case of team projects there should be a clear delineation of the responsibilities and work done by each project member. The topic should be informed to the mentor, and the student should appear for intermediate valuations.	
Industry Internship:	Students will go for the full semester industry internship in VIIIth semester. The industry internship should duly be approved by Training & Placement department and Principal of the school. Each student will be allotted a Faculty Guide and an Industry Guide during the internship work. Students need to maintain a Project Diary and update the project progress, work reports in the project diary. Every student must submit a detailed project report as per the provided template. In the case of team projects, a single copy of these items must be submitted but each team member will be required to submit an individual report detailing their own contribution to the project. Each student/group should be allotted a supervisor and periodic internal review shall be conducted which is evaluated by panel of examiners.	
	Project Evaluation Guidelines: The Project evaluator(s) verify and validate the information presented in the project report. The break-up of marks would be as follows: 1. Internal Evaluation 2. External Assessment	

	Internal Evaluation: Internal Evaluator of project needs to evaluate Internal Project work based on the following criteria: Project Scope , Objectives and Deliverables Research Work, Understanding of concepts Output of Results and Proper Documentation Interim Reports and Presentations– Twice during the course of the project	
	External Evaluation: The Project evaluator(s) perform the External Assessment based on the following criteria. • Understanding of the Project Concept • Delivery Skill • The Final Project Report • Originality and Novelty	
	The Final Project Report Details: • The report should have an excel sheet that documents the work of every project member	
	Marking Scheme: 1. **Internal Evaluation:** 50% of Total Marks 2. **External Evaluation:** 50% of Total Marks **For e.g.,** if the total mark for the Internship is 300, then ❖ Internal Evaluation = 150 marks The break-up of marks is shown below:- • Interim Evaluation 1: 30 marks • Interim Evaluation 2: 30 marks • Viva Voice: 30 marks • Implementation of project : 60 marks ❖ External Evaluation = 150 marks The break-up of marks is shown below:- • Project Report: 40 marks • Explanation of project working: 50 marks Implementation / code : 60 marks	

Course Code: **IAI 851**	**Specialization- AI** **B.Tech.- Semester-VIII** **Project**	**L-0** **T-0** **P-16** **C-8**
Course Outcomes:	**On successful completion of the course, students will be able to:-**	
CO1.	Understanding methodologies and professional way of documentation and communication.	
CO2.	Understanding about software development cycle with emphasis on different processes -requirements, design, and implementation phases.	
CO3.	Analyzing a software project and demonstrate the ability to communicate effectively in speech and writing.	
CO4.	Creating a new model over the selected field of research that will be useful for future activities.	
CO5.	Creating a project that help to gain confidence and technical knowledge.	
Course Content:	The students will undertake a project as part of their final semester. The students can do independent projects or can take up projects in groups of two or more depending on the complexity of the project. The maximum group size will be four and in case of team projects there should be a clear delineation of the responsibilities and work done by each project member. The projects must be approved by the mentor assigned to the student. The mentors will counsel the students for choosing the topic for the projects and together they will come up with the objectives and the process of the project. From there, the student takes over and works on the project. If the student chooses to undertake an industry project, then the topic should be informed to the mentor, and the student should appear for intermediate valuations. Prior to undertaking this project the students undergo a bridge course.	
Bridge Course	The bridge course ensures that all the students have the correct prerequisite knowledge before their industry interface. The purpose of a bridge course is to prepare for a healthy interaction with industry and to meet their expectations. It would be difficult to establish standards without appropriate backgrounds and therefore to bridge this gap, students are put through a week mandatory classroom participation where faculty and other experts will give adequate inputs in application based subjects, IT and soft skills.	**8 Hours**
The Project	Each student will be allotted a Faculty Guide and an Industry Guide during the internship/project work. Students need to maintain a Project Diary and update the project progress, work reports in the project diary. Every student must submit a detailed project report as per the provided template. In the case of team projects, a single copy of these items must be submitted but each team member will be required to submit an	**8 Hours**

	individual report detailing their own contribution to the project. Each student/group should be allotted a supervisor and periodic internal review shall be conducted which is evaluated by panel of examiners.	
Project Evaluation Guidelines	The Project evaluator(s) verify and validate the information presented in the project report. The break-up of marks would be as follows: 1. Internal Evaluation 2. External Assessment 3. Viva Voce	**8 Hours**
External Evaluation	The Project evaluator(s) perform the External Assessment based on the following criteria. ● Understanding of the Project Concept ● Delivery Skill ● The Final Project Report ● Originality and Novelty	**8 Hours**
The Final Project Report	● The report should have an excel sheet that documents the work of every project member	**8 Hours**
Viva Voce	● Handling questions ● Clarity and Communication Skill	
Marking Scheme:	1. **Internal Evaluation:** 35% of Total Marks 2. **External Evaluation:** 50% of Total Marks 3. **Viva Voce:** 15 % of Total Marks **For e.g.,** if the total mark for the project is 100, then ❖ Internal Evaluation = 35 marks The break-up of marks is shown below:- ● Interim Evaluation 1: 10 marks ● Interim Evaluation 2: 10 marks ● Understanding of concepts: 5 marks ● Programming technique: 5 marks ● Execution of code : 5 marks ❖ External Evaluation = 50 marks The break-up of marks is shown below:- ● Project Report: 15 marks ● Explanation of project working: 10 marks ● Execution of code: 10 marks – (if done in industry, a stand-alone module can be reprogrammed and submitted. Error rectification etc. can be included by the evaluator) ● Participation in coding: 15 marks ❖ Viva Voce = 15 marks The break-up of marks is shown below: -	

	• Questions related to project: 10 marks • Questions related to technology: 5 marks The Project evaluator(s) verifies and validates the information presented in the project report.	

Course Code: IAI801	**Professional Elective Course-VII** **Specialization- AI** **B.Tech.- Semester-VIII** **Communication Protocol**	**L-3 T-0 P-0 C-3**
Course Outcomes:	**On successful completion of the course, students will be able to:-**	
CO1.	Understanding communication protocols and their structure.	
CO2.	Understanding architectural view of communication protocols.	
CO3.	Understanding communication protocols in IoT.	
CO4.	Analyzing the different layers and its protocols.	
CO5.	Analyzing the key area of communication protocols in real time networking.	
Course Content:		
Unit-1:	**Internet Principals and Design Principals for Connected Devices** Internet Communications: An Overview,IP ,TCP ,The IP Protocol Suite (TCP/IP) ,UDP ,IP Addresses ,DNS ,Static IP Address Assignment ,Dynamic IP Address Assignment , IPv6, MAC Addresses, TCP and UDP Ports, Application Layer Protocols Calm and Ambient Technology, Magic as Metaphor, PRIVACY, Web Thinking for Connected Devices: Small Pieces, Loosely Joined ,First-Class Citizens On The Internet ,Graceful Degradation, Affordances.	**8 Hours**
Unit-2:	**OSI reference model vs IoT stack Protocol (People internet vs Device internet)** TCP/IP Protocol Stack: Physical and Data Link Layers, Network Layer, Transport Layer, Application layer The IoT Protocols: HTTP Hypertext Transfer Protocol, WebSocket, XMPP Extensible Messaging and Presence Protocol, CAoP: Constrained Application Protocol (CoAP), MQTT: MQ Telemetry Transport (MQTT	**8 Hours**
Unit-3:	**IoT Data Link Protocol** IEEE 802.15.4e, IEEE 802.11 ah, WirelessHART, Z-Wave, Bluetooth Low Energy, Zigbee Smart Energy, LTE-A, DASH7,HomePlug, G.9959, LoRaWAN.	**8 Hours**
Unit-4:	**Network Layer Routing Protocols And Encapsulation Protocols** Routing Protocols: RPLRouting Protocol for Low-Power and Lossy Networks, CORPLcognitive RPL, CARPChannel-Aware Routing Protocol (CARP) Encapsulation Protocols: 6LoWPAN, 6TiSCH, 6Lo, IPv6 over G.9959, IPv6 over Bluetooth Low Energy	**8 Hours**
Unit-5:	**Session Layer Protocols and IoT Management Protocol**	**8 Hours**

	Session Layer Protocols:: HTTP Hypertext Transfer Protocol, WebSocket, XMPP Extensible Messaging and Presence Protocol, CAoP: Constrained Application Protocol (CoAP), MQTT: MQ Telemetry Transport (MQTT) IoT Management Protocol: Interconnection of Heterogeneous Datalink, Smart Transducer Interface	
Text Books:	1. "**Designing the Internet of Things**" by Adrian McEwen, Hakim Cassimally, ISBN: 978-1-118- 43062-0	
Reference Books:	1. Tanenbaum, A.S., **"Computer Networks",** 5th Ed., Prentice Hall, 2011. 2. Kurose, J.F. and Ross, K.W., **"Computer Networking: A top down approach",** 6th Ed., Pearson Education, 2012 ***Latest editions of all the suggested books are recommended.**	
Additional electronic reference material:	1. https://library.e.abb.com/public/833db276017e41fa82873982d4624d03/1MRK511348UUS_A_en_Communication_protocol_manual__DNP___670_series_2.1.pdf	

Course Code: **IAI802**	**Professional Elective Course-VII** **Specialization- AI** **B.Tech.- Semester-VIII** **Application of AI & ML in Robotics**	**L-3 T-0 P-0 C-3**
Course Outcomes:	**On successful completion of the course, students will be able to:-**	
CO1.	Understanding the basic concepts of AI.	
CO2.	Understanding the basic Principles of Robotic Technology.	
CO3.	Understanding the Industrial Robotics And Automation.	
CO4.	Applying various ML methods and tools Configurations, Control And Programming Of Robots.	
CO5.	Analyzing the Potential Areas for Automation and Justify Need for Automation.	
Course Content:		
Unit-1:	**Introduction** Automation and Robotics, Historical Development, Definitions, Basic Structure of Robots, Robot Anatomy, Complete Classification of Robots, Fundamentals about Robot Technology, Factors related to use Robot Performance, Basic Robot Configurations and their Relative Merits and Demerits, the Wrist & Gripper Subassemblies. Concepts about Basic Control System, ,Control Loops of Robotic Systems, Different Types of Controllers-Proportional, Integral, Differential, PID controllers. (SLE: Types of Drive Systems and their Relative Merits)	**8 Hours**
Unit-2:	**Automation And Robotics** introduction, Robotics In Science Fiction – A Brief History Of Robotics – The Robot And Its Peripherals-Robot Activation And Feedback Components – Position Sensors – Velocity Sensors – Actuators – Power Transmissions Systems – Robot Joint Control Design- Introduction To Manipulator Kinematics – Homogeneous Transformations And Robot Kinematics –Manipulator Path Control – Robot Dynamics – Configuration Of A Robot Controller.	**8 Hours**
Unit-3:	**Types Of End Effectors** Mechanical Grippers – Other Types Of Grippers – Tools As End Effectors – The Robot/End Effector Interface – Considerations In Gripper Selection And Design – Sensors In Robotics – Tactile Sensors – Proximity And Range Sensors – Miscellaneous Sensors And Sensor-Based Systems – Uses Of Sensors In Robotics – Introduction To Machine Vision – The Sensing And Digitizing Function In Machine Vision – Image Processing And Analysis – Training And Vision System – Robotic Applications.	**8 Hours**
Unit-4:	**Methods Of Robot Programming** Lead Through Programming Methods – A Robot Program As A Path In Space – Motion Interpolation – WAIT, SIGNAL, And DELAY Commands – Branching – Capabilities And Limitations Of Lead Through Methods –	**8 Hours**

	The Textual Robot Languages – Generations Of Robot Programming Languages – Robot Language Structure – Constants, Variables, And Other Data Objects – Motion Commands – End Effector And Sensor Commands – Computations And Operations – Program Control And Subroutines – Communications And Data Processing – Monitor Mode Commands. **Introduction to Robot Intelligence And Task Planning**- State Space Search-Problem Reduction-Use Of Predicate Logic-Means –End Analysis-Problem-Solving –Robot Learning-Robot Task Planning Expert Systems And Knowledge Learning.	
Unit-5:	**Kinematics of Robot Manipulator** Introduction, General Mathematical Preliminaries on Vectors & Matrices, Direct Kinematics problem, Geometry Based Direct kinematics problem, Co-ordinate and vector transformation using matrices, Rotation matrix, Inverse Transformations, Problems, Composite Rotation matrix, Homogenous Transformations,, Robotic Manipulator Joint Co-Ordinate System, Euler Angle & Euler Transformations, Roll-Pitch-Yaw(RPY) Transformation. DH Representation & Displacement Matrices for Standard Configurations, Jacobian Transformation in Robotic Manipulation. (SLE: Geometrical Approach to Inverse Kinematics.) **Robot Sensing & Vision:** Various Sensors and their Classification, Use of Sensors and Sensor Based System in Robotics, Machine Vision System, Description, Sensing, Digitizing, Image Processing and Analysis and Application of Machine Vision System, Robotic Assembly Sensors and Intelligent Sensors.	**8 Hours**
Text Books:	**1.** Mikell P. Groover- Et. Al, Industrial Robotics, Technology, Programming And Applications,Mcgraw Hill	
Reference Books:	1. Automation, Production Systems And Computer Integrated Manufacturingm.P.Groover, Pearson Education.5th Edition, 2009. 2. An Introduction To Automated Process Planning Systems- Tiess Chiu Chang & Richard A. Wysk 3. Robotics, Control Vision And Intelligence-Fu, Lee And Gonzalez. Mcgraw Hill International, 2nd Edition, 2007. 4. Introduction To Robotics- John J. Craig, Addison Wesley Publishing, 3rd Edition, 2010 ***Latest editions of all the suggested books are recommended.**	
Additional electronic reference material:	1. https://arxiv.org/ftp/arxiv/papers/1803/1803.10813.pdf	

Course Code: IAI803	**Professional Elective Course-VII** **Specialization- AI** **B.Tech.- Semester-VIII** **Sensor Technologies**	**L-3 T-0 P-0 C-3**
Course Outcomes:	**On successful completion of the course, students will be able to:-**	
CO1.	Understanding the sensors and how they works in different applications	
CO2.	Understanding the Classification of sensors	
CO3.	Understanding the selection of the sensor for specific application.	
CO4.	Applying Real time integration of sensors with signal conditioning systems.	
CO5.	Analyzing various sensor technologies and their applications.	
Course Content:		
Unit-1:	**Science of Measurement and Instrumentation** Functional Elements of Measurement Systems. Definition, principles of sensing and transduction, Classification of transducers, Units and standards, Classification of errors Odds and uncertainty - Introduction to Calibration methods	**8 Hours**
Unit-2:	**Resistive Transducers** The principle of operation, construction details, characteristics and application of resistance potentiometer, strain gauge and its signal conditioning circuits, RTD, LDR, thermistor, hot-wire anemometer and humidity sensor. Demonstration of RTD, Strain gauge, LDR	**8 Hours**
Unit-3:	**Inductive and Capacitive Transducers** Induction potentiometer - Variable reluctance transducers, LVDT - Variable reluctance Tachometer, Proximity transducers - Capacitive transducer and types - Capacitor microphone	**8 Hours**
Unit-4:	**Other Transducers** A piezoelectric transducer, magnetostrictive transducer - Digital transducers - Fiber optic transducer - Hall Effect transducer - Photo electric transducer- I/P & P/I transducer. Introduction to Smart sensors and MEMS. Points to be considered for selecting a transducer.	**8 Hours**
Unit-5:	**Sensor Applications** Typical applications of sensors, Sensors in Real time industry, Selection criterial of the sensoras per the application, Application Cases: Weather monitoring system, Water monitoring system, Sensor on the Conveyor	**8 Hours**

	system	
Text Books:	1. E.A. Doebelin, "**Measurement Systems – Applications and Design**", Tata Mc Graw Hill, New York, 2012	
Reference Books:	1- D.Patranabis, "**Sensors and Transducers**", Prentice Hall of India, 2004. ***Latest editions of all the suggested books are recommended**	
Additional electronic reference material:	1. https://ingavtomatika.ru/upload/iblock/cec/cec00879170b97fc371c6e0b9c07ff98.pdf	

***