



**SOMAIYA**  
VIDYAVIHAR

Item No: 4.A.5  
A.C. Date: 07/07/2023

**K J Somaiya Institute of Technology**  
(Formerly known as K J Somaiya Institute of Engineering and Information Technology)  
An Autonomous Institute permanently affiliated to University of Mumbai

**Autonomy Syllabus Scheme-II B**

**Bachelor of Technology**  
**in**  
**Artificial Intelligence and Data Science**

**(Second Year)**  
**(Semester III and IV)**

**&**

**Internship Policy Manual**

**(With effect from AY 2023-24)**

### **From the Principal's Desk:**

The challenges and demands of the dynamic industry increasingly require technocrats to be skilled, adaptive, and innovative. The National Educational Policy 2020 (NEP 2020) framed by the Government of India intends to induce a paradigm shift by re-conceptualizing the higher education. Recent academic reforms recommended by the AICTE and UGC have also effectually upscale the higher education system in India. It is further the role of HEIs to offer high-quality educational opportunities and enable the next generation to succeed globally. Hence, to adhere to the status quo, and enhance the academic standards and quality of engineering education further, it is essential to assimilate innovation and recurrent revision in curriculum, teaching-learning methodology, examination, and assessment system.

In congruence with it, the University of Mumbai has adapted Outcome-Based Education (OBE) system and has revised the engineering curriculum thrice in the last decade — as Rev 2012, Rev 2016, and the recent Rev 2019, 'C' scheme focusing on cutting-edge technology courses.

K. J. Somaiya Institute of Technology (KJSIT), being an autonomous institute possesses more flexibility in adapting newer approaches to reach higher levels of excellence in engineering education. The Syllabus Scheme-I implemented under the academic autonomy conferred to KJSIT w.e.f. A.Y. 2021-22 already comprises of state-of-the-art courses and laboratory sessions on emerging areas of technology. With an ideology that the root of innovation is 'interest', the curriculum offered a wide range of elective courses grouped into core and inter-disciplinary domains. At par with international engineering education, it followed a learner-centric approach, where the students could choose to study courses concerning areas of their interests.

This curriculum introduces Skill-Based Learning (SBL), Activity-Based Learning (ABL), and Technology-Based Learning (TBL) as eXposure (SAT) courses that assure X factor in all the students of the institute. The SAT courses were practiced across the first three years of engineering, focusing on graduate attributes like work responsibilities towards society, problem-solving ability, communication skills, motivation for life-long learning, leadership and teamwork, etc. that could not be copiously imbibed through regular engineering courses. The inclusion of induction program for the First Year students is deliberated as per the guidelines of AICTE and helps students belonging to diverse backgrounds to adjust in the new academic environment.

However, sustained initiatives are required to assure efficiency, academic excellence, and growth. Hence, KJSIT Syllabus Scheme –II introduces 03 newer dimensions to Scheme – I: Internship, SBL of Foreign and Indian Languages, and Honours Degree that shall be implemented w.e.f. from A.Y. 2022-23 across all the branches and all 04 years of engineering.

1. **Internship:** Firstly, the redesigned Scheme-II incorporates 14 Credits for Internship (cumulative 600-700 Hours), which shall be mandatory for all the students and is to be pursued during all 04 years of graduation. Based on the AICTE Internship Policy, this initiative shall enable graduates to respond to the current needs of the industry and equip them with skills required at national and global level. The students shall gain practical understanding and training on cutting-edge technologies and industry practices in a suitable industry or organization. While innovation and entrepreneurship are emerging as fulcrums of higher education, the internship will also provide an exposure to innovation, entrepreneurial, and incubation opportunities through various related activities, and instill a start-up spirit in the students.

Further, the students of KJSIT already have an exposure to the work culture and trends in industries through live / collaborative projects / product developments, etc. and they often contribute significantly to the society through various projects. Under autonomy too, through the component of Project-Based

Learning included in the syllabus, the students develop Mini, Minor, and Major projects in Second, Third, and Last Year respectively concerning healthcare, agriculture, societal / industrial need-based problems, etc. Through duality of Major Project development and newly introduced activities / components as a part of Internship, the students shall learn about research methodology, IP and IPR resulting into generation of quality research articles, copyrights, and patents.

2. **Honours Program:** Another major initiative through the Scheme–II is the introduction of B.Tech. with Honours program for students who are desirous of pursuing focused interest in 06 emerging areas of technology recognized by AICTE: Internet of Things, Artificial Intelligence & Machine Learning, Cyber Security, Virtual and Augmented Reality, Data Science, and Blockchain. This Honours program is of high-end industry standards and shall offer multi-fold opportunities for the learners such as additional credits, specialization in the chosen domain, job-ready skills, multidisciplinary knowledge, etc.
3. **Foreign and Indian Languages:** As another initiative, the Skill-Based Learning (SBL) in Scheme – II shall also comprise of developing verbal and written communication skills in Foreign and Indian Languages, which is a blooming trend and future necessity for various career prospects. The students shall acquire these skills through MOOC courses, giving them opportunities to learn the target language from beginners to advanced level. These SBL and the TBL courses shall acquaint students with skills of digital age learning from online platforms, along with time management ability, ethics, and professionalism.

Through joint efforts of all stakeholders, newer initiatives, strategic planning, and efficient execution of neoteric educational practices with hi-tech wizardry, KJSIT is endeavouring to become a role model for all autonomous institutes across the nation.

**Dr. S. K. Ukarande**  
**Principal and Chairman - Academic Council**

### **Preamble by Member Secretary, Academic Council:**

K J Somaiya Institute of Technology (KJSIT) has been granted academic autonomy by University Grants Commission (UGC) from Academic Year 2021-22 for 10 years. UGC states the benefits of granting academic autonomy to higher education institutes as ‘the freedom to modernize curricula, making it globally competent, locally relevant and skill oriented to promote employability’.

We, autonomous KJSITs Board of Studies in Computer Engineering (CE), Artificial Intelligence and Data Science (AI-DS), Electronics and Telecommunication (ET) and Information Technology (IT) had prepared Autonomy Scheme-I curricula from Academic Year 2021-22 for 4 years undergraduate (UG) and 2 years of post-graduation (PG) in Engineering and Technology disciplines, exercising academic freedom, meeting the needs of Industry 4.0, addressing the world wide challenges and providing globally required exposure to our UG and PG learners, focusing sound theoretical background supported by practical experiences in the relevant areas of engineering and technology.

Industry 4.0 demands modern and industry-oriented education, up-to-date knowledge of analysis, interpretation, designing, implementation, validation, and documentation of not only computer software and systems but also electronics and communication systems, hardware devices and tools, trained professionals, ability to work in teams on multidisciplinary projects, etc from engineering graduates. KJSITs autonomy Scheme-I syllabus was framed looking at the overall demands of Industry 4.0 and society to successfully acquaint learners with life-long experiential learning, professional ethics with universal human values, needed skill sets, in line with the objectives of higher and technical education, AICTE, UGC and various accreditation and ranking agencies, by keeping an eye on the technological developments and innovations.

It provides unique learning experiences to learners through extracurricular activities, innovations, and research with the introduction of Skill Based, Activity Based, Technology based and Project Based learning, showcasing learners’ creativity, interest and talent by developing additional skill sets, social involvement and contributions through activities, case studies, field visits, internships, creative learning, innovative mini, minor and major project developments. This helped in strengthening learners' profile with increased chances of employability and avenues for start-ups. It is also provided with Value addition learning through MOOCs platforms such as IBM-ICE, Coursera, NPTEL, SWAYAM, Spoken Tutorial, Udemy etc.

We are happy to present the additional exposure to our learners under the Autonomy Academic Scheme-II, implemented w.e.f academic year 2022-23 for developing the intellectual climate of our country, bringing academic excellence in higher education system with the introduction of additional credit and audit courses for

1. Internships,
2. Skill Based Learning and
3. Honors Degree Programs in 6 emerging areas of technologies.

These additions are targeted for promoting academic, professional and personal development of learners through hands-on working experience under internships, exposure to foreign and Indian Regional Languages through MOOCs and award of specialization through Honors Degree Program. Internships will channelize learners' working experience with Industries, Government Sectors, NGO, MSMEs, Long term Rural Developments, and Research, Innovation, IPRs and Entrepreneurial setup. Two innovative courses on skill based implementing NEP 2020 guidelines and Honors Degree Program along with Regular B.Tech degree will boost the knowledge of graduating engineers in emerging areas of technologies contributing largely for industrial and personal automation, cyber, digitization, digital currency, security and artificial intelligence sector.

We are sure that with Scheme-I in academic year 2021-22 and Scheme-II from Academic Year 2022-23, the blend of innovative learning components in the curriculum shall strengthen the research and entrepreneurial culture of the institute benefitting the graduating engineers immensely.

We would like to place on record our gratitude to the faculty, alumni, students, industry experts, academicians and stakeholders, helping continuously strengthen the academics, making KJSIT as one of best engineering colleges across nation and top most choice of engineering aspirants.

**Dr. Sunita R Patil**

**Member Secretary, Academic Council and Vice Principal, KJSIT, Sion**

## **Preface by Board of Studies in Artificial Intelligence and Data Science:**

We, the members of Board of Studies of B. Tech in Artificial Intelligence and Data Science (AI-DS) are very happy to present Autonomy Syllabus Scheme-II B of Second Year of B. Tech in Artificial Intelligence with effect from the Academic Year 2023-23. We are assured that you will discover this syllabus interesting and challenging.

AI-DS is one of the newest programme amongst engineering students. The syllabus focuses on providing a sound theoretical background as well as good practical exposure to students in the relevant areas like human intelligence and its applications in industry, defence healthcare, agriculture and many other areas. It is envisioned to deliver a modern, industry-oriented education in AI-DS. It aims at creating skilled engineers who can successfully acquaint with the demands of the industry worldwide. We have included internships under Autonomy Syllabus Scheme-II from SEM-II to SEM-VIII of B.Tech AI-DS. Internship is now applied to Second Year of AI-DS students from the Academic Year 2023-24 and it will be progressively applied to Third Year and Last Year of AI-DS. Honour degree courses introduced in this Syllabus Scheme-II of AI-DS. They obtain skills and experience in up-to-date knowledge to analysis, design, employ, technologies, software and systems.

In this course, the students may have career opportunities in healthcare, business, e-Commerce, social networking companies, biotechnology, genetics and other areas. For holistic development of students Foreign and Indian modern language and other skill-based courses introduced first time in this new scheme. At the beginning of every course, we have added two theory lectures for prerequisites and course outline and at the end one theory lecture added for coverage of course conclusion which includes recap of modules, outcomes, applications, and summarization. We have mapped course outcomes, PBL outcomes, Skills outcomes, Activity outcomes and TBL outcomes module wise throughout the syllabus. Faculty in this program adopted collaborative, co-operative and online teaching learning techniques during coverage of the course; this will help students to understand each course in depth. The designed syllabus promises to achieve the objectives of affiliating University, AICTE, UGC, and various accreditation agencies by keeping an eye on the technological developments, innovations, and industry requirements.

We would like to show our appreciation to the faculties, students, industry experts and stakeholders assisting us in the design of this syllabus.

### **Board of Studies in Artificial Intelligence and Data Science are,**

<b>Sr. No.</b>	<b>Name</b>	<b>Designation</b>	<b>Sr. No.</b>	<b>Name</b>	<b>Designation</b>
1	Dr. Milind U. Nemade	Head of the Department concerned (Chairman)	11	Prof. Vidya Sagvekar	Member
2	Dr. Michel Mistry	Experts from outside parent university nominated by Academic council	12	Prof. Sejal Shah	Member
3	Dr. Sanjay Shitole		13	Prof. G. R. Phadke	Member
4	Dr. Madhav Chandane	One expert to be nominated by the Vice-Chancellor	14	Prof. Sarika Mane	Member
5	Mr. Akhil Hada	One Representative from Industry /Corporate Sector/ Allied area relating to Placement	15	Prof. Sheetal Jagtap	Member
6	Dr. Vaishali Wadhe	Member	16	Prof. Devanand Bathe	Member
7	Prof. Pankaj Deshmukh	Member	17	Prof. Ganesh Wadmare	Member
8	Prof. Medha Asurlekar	Member	18	Dr. Hariram Chavan	Other Member
9	Dr. Sunita Patil	Other Member	19	Dr. Radhika Kotecha	Other member
10	Dr. Namrata Gharat	Other member			

**Program Structure for Second Year UG Technology (AI-DS)**  
**Semester-III- Credit Scheme**

Course Code	Course Name	Teaching Scheme (Hrs.) TH – P – TUT	Total (Hrs.)	Credits Assigned TH – P – TUT	Total Credits	Course Category
AIC301	Applications of Mathematics in Engineering-I	3–0–1	04	3–0–1	04	BS
AIC302	Discrete Structures and Graph Theory	2–0–0	02	2–0–0	02	PC
AIC303	Data Structure	3–0–0	03	3–0–0	03	PC
AIC304	Digital Logic & Computer Architecture	3–0–0	03	3–0–0	03	PC
AIC305	Computer Graphics	3–0–0	03	3–0–0	03	PC
AIL303	Data Structure Lab	0–2–0	02	0–1–0	01	PC
AIL304	Digital Logic & Computer Architecture Lab	0–2–0	02	0–1–0	01	PC
AIL305	Computer Graphics Lab	0–2–0	02	0–1–0	01	PC
AIPR31	Project Based Learning- Mini Project Lab-I	0–2–0	02	0–1–0	01	PBL
AIXS33	Skill Based Learning-III	0-2*-0	02	0-1-0	01	SAT
AIXS34	Activity Based Learning-IV	0-2*-0	02	0-1-0	01	SAT
INT 32	Internship-II	--	--	--	--	INT
<b>Total</b>		<b>14–12–1</b>	<b>27</b>	<b>14-6-1</b>	<b>21</b>	

\*SAT Hours are under Practical head but can be taken as Theory or Practical or both as per the need.

PBL - Mini Project Lab 1 and 2:

- Students can form groups with minimum 2 (Two) and not more than 4 (Four)
- Faculty Load: 1 hour per week per four groups

### Semester-III- Examination Scheme

Course Code	Course Name	Examination Scheme Marks										
		CA				ESE	Duration in Hrs.	TW	O	P	P&O	Total
		T1	T2	Avg. of T1 & T2	IA							
AIC301	Applications of Mathematics in Engineering-I	30	30	30	10	60	2.30	25	--	--	--	125
AIC302	Discrete Structures and Graph Theory	20	20	20	10	45	2	--	--	--	--	75
AIC303	Data Structure	30	30	30	10	60	2.30	--	--	--	--	100
AIC304	Digital Logic & Computer Architecture	30	30	30	10	60	2.30	--	--	--	--	100
AIC305	Computer Graphics	30	30	30	10	60	2.30	--	--	--	--	100
AIL303	Data Structure Lab	--	--	--	--	--	--	25	--	--	25	50
AIL304	Digital Logic & Computer Architecture Lab	--	--	--	--	--	--	25	--	--	--	25
AIL305	Computer Graphics Lab	--	--	--	--	--	--	25	--	--	25	50
AIPR31	Project Based Learning-Mini Project Lab-I	--	--	--	--	--	--	25	--	--	25	50
AIXS33	Skill Based Learning-III	--	--	--	--	--	--	25	--	--	--	25
AIXS34	Activity Based Learning-IV	--	--	--	--	--	--	25	--	--	--	25
INT 32	Internship-II	--	--	--	--	--	--	--	--	--	--	--
<b>Total</b>		--	--	<b>140</b>	<b>50</b>	<b>285</b>	--	--	--	--	<b>75</b>	<b>725</b>

## Program Structure for Second Year UG Technology (AI-DS)

### Semester- IV-Credit Scheme

Course Code	Course Name	Teaching Scheme	Total (Hrs.)	Credit Assigned	Total Credits	Course Category
		(Hrs.) TH – P – TUT		TH – P – TUT		
AIC401	Applications of Mathematics in Engineering-II	3-0-1	04	3-0-1	04	BS
AIC402	Analysis of Algorithm	3-0-0	03	3-0-0	03	PC
AIC403	Database Management Systems	3-0-0	03	3-0-0	03	PC
AIC404	Operating System	3-0-0	03	3-0-0	03	PC
AIC405	Microprocessor	3-0-0	03	3-0-0	03	PC
AIL402	Analysis of Algorithm Lab	0-2-0	02	0-1-0	01	PC
AIL403	Database Management Systems Lab	0-2-0	02	0-1-0	01	PC
AIL404	Operating System Lab	0-2-0	02	0-1-0	01	PC
AIPR42	Project Based Learning- Mini Project Lab-2	0-2-0	02	0-1-0	01	PBL
AIXS45	Skill Based Learning-V	0-2*-0	02	0-1-0	01	SAT
AIXS46	Skill Based Learning-VI	0-2*-0	02	0-1-0	01	SAT
INT43	Internship-III	--		--	--	INT
<b>Total</b>		<b>15-12-1</b>	<b>28</b>	<b>15-6-1</b>	<b>22</b>	

\*SAT Hours are under Practical head but can be taken as Theory or Practical or both as per the need.

PBL - Mini Project Lab 1 and 2:

- Students can form groups with minimum 2 (Two) and not more than 4 (Four)
- Faculty Load: 1 hour per week per four groups

### Semester- IV-Examination Scheme

Course Code	Course Name	Examination Scheme										
		Marks										
		CA				ESE	Durati on in Hrs.	TW	O	P	P&O	Total
		T1	T2	Avg. (T1 & T2)	IA							
AIC401	Applications of Mathematics in Engineering-II	30	30	30	10	60	2.30	25	--	--	--	125
AIC402	Analysis of Algorithm	30	30	30	10	60	2.30	--	--	--	--	100
AIC403	Database Management Systems	30	30	30	10	60	2.30	--	--	--	--	100
AIC404	Operating System	30	30	30	10	60	2.30	--	--	--	--	100
AIC405	Microprocessor	30	30	30	10	60	2.30	--	--	--	--	100
AIL402	Analysis of Algorithm Lab	--	--	--	--	--	--	25	--	--	25	50
AIL403	Database Management Systems Lab	--	--	--	--	--	--	25	--	--	25	50
AIL404	Operating System Lab	--	--	--	--	--	--	25	--	--	25	50
AIPR42	Project Based Learning-Mini Project Lab-2	--	--	--	--	--	--	25	--	--	25	50
AIXS45	Skill Based Learning-V	--	--	--	--	--	--	25	--	--	--	25
AIXS46	Skill Based Learning-VI	--	--	--	--	--	--	25	--	--	--	25
INT43	Internship-III	--	--	--	--	--	--	--	--	--	--	--
<b>Total</b>		--	--	<b>150</b>	<b>50</b>	<b>300</b>	--	<b>150</b>	--	--	<b>100</b>	<b>775</b>

### Details of AI-DS Courses Common with Other Departments

Semester	Course Name	B. Tech Programs		
		COMP	IT	EXTC
III	Applications of Mathematics in Engineering-I	√	√	-
III	Discrete Structure and Graph Theory	√	-	-
III	Digital Logic and Computer Architecture	√	-	-
III	Computer Graphics	√	-	-
III	Skill Based Learning-IV	√	√	√
IV	Applications of Mathematics in Engineering-II	√	√	-
IV	Analysis of Algorithms	√	-	-
IV	Database Management Systems	√	-	-
IV	Operating Systems	√	-	-
IV	Skill Based Learning-V	√	-	-
IV	Skill Based Learning-VI	√	√	√
V	Business Communication and Ethics	√	√	√

Course Code	Course Name	Credits (TH+P+TUT)		
AIC301	Applications of Mathematics in Engineering-I	(3+0+1)		
<b>Prerequisite:</b>	1.Engineering Mathematics-I 2.Engineering Mathematics-II			
<b>Course Objectives:</b>	1. To learn the Laplace Transform, Inverse Laplace Transform of various functions, its applications. 2. To understand the concept of Fourier Series, its complex form and enhance the problem-solving skills. 3. To understand the concept of complex variables, C-R equations with applications. 4. To understand the basic techniques of statistics like correlation, regression, and curve fitting for data analysis, Machine learning and AI. 5. To understand some advanced topics of probability, random variables with their distributions and expectations.			
<b>Couse Outcomes:</b>	On successful completion, of course, learner/student will be able to: 1. Solve the real integrals in engineering problems using the concept of Laplace Transform. 2. Analyze engineering problems through the application of inverse Laplace transform of various functions. 3. Expand the periodic function by using the Fourier series for real-life problems and complex engineering problems. 4. Solve the problems of obtaining orthogonal trajectories and analytic functions by means of complex variable theory and application of harmonic conjugate. 5. Apply the concept of Correlation and Regression to the engineering problems in data science, machine learning, and AI. 6. Analyze the spread of data and distribution of probabilities by the concepts of probability and expectation.			
Module No. & Name	Sub Topics	CO mapped	Hrs./ Subtopic	Total Hrs./ Module
<b>I. Prerequisite and Course Outline</b>	Prerequisite Concepts and Course Introduction	---	02	02
<b>1.Laplace Transform</b>	1.1. Definition of Laplace transforms Condition of Existence of Laplace transform.	CO1	01	07
	1.2 Laplace Transform (L) of Standard Functions like $e^{at}$ , $\sin(at)$ , $\cos(at)$ , $\sinh(at)$ , $\cosh(at)$ and $t^n$ , $n \geq 0$ .		02	
	1.3 Properties of Laplace Transform: Linearity, First Shifting theorem, Second Shifting Theorem, change of scales Property, multiplication by t, Division by t, Laplace Transform of derivatives and integrals (Properties without proof).		02	
	1.4 Evaluation of integrals by using Laplace Transformation		02	
<b>2.Inverse Laplace Transform</b>	2.1 Definition of Inverse Laplace Transform, Linearity property, Inverse Laplace Transform of standard functions, Inverse Laplace Transform using derivatives.	CO2	02	06
	2.2 Partial fractions method to find inverse Laplace Transform.		02	

	2.3 Inverse Laplace transform using Convolution theorem (without proof).		02	
<b>3. Fourier Series</b>	3.1 Dirichlet's conditions, Definition of Fourier series and Parseval's Identity (without proof).	CO3	01	07
	3.2 Fourier series of periodic function with period 2 and 2l.		02	
	3.3 Fourier series of even and odd functions.		02	
	3.4 Fourier Transform-Fourier sine transform and Fourier cosine transform.		02	
<b>4.Module: Complex Variables</b>	4.1Function $f(z)$ of complex variable, Limit, Continuity and Differentiability $f'(z)$ , Analytic function: Necessary and sufficient conditions for $f(z)$ to be analytic (without proof).	CO4	01	07
	4.2Cauchy-Riemann equations in Cartesian coordinates (without proof).		02	
	4.3Milne-Thomson method to determine analytic function $f(z)$ when real part( $u$ ) or Imaginary part ( $v$ ) or its combination ( $u+v$ or $u-v$ ) is given.		02	
	4.4 Harmonic function, Harmonic conjugate and orthogonal trajectories.		02	
<b>5. Statistical Techniques</b>	5.1 Karl Pearson's coefficient of correlation ( $r$ )	CO5	01	06
	5.2 Spearman's Rank correlation coefficient ( $R$ ) (with repeated and non-repeated ranks)		01	
	5.3 Lines of regression		02	
	5.4 Fitting of first- and second-degree curves.		02	
<b>6.Probability</b>	6.1Definition and basics of probability, conditional probability.	CO6	01	06
	6.2Total Probability theorem and Bayes' theorem.		01	
	6.3Discrete and continuous random variable with probability distribution and probability density function.		02	
	6.4Expectation, Variance, Moment generating function, Raw and central moments up to 4 <sup>th</sup> order.		02	
<b>II. Course Conclusion</b>	Recap of Modules, Outcomes, Applications, and Summarization.	---	01	01
			<b>Total hours</b>	<b>42</b>
<b>Books:</b>				
<b>Text Books</b>	1. B. Grewal, Higher Engineering Mathematics, Khanna Publications 2. E. Kreyszig, Advanced Engineering Mathematics, Wiley 3. T. Veerarajan, Probability, Statistics and Random Processes, McGraw Hill			
<b>Reference Books</b>	1. R. Jain and S. Iyengar, Advanced Engineering, Mathematics, Narosa Publication 2. J. Brown and R. Churchill, Complex Variables and Applications, McGraw Hill. 3. M. Spiegel, Theory and Problems of Fourier Analysis with applications to BVP, Schaum's Outline Series.			
<b>Useful Links</b>	1. <a href="http://epgp.inflibnet.ac.in/Home/ViewSubject?catid=25">http://epgp.inflibnet.ac.in/Home/ViewSubject?catid=25</a> 2. <a href="https://nptel.ac.in/noc/courses/111/">https://nptel.ac.in/noc/courses/111/</a> 3. <a href="https://www.coursera.org/courses?query=mathematics">https://www.coursera.org/courses?query=mathematics</a> 4. <a href="https://ndl.iitkgp.ac.in/">https://ndl.iitkgp.ac.in/</a>			
<b>Term Work (TW):</b>	1. Term work should consist of 6 batch wise tutorials 2. Journal must include at least 2 assignments on content of theory of the course. The distribution of term work marks will be as follows			

		1	Tutorials	15
		2	Assignment	10
<b>Continuous Assessment:</b>	<ul style="list-style-type: none"> <li>• Continuous Assessment shall be conducted for Total 40 Marks, and includes —</li> <li>• Average of Test 1 and Test 2: 30 Marks (where each Test shall be of 30 Marks),</li> <li>• Internal Assessment: 10 Marks.</li> <li>• Duration of each Test shall be 1 Hour and 15 Minutes.</li> <li>• Internal Assessment shall be based on presentation / during-the-lecture quiz / assignments / field studies / course-specific activity.</li> </ul>			
<b>End Semester Examination (ESE):</b>	<ul style="list-style-type: none"> <li>• End Semester Exam shall be conducted for Total 60 Marks.</li> <li>• Duration of End Semester Exam shall be 02 Hours and 30 Minutes.</li> </ul>			

Course Code	Course Name	Credits (TH+P+TUT)		
AIC302	Discrete Structures and Graph Theory	(3+0+0)		
<b>Prerequisite:</b>	Discrete Mathematics			
<b>Course Objectives:</b>	1. To cultivate clear thinking and creative problem solving. 2. To thoroughly train in the construction and understanding of mathematical proofs. Exercise common mathematical arguments and proof strategies. 3. To apply graph theory in solving practical problems. 4. To thoroughly prepare for the mathematical aspects of other Artificial Intelligence and Data Science courses.			
<b>Couse Outcomes:</b>	On successful completion, of course student will be able to: 1. Analyze to the reason logically 2. Apply the relations, functions, Diagraph and Lattice. 3. Apply the notion of mathematical thinking, mathematical proofs and to apply them in problem solving. 4. Identify problems concepts of graph theory in solving real world problems 5. Examine the groups and codes in Encoding-Decoding. 6. Analyze a complex computing problem and apply principles of discrete mathematics to identify solutions			
Module No. & Name	Sub Topics	CO mapped	Hrs. /Subtopic	Total Hrs. /Module
<b>I. Prerequisite and Course Outline</b>	Prerequisite Concepts and Course Introduction	---	02	02
<b>1. Logic</b>	Propositional Logic, Predicate Logic, Laws of Logic, Quantifiers, Normal Forms, Inference Theory of Predicate Calculus, Mathematical Induction.	CO1	04	04
<b>2. Relations and Functions</b>	2.1 Basic concepts of Set Theory	CO2	01	04
	2.2 Relations: Definition, Types of Relations, Representation of Relations, Closures of Relations, Warshall's algorithm, Equivalence relations and Equivalence Classes		02	
	2.3 Functions: Definition, Types of functions, Composition of functions, Identity and Inverse function		01	
<b>3. Posets and Lattice</b>	Partial Order Relations, Poset, Hasse Diagram, Chain and Antichains, Lattice, Types of Lattice, Sub lattice	CO3	04	04
<b>4. Counting</b>	4.1 Basic Counting Principle- , Product Rule, Inclusion-Exclusion Principle, Pigeon hole Principle	CO4	02	04
	4.2 Recurrence relations, Solving recurrence relations		02	
<b>5. Algebraic Structures</b>	5.1 Algebraic structures with one binary operation: Semi group, Monoid, Groups, Subgroups, Abelian Group, Cyclic group, Isomorphism.	CO5	02	05

	5.2 Algebraic structures with two binary operations: Ring.		01	
	5.3 Coding Theory: Coding, binary information and error detection, decoding and error correction.		02	
<b>6. Graph Theory</b>	Types of graphs, Graph Representation, Sub graphs, Operations on Graphs, Walk, Path, Circuit, Connected Graphs, Disconnected Graph, Components, Homomorphism and Isomorphism of Graphs, Eulerand Hamiltonian Graphs, Planar Graph, Cut Set, Cut Vertex, Applications.	CO6	05	05
<b>II. Course Conclusion</b>	Recap of Modules, Outcomes, Applications and Summarization.	---	01	01
			<b>Total hours</b>	<b>28</b>
<b>Books:</b>				
<b>Text Books</b>	1. Bernad Kolman, Robert Busby, Sharon Cutler Ross, Nadeem -ur Rehman, “Discrete Mathematical Structures”, Pearson Education. 2. C.L.Liu“ Elements of Discrete Mathematics”, second edition 1985, McGraw-Hill Book Company. Reprinted 2000. 3. K.H.Rosen,“ Discrete Mathematics and applications”, fifth edition2003,Tata McGraw Hill Publishing Company			
<b>Reference Books</b>	1. Y N Singh,“ Discrete Mathematical Structures”, Wiley-India. 2. J.L.Mott, A.Kandel, T.P.Baker,“ Discrete Mathematics for Computer Scientists and Mathematicians”, Second Edition 1986, Prentice Hall of India. 3. J.P.Trembley, R.Manohar“ Discrete Mathematical Structures with Applications to Computer Science”, Tata McGraw Hill Publishing Company 4. Seymour Lipschutz, Marc Lars Lipson, “Discrete Mathematics” Schaum“s Outline, McGraw Hill Education. 5. Narsing Deo, “Graph Theory with applications to engineering and computer science”, PHI Publications. 6. P.K. Bisht , H.S.Dhami, “Discrete Mathematics”, Oxford press.			
<b>Useful Links:</b>				
1. <a href="https://www.edx.org/learn/discrete-mathematics">https://www.edx.org/learn/discrete-mathematics</a>				
2. <a href="https://www.coursera.org/specializations/discrete-mathematics">https://www.coursera.org/specializations/discrete-mathematics</a>				
3. <a href="https://nptel.ac.in/courses/106/106/106106094/">https://nptel.ac.in/courses/106/106/106106094/</a>				
4. <a href="https://swayam.gov.in/nd1_noc19_cs67/preview">https://swayam.gov.in/nd1_noc19_cs67/preview</a>				
<b>Continuous Assessment:</b>				
<ul style="list-style-type: none"> <li>• Test-1, Test-2 and Average of T-1 and T-2 (10Marks): Test-1 and Test-2 consists of two class tests of 10 marks each.</li> <li>• Test-1 is to be conducted on approximately 40% of the syllabus completed and Test-2 will be based on remaining contents (approximately 40% syllabus).</li> <li>• Average marks of T-1 and T-2 will be considered.</li> <li>• Internal Assessment (10 Marks): Internal assessment will be based on quizzes /case study/activity conducted by the faculty</li> </ul>				
<b>End Semester Examination (ESE):</b>				
<ul style="list-style-type: none"> <li>• End Semester Exam shall be conducted for Total 45 Marks.</li> <li>• Duration of End Semester Exam shall be 02 Hours.</li> </ul>				

Course Code	Course Name	Credits (TH+P+TUT)		
AIC303	Data Structure	(3+0+0)		
<b>Prerequisite:</b>	1.Computer Programming 2.Computer Programming Laboratory			
<b>Course Objectives:</b>	1. To discuss types of different data structures and concept of Abstract Data Type 2. To discuss the concept of stack and queue and apply them to various applications. 3. To describe the concept of link list and apply it to various applications 4. To introduce the different kinds of trees. 5. To discuss graph related concepts and traversals along with application. 6. To teach various searching techniques.			
<b>Couse Outcomes:</b>	After successful completion of the course students will be able to: 1. Describe types of data structure and related terminologies and its types and operations on data structures. 2. Implement linear data structures using arrays and linked lists. 3. Implement nonlinear data structures like graphs and trees 4. Perform various operations like searching, insertion, deletion and traversals on a given data structures. 5. Implement appropriate searching techniques for a given problem 6. Choose suitable data structure and apply it to solve a given problem.			
Module No. & Name	Sub Topics	CO mapped	Hrs. /Sub topic	Total Hrs./ Module
<b>I. Prerequisite and Course Outline</b>	Prerequisite Concepts and Course Introduction	---	02	02
<b>1. Introduction to Data Structures</b>	1.1Introduction to Data Structures, Concept of ADT, Types of Data Structures- Linear and Nonlinear,	CO1	01	02
	1.2Operations on Data Structures.		01	
<b>2.Arrays and linked lists</b>	2.1Arrays and array operations implementation of List, Traversing, Insertion, Deletion, Applications of arrays (sorting, searching, polynomial representation)	CO2, CO4, CO6	03	08
	2.2Linked List, Linked List v/s Array, Types of Linked List - Singly Linked List, Circular Linked List, Doubly Linked List, Operations on Singly Linked List and Doubly Linked List, Singly Linked List Application-Polynomial Representation and polynomial addition		05	
<b>3.Stack</b>	Introduction, ADT of Stack, Operations on Stack, Array Implementation of Stack, Stack using Singly Linked List Applications of Stack-Well form-ness of Parenthesis, Infix to Postfix Conversion and Postfix Evaluation, Recursion.	CO2, CO4, CO6	05	05
<b>4.Queues</b>	4.1Introduction, ADT of Queue, Operations on Queue, Array Implementation of Queue, Queue using Singly Linked List	CO2, CO4, CO6	04	06

	4.2Types of Queue-Circular Queue, Priority Queue, Introduction of Double Ended Queue, Applications of Queue		02	
<b>5.Trees</b>	5.1Introduction, Tree Terminologies, Binary Tree, Binary Tree Representation, Types of Binary Tree, Binary Tree Traversals, Binary Search Tree, Operations on Binary Search Tree,	CO3, CO4, CO6	05	10
	5.2Applications of Binary Tree-Expression Tree, Huffman Encoding, AVL, rotations in AVL Tree, operations on AVL Tree, Search Trees -Introduction of B Tree, B+ tree		05	
<b>6.Graphs</b>	6.1Introduction, Graph Terminologies, Representation of Graph, Graph Traversals- Depth First Search (DFS) and Breadth First Search (BFS)	CO3, CO5, CO4	03	04
	6.2Graph Application- Topological Sorting.	CO5, CO6	01	
<b>7.Searching Techniques</b>	Linear Search, Binary Search, Hashing-Concept, Hash Functions, Collision resolution Techniques	CO5	04	04
<b>II. Course Conclusion</b>	Recap of Modules, Outcomes, Applications, and Summarization.	---	01	01
<b>Total hours</b>				<b>42</b>
<b>Books:</b>				
<b>Text Books</b>	<ol style="list-style-type: none"> <li>1. Aaron M Tenenbaum, Yedidyah Langsam, Moshe J Augenstein, "Data Structures Using C", Pearson Publication.</li> <li>2. Reema Thareja, "Data Structures using C", Oxford Press.</li> <li>3. Richard F. Gilberg and Behrouz A. Forouzan, "Data Structures: A Pseudocode Approach with C", 2ndEdition, CENGAGE Learning.</li> <li>4. Jean Paul Tremblay, P. G. Sorenson, "Introduction to Data Structure and Its Applications", McGraw-Hill Higher Education</li> <li>5. Data Structures Using C, ISRD Group, 2ndEdition, Tata McGraw-Hill.</li> </ol>			
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1.Prof. P. S. Deshpande, Prof. O. G. Kakde, "C and Data Structures", DreamTech press.</li> <li>2.E. Balagurusamy, "Data Structure Using C", Tata McGraw-Hill Education India.</li> <li>3.Rajesh K Shukla, "Data Structures using C and C++", Wiley-India</li> <li>4.GAV PAI, "Data Structures", Schaum's Outlines.</li> <li>5.Robert Kruse, C. L. Tondo, Bruce Leung, "Data Structures and Program Design in C", Pearson Edition</li> </ol>			
<b>Useful Links:</b>				
1. <a href="https://learndsa.KJSIT.in/">https://learndsa.KJSIT.in/</a>				
2. <a href="https://nptel.ac.in/courses/106/102/106102064/">https://nptel.ac.in/courses/106/102/106102064/</a>				
3. <a href="https://www.coursera.org/specializations/data-structures-algorithms">https://www.coursera.org/specializations/data-structures-algorithms</a>				
4. <a href="https://www.edx.org/course/data-structures-fundamentals">https://www.edx.org/course/data-structures-fundamentals</a>				
5. <a href="https://swayam.gov.in/nd1_noc19_cs67/preview">https://swayam.gov.in/nd1_noc19_cs67/preview</a>				

**Continuous Assessment:**

- Test-1, Test-2 and Average of T-1 and T-2 (30Marks): Test-1 and Test-2 consists of two class tests of 30 marks each.
- Test-1 is to be conducted on approximately 40% of the syllabus completed and Test-2 will be based on remaining contents (approximately 40% syllabus).
- Average marks of T-1 and T-2 will be considered.
- Internal Assessment (10 Marks): Internal assessment will be based on quizzes /case study/activity conducted by the faculty

**End Semester Examination (ESE):**

- End Semester Exam shall be conducted for Total 60 Marks.
- Duration of End Semester Exam shall be 02 Hours 30 Minutes.

Course Code	Course Name	Credits (TH+P+TUT)		
AIC304	Digital Logic & Computer Architecture	(3+0+0)		
<b>Prerequisite:</b>	1. Knowledge of number systems 2. Knowledge of Basic computer organizations 3. Basic electrical and electronics engineering			
<b>Course Objectives:</b>	1. To have the basic awareness about structure and operation of digital circuits and digital computer. 2. To discuss in detail arithmetic operations in digital system. 3. To discuss generation of control signals and different ways of communication with I/O devices. 4. To study the hierarchical memory and principles of advanced computing.			
<b>Course Outcomes:</b>	After successful completion of course student will be able to: 1. Describe the fundamentals of Digital Logic Design and basic structure of computer systems. 2. Demonstrate the data representation and arithmetic algorithms. 3. Explain the basic concepts of digital components and processor organization. 4. Demonstrate control unit operations. 5. Categories memory organization and explain the function of each element. 6. Describe the concepts of parallel processing and different Buses.			
Module No. & Name	Sub Topics	CO mapped	Hrs./Subtopic	Total Hrs./Module
<b>I. Prerequisite and Course Outline</b>	Prerequisite Concepts and Course Introduction	---	02	02
<b>1. Computer fundamentals</b>	1.1 Introduction to Number System and Codes	CO1	01	05
	1.2 Number Systems: Binary, Octal, Decimal, Hexadecimal,		01	
	1.3 Codes: Grey, BCD, Excess-3, ASCII, Boolean Algebra.		01	
	1.4 Logic Gates: AND, OR, NOT, NAND, NOR, EX-OR		01	
	1.5 Overview of computer organization and architecture		01	
	1.6 Basic Organization of Computer and Block Level functional Units, Von-Neumann Model.		01	
<b>2.Data representation and Arithmetic algorithms</b>	2.1 Binary Arithmetic: Addition, Subtraction, Multiplication, Division using Sign Magnitude, 1's and 2's compliment, BCD and Hex Arithmetic Operation.	CO2	05	08
	2.2 Booths Multiplication Algorithm, Restoring and Non-restoring Division Algorithm.		03	
	2.3 IEEE-754 Floating point Representation. (Single & Double precision.) Floating point Arithmetic: Addition, Subtraction			
<b>3.Processor Organization and Architecture</b>	3.1 Introduction of Combinational Logic: Half adder, Full adder, MUX, DMUX, Encoder, Decoder (IC level).	CO3	03	08
	3.2 Introduction of Sequential Logics: Introduction to Flip Flop: SR, JK, D, T, Types of counters (Synchronous and Asynchronous)		03	
	3.3 Register Organization, Instruction Formats,		02	

	Addressing modes, Instruction Cycle, Interpretation and sequencing.			
<b>4.Control Unit Design</b>	4.1 Hardwired Control Unit: State Table Method, Delay Element Methods.	CO4	03	06
	4.2 Microprogrammed Control Unit: Micro Instruction-Format, Sequencing and execution, Micro operations, Examples of microprograms. Introduction to RISC and CISC architectures and design issues.		03	
<b>5.Memory organization</b>	5.1 Introduction and characteristics of memory, Types of RAM and ROM, Memory Hierarchy, 2-level Memory Characteristic,	CO5	01	05
	5.2 Cache Memory: Concept, locality of reference, Design problems based on mapping techniques, Cache coherence and write policies. Interleaved and Associative Memory.		04	
<b>6.Principle of Advanced Processor and Buses</b>	6.1 Basic Pipelined Data path and control, data dependencies, data hazards, branch hazards, delayed branch, and branch prediction, Performance measures-CPI, Speedup, Efficiency, throughput, Amdhal's law.	CO6	03	07
	6.2 Flynn's Classification, Instruction pipelining, pipeline hazards, Introduction to multicore architecture.		02	
	6.3 Introduction to buses: ISA, PCI, USB. Bus Contention and Arbitration.		02	
<b>II. Course Conclusion</b>	Recap of Modules, Outcomes, Applications, and Summarization.	---	01	01
			<b>Total hours</b>	<b>42</b>
<b>Books:</b>				
<b>Text Books</b>	<ol style="list-style-type: none"> <li>1. R. P. Jain, "Modern Digital Electronic", McGraw-Hill Publication, 4<sup>th</sup> Edition.</li> <li>2. William Stalling, "Computer Organization and Architecture: Designing and Performance", Pearson Publication 10th Edition.</li> <li>3. John P Hayes, "Computer Architecture and Organization", McGraw-Hill Publication, 3RD Edition.</li> <li>4. Dr. M. Usha and T. S. Shrikanth, "Computer system Architecture and Organization", Wiley publication.</li> <li>5. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, "Computer Organization", Fifth Edition, Tata McGraw-Hill.</li> <li>6. John F. Wakerly, "Digital Design Principles and Practices", Pearson Education, Fourth Edition (2008).</li> </ol>			
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Andrew S. Tanenbaum, "Structured Computer Organization", Pearson Publication.</li> <li>2. B. Govindarajalu, "Computer Architecture and Organization", McGraw-Hill Publication.</li> <li>3. Malvino, "Digital computer Electronics", McGraw-Hill Publication, 3rdEdition.</li> <li>4. Smruti Ranjan Sarangi, "Computer Organization and Architecture", McGraw-Hill Publication.</li> <li>5. Ronald J. Tocci, Neal S. Widmer, "Digital Systems Principles and Applications", Eighth Edition, PHI (2003)</li> <li>6. Thomas L. Floyd, "Digital Fundamentals", Pearson Prentice Hall, Eleventh Global Edition (2015).</li> </ol>			
<b>Useful Links:</b>				

1. <a href="https://learnabout-electronics.org/Digital/dig20.php">https://learnabout-electronics.org/Digital/dig20.php</a>
2. <a href="https://nptel.ac.in/courses/117/106/117106086/">https://nptel.ac.in/courses/117/106/117106086/</a>
3. <a href="https://www.classcentral.com/course/swayam-computer-organization-and-architecture-a-pedagogical-aspect-9824">https://www.classcentral.com/course/swayam-computer-organization-and-architecture-a-pedagogical-aspect-9824</a>
4. <a href="https://nptel.ac.in/courses/106/103/106103068/">https://nptel.ac.in/courses/106/103/106103068/</a>
5. <a href="https://www.coursera.org/learn/comparch">https://www.coursera.org/learn/comparch</a>
6. <a href="https://www.edx.org/learn/computer-architecture">https://www.edx.org/learn/computer-architecture</a>
<b>Continuous Assessment:</b>
<ul style="list-style-type: none"> <li>• Test-1, Test-2 and Average of T-1 and T-2 (30Marks): Test-1 and Test-2 consists of two class tests of 30 marks each.</li> <li>• Test-1 is to be conducted on approximately 40% of the syllabus completed and Test-2 will be based on remaining contents (approximately 40% syllabus).</li> <li>• Average marks of T-1 and T-2 will be considered.</li> <li>• Internal Assessment (10 Marks): Internal assessment will be based on quizzes /case study/activity conducted by the faculty</li> </ul>
<b>End Semester Examination (ESE):</b>
<ul style="list-style-type: none"> <li>• End Semester Exam shall be conducted for Total 60 Marks.</li> <li>• Duration of End Semester Exam shall be 02 Hours 30 Minutes.</li> </ul>

Course Code	Course Name	Credits (TH+P+TUT)		
AIC305	Computer Graphics	(3+0+0)		
<b>Prerequisite:</b>	Basic Mathematics			
<b>Course Objectives:</b>	1.To equip students with the fundamental knowledge and basic technical competence in the field of Computer Graphics. 2.To emphasize on implementation aspect of Computer Graphics Algorithms. 3.To prepare the student for advance areas and professional avenues in the field of Computer Graphics.			
<b>Couse Outcomes:</b>	At the end of the course, the students should be able to, 1. Describe the basic concepts of Computer Graphics. 2. Demonstrate various algorithms for basic graphics primitives. 3. Apply 2-D geometric transformations on graphical objects. 4. Use various Clipping algorithms on graphical objects. 5. Apply 3-D geometric transformations, curve representation techniques and projections methods. 6. Explain visible surface detection techniques and Animation.			
Module No. & Name	Sub Topics	CO mapped	Hrs./Subtopic	Total Hrs./Module
<b>I. Prerequisite and Course Outline</b>	Prerequisite Concepts and Course Introduction	---	02	02
<b>1.Introduction and Overview of Graphics System</b>	1.1 Definition and Representative uses of computer graphics, Overview of coordinate system, Definition of scan conversion, Rasterization and Rendering.	CO1	01	03
	1.2 Raster scan & Random scan displays, Architecture of Raster graphics system with display processor, Architecture of Random scan systems. Self-Learning Topics: Display devices like Plasma Display, 3D Display		02	
<b>2.Output Primitives:</b>	2.1 Scan conversions of point, line, circle and ellipse: DDA algorithm and Bresenham algorithm for line drawing, midpoint algorithm for circle, midpoint algorithm for ellipse drawing (Mathematical derivation for above algorithms is expected)	CO2	08	12
	2.2 Aliasing, Antialiasing techniques like Pre and post filtering, super sampling, and pixel phasing).		01	
	2.3 Filled Area Primitive: Scan line Polygon Fill algorithm, inside outside tests, Boundary Fill and Flood fill algorithm.		03	
<b>3.Two Dimensional Geometric Transformations</b>	3.1 Basic transformations: Translation, Scaling, Rotation	CO3	01	04
	3.2 Matrix representation and Homogeneous Coordinates.		01	
	3.3 Composite transformation.		01	
	3.4 Other transformations: Reflection and Shear.		01	

<b>4.Two-Dimensional Viewing and Clipping</b>	4.1 Viewing transformation pipeline and Window to Viewport coordinate transformation.	CO4	02	06
	4.2 Clipping operations: Point clipping, Line clipping algorithms: Cohen-Sutherland, Liang: Barsky, Polygon Clipping Algorithms: Sutherland-Hodgeman, Weiler-Atherton.		04	
<b>5.Three Dimensional Geometric Transformations, Curves and Fractal Generation</b>	5.1 3D Transformations: Translation, Rotation, Scaling and Reflection	CO5	01	08
	5.2 Composite transformations: Rotation about an arbitrary axis		01	
	5.3 Projections – Parallel, Perspective. (Matrix Representation)		02	
	5.4 Bezier Curve, B-Spline Curve, Fractal-Geometry: Fractal Dimension, Koch Curve. Self-learning topics: Piano Curve, Hilbert Curve.		04	
<b>6.Visible Surface Detection and Animation</b>	6.1 Visible Surface Detection: Classification of Visible Surface Detection algorithm, Back Surface detection method, Depth Buffer method, Area Subdivision method.	CO6	03	06
	6.2 Animation: Introduction to Animation, Traditional Animation Techniques, Principles of Animation, Key framing: Character and Facial Animation, Deformation, Motion capture.		03	
<b>II. Course Conclusion</b>	Recap of Modules, Outcomes, Applications, and Summarization.	---	01	01
<b>Total hours</b>			<b>42</b>	
<b>Books:</b>				
<b>Text Books</b>	<ol style="list-style-type: none"> <li>Hearn &amp; Baker, “Computer Graphics C version”, 2<sup>nd</sup> Edition, Pearson Publication</li> <li>James D. Foley, Andries van Dam, Steven K Feiner, John F. Hughes, “Computer Graphics Principles and Practice in C”, 2<sup>nd</sup> Edition, Pearson Publication</li> <li>Samit Bhattacharya, “Computer Graphics”, Oxford Publication</li> </ol>			
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>D. Rogers, “Procedural Elements for Computer Graphics”, Tata McGraw-Hill Publications</li> <li>Zhigang Xiang, Roy Plastock, “Computer Graphics”, Schaum’s Outlines McGraw-Hill Education</li> <li>Rajesh K. Maurya, “Computer Graphics”, Wiley India Publication.</li> <li>F. S. Hill, “Computer Graphics using OpenGL”, Third edition, Pearson Publications</li> </ol>			
<b>Useful Links:</b>				
1. <a href="https://onlinecourses.nptel.ac.in/noc21_cs97/preview">https://onlinecourses.nptel.ac.in/noc21_cs97/preview</a>				
2. <a href="https://nptel.ac.in/courses/106/106/106106090/">https://nptel.ac.in/courses/106/106/106106090/</a>				
3. <a href="https://www.classcentral.com/course/interactivegraphics-2067">https://www.classcentral.com/course/interactivegraphics-2067</a>				
<b>Continuous Assessment:</b>				
<ul style="list-style-type: none"> <li>Test-1, Test-2 and Average of T-1 and T-2 (30Marks): Test-1 and Test-2 consists of two class tests of 30 marks each.</li> <li>Test-1 is to be conducted on approximately 40% of the syllabus completed and Test-2 will be based on remaining contents (approximately 40% syllabus).</li> <li>Average marks of T-1 and T-2 will be considered.</li> </ul>				

- Internal Assessment (10 Marks): Internal assessment will be based on quizzes /case study/activity conducted by the faculty

**End Semester Examination (ESE):**

- End Semester Exam shall be conducted for Total 60 Marks.
- Duration of End Semester Exam shall be 02 Hours 30 Minutes.

Lab Code	Lab Name	Credits (P+TUT)	
AIL303	Data Structure Lab	(1+0)	
<b>Lab Prerequisite:</b>	1. Computer Programming 2. Computer Programming Laboratory		
<b>Lab Objectives:</b>	1. To implement basic data structures such as linked lists, stacks and queues 2. To solve problem involving graphs and trees 3. To choose appropriate data structure and apply it to various problems		
<b>Lab Outcomes (LOs):</b>	1. Implement linear data structures & be able to handle operations like insertion, deletion, searching and traversing on them. 2. Implement nonlinear data structures & be able to handle operations like insertion, deletion, searching and traversing on them 3. Choose appropriate data structure and apply it in various problems 4. Select appropriate searching techniques for given problems. 5. Apply ethical principles like timeliness and adhere to the rules of the laboratory.		
Lab No.	Experiment Title	LO mapped	Hrs. /Lab
Star (*) marked experiments are compulsory.			
I.	Lab Prerequisite	---	02
1.	Implement Stack ADT using array.	LO1, LO5	02
2.	Convert an Infix expression to Postfix expression using stack ADT.		02
3.	Evaluate Postfix Expression using Stack ADT		02
4*.	At least 2 applications of Stack from the useful links/any other given below.	LO1, LO3, LO5	02
5.	Implement Linear Queue ADT using array.	LO1, LO5	02
6.	Implement Circular/Double ended Queue ADT using array.		02
7.	Implement Priority Queue ADT using array.		02
8.	Implement Singly Linked List ADT.		02
9.	Implement Circular Linked List ADT.		02
10.	Implement Doubly Linked List ADT.		02
11.	Implement Stack / Linear Queue ADT using Linked List.		02
12* .	Implement Binary Search Tree ADT using Linked List.	LO2, LO3, LO5	02
13* .	Implement Graph Traversal techniques: a) Depth First Search b) Breadth First Search.		02
14* .	At least 2 applications of Binary Search Technique from the useful links/any other given below	LO4, LO5	02
<b>Useful Links:</b>			
1. <a href="http://www.leetcode.com">www.leetcode.com</a>			
2. <a href="http://www.hackerrank.com">www.hackerrank.com</a>			
3. <a href="http://www.cs.usfca.edu/~galles/visualization/Algorithms.html">www.cs.usfca.edu/~galles/visualization/Algorithms.html</a>			
4. <a href="http://www.codechef.com">www.codechef.com</a>			

**Term work:**

1. Term work should consist of a Minimum of 8 experiments.
2. Journal must include at least 2 assignments on content of theory and practical of the course “Data Structure”.
3. The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and Minimum passing marks in term work.
4. Total 25 Marks (Experiments:-20 marks, Assignments:-05 marks)

**P&O:** P&O examination will be based on experiment list and performance of experiment.

Lab Code	Lab Name	Credits (P+TUT)	
AIL304	Digital Logic & Computer Architecture Lab	(1+0)	
<b>Lab Prerequisite:</b>	1. C Programming Language		
<b>Lab Objectives:</b>	1. To discuss basic concepts of digital logic design. 2. To Design and simulate different digital circuits. 3. To implement operations of the arithmetic unit using algorithms. 4. To design memory subsystem including cache memory. 5. To demonstrate CPU and ALU design.		
<b>Lab Outcomes (LOs):</b>	1. The student will be able explain the basics of digital components. 2. The student will be able implement different digital circuits. 3. The student will be able design the basic building blocks of a computer: ALU, registers, CPU and memory 4. The student will be able recognize the importance of digital systems in computer architecture. 5. The student will be able implement various algorithms for arithmetic operations. 6. The student will be able to write accurate documentation for experiments performed.		
Lab No.	Experiment Title	LO mapped	Hrs./Lab
1.	Lab Prerequisite	---	02
1.	To verify the truth table of various logic gates using ICs.	LO1,LO6	02
2.	To realize the gates using universal gates	LO2, LO6	02
3.	Code conversion.		02
4.	To realize half adder and full adder.		02
5.	To implement logic operation using MUX IC.		02
6.	To implement logic operation decoder IC.		02
7.	Study of flip flop IC.		02
8.	To implement ripple carry adder.		LO4, LO6
9.	To implement carry look ahead adder.	02	
10.	To implement Booth's algorithm.	LO5, LO6	02
11.	To implement restoring division algorithm.		02
12.	To implement non restoring division algorithm.	LO4, LO6	02
13.	To implement ALU design.	LO3, LO6	02
14.	To implement CPU design.		02
15.	To implement memory design.		02
16.	To implement cache memory design.		02
17.	To study MASM (Micro Assembler).	LO5, LO6	02
18.	A program to simulate the mapping techniques of Cache memory. 18.1 Direct Mapped cache	LO3, LO6	02

	18.2 Associative Mapped cache 18.3 Set Associative Mapped cache		
<b>Virtual Lab Links:</b>			
1. <a href="http://vlabs.iitkgp.ac.in/dec/exp3/index.html#">http://vlabs.iitkgp.ac.in/dec/exp3/index.html#</a>			
2. <a href="http://vlabs.iitb.ac.in/vlabs-dev/labs/dldesignlab/experimentlist.html">http://vlabs.iitb.ac.in/vlabs-dev/labs/dldesignlab/experimentlist.html</a>			
3. <a href="http://vlabs.iitkgp.ac.in/coa/">http://vlabs.iitkgp.ac.in/coa/</a>			
<b>Term work:</b>			
<ol style="list-style-type: none"> <li>1. Term work should consist of a Minimum of 8 experiments.</li> <li>2. Journal must include at least 2 assignments on content of theory and practical of the course “Digital Logic &amp; Computer Architecture”.</li> <li>3. The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and Minimum passing marks in term work.</li> <li>4. Total 25 Marks (Experiments:-20 marks, Assignments:-05 marks),</li> </ol>			

Lab Code	Lab Name	Credits (P+TUT)	
AIL305	Computer Graphics Lab	(1+0)	
<b>Lab Prerequisite:</b>	C Programming Language.		
<b>Lab Objectives:</b>	1. Understand the need of developing graphics application 2. Learn algorithmic development of graphics primitives like line, circle, polygon etc. 3. Learn the representation and transformation of graphical images and pictures		
<b>Lab Outcomes (LOs):</b>	Students will be able to: 1. Implement various output and filled area primitive algorithms 2. Apply transformation, projection and clipping algorithms on graphical objects 3. Perform curve and fractal generation methods 4. Develop a Graphical application/Animation based on learned concept. 5. Apply ethical principles like timeliness and adhere to the rules of the laboratory.		
Lab No.	Experiment Title	LO mapped	Hrs./Lab
I.	Lab Prerequisite	---	02
1.	Implement DDA Line Drawing algorithm (dotted/dashed/thick)	LO1, LO5	02
2.	Implement Bresenham's Line algorithm (dotted /dashed/thick)		02
3.	Implement midpoint Circle algorithm.		02
4.	Implement midpoint Ellipse algorithm.		02
5.	Implement Area Filling Algorithm: Boundary Fill, Flood Fill.		02
6.	Implement Scan line Polygon Filling algorithm.		02
7.	Implement Curve: Bezier for n control points, B Spline (Uniform) (at least one)	LO3, LO5	02
8.	Implement Fractal generation method (any one)		02
9.	Character Generation: Bit Map method and Stroke Method	LO1, LO5	02
10.	Implement 2D Transformations: Translation, Scaling, Rotation, Reflection, Shear.	LO2, LO5	02
11.	Implement Line Clipping Algorithm: Cohen Sutherland / Liang Barsky.		02
12.	Implement polygon clipping algorithm (at least one)		02
13.	Program to perform 3D transformation.		02
14.	Perform projection of a 3D object on Projection Plane: Parallel and Perspective.		02
<b>Virtual Lab Links:</b>			
<a href="http://vlabs.iitb.ac.in/vlabs-dev/labs/cglab/experimentlist.html">http://vlabs.iitb.ac.in/vlabs-dev/labs/cglab/experimentlist.html</a>			

**Term work:**

1. Term work should consist of a minimum of 8 experiments
2. Journal must include at least 2 assignments on content of theory and practical of the course “Computer Graphics”.
3. The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and minimum passing marks in term work.
4. Total 25 Marks (Experiments:-20 marks, Assignments:-05 marks)

**P&O:** P&O examination will be based on experiment list and performance of experiment.

<b>Project Based Learning Code</b>	<b>Project Based Learning</b>	<b>Credits (P+TUT)</b>
<b>AIPR31</b>	<b>Mini Project Lab-I</b>	<b>(1+0)</b>
<b>PBL Prerequisites:</b>	---	
<b>PBL Objectives:</b>	1. To acquaint with the process of identifying the needs and converting it into the problem. 2. To familiarize the process of solving the problem in a group. 3. To acquaint with the process of applying basic engineering fundamentals to attempt solutions to the problems. 4. To inculcate the process of self-learning and research.	
<b>PBL Outcomes:</b>	At the end of the course, the student will be able to: 1. Identify problems based on societal /research needs. 2. Apply Knowledge and skill to solve societal problems in a group. 3. Develop interpersonal skills to work as member of a group or leader. 4. Analyze the impact of solutions in societal and environmental context for sustainable development. 5. Excel in written and oral communication. 6. Demonstrate capabilities of self-learning in a group, which leads to lifelong learning. 7. Demonstrate project management principles during project work.	
<b>Guidelines for Mini Project:</b>		
1.	Project based learning Mini Project Lab-1 should be implemented using Java programming (AIXS33)	
2.	Students shall form a group of 2 to 4 students, while forming a group shall not be allowed less than two or more than three students, as it is a group activity.	
3.	Students should do survey and identify needs, which shall be converted into problem statement for mini project in consultation with faculty supervisor/internal committee of faculties.	
4.	Students shall submit implementation plan in the form of Gantt/PERT/CPM chart, which will cover weekly activity of mini project.	
5.	A logbook to be prepared by each group, wherein group can record weekly work progress, guide/supervisor can verify and record notes/comments.	
6.	Faculty supervisor may give inputs to students during mini project activity; however, focus shall be on self-learning.	
7.	Students in a group shall understand problem effectively, propose multiple solution and select best possible solution in consultation with guide/ supervisor.	
8.	Students shall convert the best solution into working model using Java programming.	
9.	The solution to be validated with proper justification and report to be compiled in standard format of the college.	
10.	With the focus on the self-learning, innovation, addressing societal problems and entrepreneurship quality development within the students through the Mini Projects, it is preferable that a single project of appropriate level and quality to be carried out in two semesters by all the groups of the students. i.e. Mini Project 1 in semester III and IV.	

11	However, based on the individual students or group capability, with the mentor's recommendations, if the proposed Mini Project adhering to the qualitative aspects mentioned above gets completed in odd semester, then that group can be allowed to work on the extension of the Mini Project with suitable improvements/modifications or a completely new project idea in even semester. This policy can be adopted on case by case basis.	
<b>Term Work:</b>		
The review/ progress monitoring committee shall be constituted by senior faculty members. The progress of mini project to be evaluated on continuous basis, minimum two reviews in each semester. Assessment also considers peer review and ethics observed by faculties and participation involvement.		
<b>Distribution of Term work marks for both semesters shall be as below</b>		<b>Practical Marks</b>
1.	Marks awarded by guide/supervisor based on implementation	10
2.	Peer assessment by team members	05
3.	Marks awarded by review committee	05
4.	Quality of Project report	05
<b>Review / progress monitoring committee may consider following points for assessment based on project as mentioned in general guidelines</b>		
1.	Students' group shall complete project in all aspects including, <ul style="list-style-type: none"> <li>a. Identification of need/problem</li> <li>b. Proposed final solution</li> <li>c. Procurement of components/system</li> <li>d. Building prototype and testing</li> </ul>	
2.	Continuous assessment will be weekly based on logbook. Two presentations will be conducted for review before a panel. <ul style="list-style-type: none"> <li>a. First shall be for finalization of problem and proposed solution</li> <li>b. Second shall be for implementation and testing of solution.</li> </ul>	
<b>Assessment criteria of Mini Project:</b>		
Mini Project shall be assessed based on following criteria;		
1.	Quality of survey and identification of problem statement	
2.	Innovativeness in solutions	
3.	Implementation	
4.	Team work	
5.	Project report	
<b>Guidelines for Assessment of Mini Project Practical/Oral Examination:</b>		
1.	Report should be prepared as per the guidelines.	
2.	Mini Project shall be assessed through a presentation and demonstration of working model by the student project group to a panel of Internal and External Examiners.	
3.	Students shall be motivated to participate in poster, project competition on the work in students' competitions.	
Mini Project shall be assessed based on following points.		
1.	Quality of problem and Clarity	
2.	Innovativeness in solutions	
3.	Cost effectiveness and Societal impact	
4.	Full functioning of working model as per stated requirements	

5.	Effective use of skill sets
6.	Effective use of standard engineering norms
7.	Contribution of an individual's as member or leader
8.	Clarity in written and oral communication
<b>P&amp;O:</b> P&O examination will be based on mini project implementation.	

Exposure (SAT-III) Course Code	Exposure (SAT-III) Course Name	Credits (P+TUT)	
AIXS33	SAT-III: Skill Based Learning (Object Oriented Programming with Java)	(1+0)	
<b>Skill Prerequisite:</b>	1. Structured Programming Approach		
<b>Skill Objectives:</b>	1. To learn the basic concepts of object-oriented programming 2. To study JAVA programming language 3. To study various concepts of JAVA programming like multithreading, exception Handling, packages, etc. 4. To explain components of GUI based programming.		
<b>Skill Outcomes (SOs):</b>	1. To apply fundamental programming constructs. 2. To implement the concept of classes and objects. 3. To implement the concept of strings, arrays , vectors and packages 4. To implement the concept of inheritance and interfaces 5. To implement the concept of exception handling and multithreading 6. To develop GUI based application		
Module No.	Module Name	SO mapped	Hrs. /Module
1.	Introduction to Object Oriented Programming: Title: Write a program to implement basic programming constructs like branching and looping. Concepts: Introduction to Java, Object Oriented Concepts, Java Virtual Machine, Basic programming constructs: variables, data types, and operators, expressions, branching and looping. Objective: Objective of this module is to provide students an overview Object Oriented Concepts and Basic Java programming constructs.	SO1	01
2.	Class, Object, Packages and Input /output: Title: Write a program to demonstrate different ways of accepting user input in Java. Concepts: Class, object, data members, member functions, Command Line Argument, Input and output functions in Java, Buffered reader class, Scanner class. Objective: Students will learn how to use different ways to accept user input in Java. Title: Write a program to implement the concept of method overloading and Constructor overloading. Concepts: Introduction to Constructors, Constructor types, Constructor overloading, static members and functions Method overloading. Objective: Students will learn how to apply concept of constructor, constructor overloading, method overloading in Java.	SO2	02
3	Array, String, Vector and Packages: Title: Write a program implement the concept of 2D array and String Manipulation functions in Java. Concepts: Array, Strings, String Buffer Objective: Students will learn how to create and use 1D, 2D array and how to use different string manipulation functions. Title: Write a program to implement the concept of vector. Concepts: Introduction to Vector	SO3	03

	Objective: Students will learn how to create vector, how to add and delete elements in vector.		
	Title: Write a program to implement the concept of package. Concepts: Package, User defined packages Objective: Students will learn how to use inbuilt packages and user defined packages		
4.	Inheritance and Interface: Title: Write a program to implement the concept of Inheritance. Concepts: Inheritance, Types of inheritance, extends keyword, super keyword, Access Modifiers Objective: Students will learn how to use concept of inheritance and types of inheritance in java, Multiple inheritance using interface	SO4	04
	Title: Write a program to implement the concept of Method Overriding. Concepts: Method overriding Objective: Students will learn how to implement Method overriding		
	Title: Write a program to implement the concept of abstract class and abstract method. Concepts: Abstract class and abstract method Objective: Students will learn how to create and use Abstract class and abstract method.		
	Title: Write a program to implement the concept of Interface Concepts: Interface, how to create interface, How to extend interface. Objective: Students will learn how to create interface, How to extend interface.		
5.	Exception handling and Multithreading: Title: Write a program to implement the concept of Exception handling Concepts: Exception handling using try, catch, finally, throw and throws, Multiple try and catch blocks Objective: Students will learn how to apply Exception handling using try, catch, finally, throw and throws.	SO5	03
	Title: Write a program to implement the concept of user defined exception Concepts: User defined exception Objective: Students will learn how to create user defined exception		
	Title: Write a program to implement the concept of Multithreading Concepts: Thread lifecycle, thread class methods, creating threads using extends and implements keyword. Objective: Students will learn how to create Thread by extending Thread class and Implementation Runnable interface		
6.	GUI programming in JAVA: Title: Design form for Admission process management application system. Concepts: Applet and applet life cycle, creating applets, graphics class functions, parameter passing to applet, Font and color class. Event handling using event class AWT: working with windows, using AWT controls for GUI design Swing class in JAVA. Objective: Students will learn how to use AWT or SWING to design GUI.	SO6	02
	Title: Study and Implement the concept of JDBC and Perform CRUD Operation on the form created in 6.1 using Java Database Connectivity		

	<p>Concepts: Introduction to JDBC, JDBC-ODBC connectivity, JDBC architecture.</p> <p>Objective: Objective of this module is to provide students an overview JDBC.</p>		
<b>Books:</b>			
<b>Textbooks</b>	1. Herbert Schildt, 'JAVA: The Complete Reference', Ninth Edition, Oracle Press.		
	2. E. Balagurusamy, 'Programming with Java', McGraw Hill Education.		
<b>Reference Books</b>	1. 'JAVA Programming', Black Book, Dream tech Press.		
	2. Dietal and Dietal, 'Java: How to Program', 8th Edition, PHI		
	3. Ivor Horton, 'Beginning JAVA', Wiley India.		
	4. 'Learn to Master Java programming', Staredu solutions		
<b>Useful learning Links:</b>			
	1. <a href="http://www.nptelvideos.in">www.nptelvideos.in</a>		
	2. <a href="http://www.w3schools.com">www.w3schools.com</a>		
	3. <a href="http://www.tutorialspoint.com">www.tutorialspoint.com</a>		
	4. <a href="https://starcertification.org/Certifications/Certificate/securejava">https://starcertification.org/Certifications/Certificate/securejava</a>		
<b>Term Work:</b>			
<p>Term work shall be awarded based on</p> <ol style="list-style-type: none"> <li>1. Students active participation in skill-based learning.</li> <li>2. Presenting/showcasing learned skills through Social /outreach/ extension activities/Events/ Competitions/Trainings/Internships etc;</li> <li>3. Submission of Report/ act/ demonstrations/ specific participation/ Idea creation/ scope/ creativity/Case study etc.</li> <li>4. Term work total 25 marks.</li> </ol>			

Exposure (SAT-IV) Course Code	Exposure (SAT-IV) Course Name	Credits			
		TH	P	TUT	Total
<b>AIXS34</b>	<b>SAT-IV: Activity-Based Learning (Interdisciplinary Informatics)</b>	-	<b>01</b>	-	<b>01</b>
<b>ABL Objectives (AOBs):</b>	<ol style="list-style-type: none"> <li>To expose learners to the opportunities, effectiveness and benefits of integrating informatics with diverse disciplines such as biotechnology, healthcare, agriculture, nanotechnology, earth sciences, etc.</li> <li>To introduce the approaches for integrating informatics with different disciplines.</li> <li>To explore real-world applications of interdisciplinary informatics, relevant data and tools for its development.</li> <li>To acquaint learners with recent trends and research in interdisciplinary informatics.</li> <li>To enhance critical thinking, research, communication and presentation skills.</li> <li>To promote interdisciplinary research and development.</li> </ol>				
<b>ABL Outcomes (AOs):</b>	<p>Upon completion of the course, the learners will be able to:</p> <ol style="list-style-type: none"> <li>Understand the fundamental concepts and interdisciplinary nature of informatics.</li> <li>Analyze literature, case studies and successful solutions related to interdisciplinary informatics applications.</li> <li>Analyze and interpret the data for interdisciplinary informatics.</li> <li>Identify real-world problems that can be addressed through interdisciplinary informatics.</li> <li>Demonstrate effective communication skills to bridge the gap between disciplinary jargons and develop interdisciplinary collaborations.</li> <li>Demonstrate a life-long motivation to engage in hands-on projects, research and practices in sustainable interdisciplinary informatics.</li> </ol>				
<b>Guidelines for Activity-Based Learning (ABL):</b>	<ol style="list-style-type: none"> <li>Students shall work in team of 03-04 members, which shall remain for this entire course.</li> <li>Student teams shall choose, survey and study any 01 of the following informatics using the Internet / Library Resources / Research Articles / Case Study Reports / etc.: <ol style="list-style-type: none"> <li>Bioinformatics</li> <li>Agro Informatics</li> <li>Health Informatics</li> <li>Weather Informatics</li> <li>Nano Informatics</li> <li>Geo Informatics</li> </ol> </li> <li>Students are also required to study the recent Research and Development in the interdisciplinary informatics, focusing on need-based real-world applications.</li> <li>During the contact hours, each student team is required to provide a weekly report of their progress — orally and as written summaries of approximately 01-02 pages, accompanied by a list of references.</li> <li>During the contact hours across the entire semester, each student team is also required to deliver 02 Seminars (Power Point Presentations) of 15-20 minutes each, which reflect their learning outcomes.</li> </ol>				

	<ol style="list-style-type: none"> <li>6. At the end of the term, each student team has to present a synthesis of their work in a final documented report of approximately 10-15 pages.</li> <li>7. Faculties shall act as facilitators: Observe students as they work on the activity and provide guidance as well as support wherever required.</li> </ol>
<b>Term Work (TW):</b>	Term Work evaluation shall be for Total 25 Marks based on the 02 Seminars (50%), Final Report (20%), Weekly Participation and Reporting (30%) and contents covered therein.

## Program Structure for Second Year UG Technology (AI-DS)

### Semester- IV-Credit Scheme

Course Code	Course Name	Teaching Scheme (Hrs.) TH – P – TUT	Total (Hrs.)	Credit Assigned TH – P – TUT	Total Credits	Course Category
AIC401	Applications of Mathematics in Engineering-II	3-0-1	04	3-0-1	04	BS
AIC402	Analysis of Algorithm	3-0-0	03	3-0-0	03	PC
AIC403	Database Management Systems	3-0-0	03	3-0-0	03	PC
AIC404	Operating System	3-0-0	03	3-0-0	03	PC
AIC405	Microprocessor	3-0-0	03	3-0-0	03	PC
AIL402	Analysis of Algorithm Lab	0-2-0	02	0-1-0	01	PC
AIL403	Database Management Systems Lab	0-2-0	02	0-1-0	01	PC
AIL404	Operating System Lab	0-2-0	02	0-1-0	01	PC
AIPR42	Project Based Learning- Mini Project Lab-2	0-2-0	02	0-1-0	01	PBL
AIXS45	Skill Based Learning-V	0-2*-0	02	0-1-0	01	SAT
AIXS46	Skill Based Learning-VI	0-2*-0	02	0-1-0	01	SAT
INT43	Internship-III	--		--	--	INT
<b>Total</b>		<b>15-12-1</b>	<b>28</b>	<b>15-6-1</b>	<b>22</b>	

\*SAT Hours are under Practical head but can be taken as Theory or Practical or both as per the need.

PBL - Mini Project Lab 1 and 2:

- Students can form groups with minimum 2 (Two) and not more than 4 (Four)
- Faculty Load: 1 hour per week per four groups

## Semester- IV-Examination Scheme

Course Code	Course Name	Examination Scheme										
		Marks										
		CA				ESE	Duration in Hrs.	TW	O	P	P&O	Total
		T1	T2	Avg. (T1 & T2)	IA							
AIC401	Applications of Mathematics in Engineering-II	30	30	30	10	60	2.30	25	--	--	--	125
AIC402	Analysis of Algorithm	30	30	30	10	60	2.30	--	--	--	--	100
AIC403	Database Management Systems	30	30	30	10	60	2.30	--	--	--	--	100
AIC404	Operating System	30	30	30	10	60	2.30	--	--	--	--	100
AIC405	Microprocessor	30	30	30	10	60	2.30	--	--	--	--	100
AIL402	Analysis of Algorithm Lab	--	--	--	--	--	--	25	--	--	25	50
AIL403	Database Management Systems Lab	--	--	--	--	--	--	25	--	--	25	50
AIL404	Operating System Lab	--	--	--	--	--	--	25	--	--	25	50
AIPR42	Project Based Learning-Mini Project Lab-2	--	--	--	--	--	--	25	--	--	25	50
AIXS45	Skill Based Learning-V	--	--	--	--	--	--	25	--	--	--	25
AIXS46	Skill Based Learning-VI	--	--	--	--	--	--	25	--	--	--	25
INT43	Internship-III	--	--	--	--	--	--	--	--	--	--	--
<b>Total</b>		<b>--</b>	<b>--</b>	<b>150</b>	<b>50</b>	<b>300</b>	<b>--</b>	<b>150</b>	<b>--</b>	<b>--</b>	<b>100</b>	<b>775</b>

Course Code	Course Name	Credits (TH+P+TUT)		
AIC401	Applications of Mathematics in Engineering-II	(3+0+1)		
<b>Prerequisite:</b>	1. Engineering Mathematics-I 2. Engineering Mathematics-II			
<b>Course Objectives:</b>	1. Matrix algebra to understand engineering problems. 2. Understand line and contour integrals and expansion of a complex valued function in a power series. 3. Understand the concepts of vector spaces used in the field of machine learning and engineering problems. 4. Understand the concepts of probability distributions and sampling theory for small samples. 5. Understand linear and Non-linear programming problems of optimization.			
<b>Couse Outcomes:</b>	1. Apply the concepts of eigenvalues and eigenvectors in engineering problems. 2. Use the concepts of Complex Integration for evaluating integrals, computing residues & evaluate various contour integrals. 3. Apply the concept of vector spaces and orthogonalization process in Engineering Problems. 4. Use the concept of probability distribution and sampling theory to engineering problems. 5. Apply the concept of Linear Programming Problems to optimization. 6. Solve Non-Linear Programming Problems for optimization of engineering problems.			
Module No. & Name	Sub Topics	CO mapped	Hrs./ Subtopic	Total Hrs./ Module
<b>I. Prerequisite and Course Outline</b>	Prerequisite Concepts and Course Introduction	---	02	02
<b>1. Linear Algebra (Theory of Matrices)</b>	1.1 Characteristic Equation, Eigenvalues and Eigenvectors, and properties (Without proof)	CO1	02	06
	1.2 Cayley-Hamilton Theorem (without proof), verification and reduction of higher degree polynomials		02	
	1.3 Similarity of matrices, diagonalizable and non-diagonalizable matrices		02	
<b>2. Complex Integration</b>	2.1 Line Integral, Cauchy's Integral theorem for simple connected and multiply connected regions (without proof), Cauchy's Integral formula (Without proof).	CO2	02	07
	2.2 Taylor's and Laurent's series (without proof).		03	
	2.3 Definition of Singularity, Zeroes, poles of $f(z)$ , Residues, Cauchy's Residue Theorem (without proof)		02	
<b>3. Linear Algebra: Vector Spaces</b>	3.1 Vectors in n-dimensional vector space, norm, dot product, The Cauchy-Schwarz inequality (with proof), and Unit vector.	CO3	02	06
	3.2 Othogonal projection, Orthonormal basis, Gram-Schmidt process for vectors.		02	
	3.3 Vector spaces over real field, subspaces.		02	

<b>4. Probability Distribution and Sampling Theory</b>	4.1 Probability Distribution: Poisson and Normal distribution	CO4	03	07						
	4.2 Sampling distribution Test of Hypothesis, Level of Significance, Critical region, One-tailed, and two-tailed test, Degree of freedom.		02							
	4.3 Students't-distribution (Small sample). Test the significance of mean and Difference between the means of two samples. Chi-Square Test: test of goodness of fit and independence of attributes, Contingency table.		02							
<b>5. Linear Programming Problems</b>	5.1 Types of solutions, Standard and Canonical of LPP, Basic and Feasible solutions, slack variables, surplus variables, Simplex method.	CO5	02	06						
	5.2 Artificial variables, Big-M method (Method of penalty)		02							
	5.3 Duality, Dual of LPP and Dual Simplex Method.		02							
<b>6. Nonlinear Programming Problems</b>	6.1 NLPP with one equality constraint (two or three variables) using the method of Lagrange's multipliers	CO6	02	07						
	6.2 NLPP with two equality constraints		02							
	6.3 NLPP with inequality constraint: Kuhn-Tucker conditions.		03							
<b>II. Course Conclusion</b>	Recap of Modules, Outcomes, Applications, and Summarization.	---	01	01						
			<b>Total hours</b>	<b>42</b>						
<b>Books:</b>										
<b>Text Books</b>	1. E. Kreyszig, Advanced Engineering Mathematics, Wiley. 2. R. Jain and S. Iyengar, Advanced Engineering Mathematics, Narosa Publication. 3. J. Brown and R. Churchill, Complex Variables and Applications, McGraw Hill.									
<b>Reference Books</b>	1. T. Veerarajan, Probability, Statistics and Random Processes, McGraw Hill. 2. H. Taha, Operations Research: An Introduction, Pearson. 3. S. Rao, Engineering Optimization: Theory and Practice, Wiley. 4. D. Hira and P. Gupta, Operations Research, S. Chand and Sons.									
<b>Useful Links:</b>	1. <a href="https://nptel.ac.in/courses/111/108/111108066/">https://nptel.ac.in/courses/111/108/111108066/</a> 2. <a href="https://nptel.ac.in/courses/111/103/111103070/">https://nptel.ac.in/courses/111/103/111103070/</a> 3. <a href="https://nptel.ac.in/courses/111/104/111104071/">https://nptel.ac.in/courses/111/104/111104071/</a> 4. <a href="https://nptel.ac.in/courses/111/105/111105041/">https://nptel.ac.in/courses/111/105/111105041/</a> 5. <a href="https://www.coursera.org/learn/complex-analysis">https://www.coursera.org/learn/complex-analysis</a>									
<b>Term Work (TW):</b>	1. Term work should consist of 6 batch wise tutorials. 2. Journal must include at least 2 assignments on content of theory of the course. The distribution of term work marks will be as follows <table border="1" style="margin-left: 20px;"> <tbody> <tr> <td>1</td> <td>Tutorials</td> <td>15</td> </tr> <tr> <td>2</td> <td>Assignment</td> <td>10</td> </tr> </tbody> </table>				1	Tutorials	15	2	Assignment	10
1	Tutorials	15								
2	Assignment	10								

<b>Continuous Assessment (CA):</b>	<ul style="list-style-type: none"> <li>• Continuous Assessment shall be conducted for Total 40 Marks, and includes</li> <li>• Average of Test 1 and Test 2: 30 Marks (where each Test shall be of 30 Marks),</li> <li>• Internal Assessment: 10 Marks.</li> <li>• Duration of each Test shall be 1 Hour and 15 Minutes.</li> <li>• Internal Assessment shall be based on presentation / during-the-lecture quiz / assignments / field studies / course-specific activity.</li> </ul>
<b>End Semester Examination (ESE):</b>	<ul style="list-style-type: none"> <li>• End Semester Exam shall be conducted for Total 60 Marks.</li> <li>• Duration of End Semester Exam shall be 02 Hours and 30 Minutes.</li> </ul>

Course Code	Course Name	Credits (TH+P+TUT)		
AIC402	Analysis of Algorithm	(3+0+0)		
<b>Prerequisite:</b>	1. Discrete Structures and Graph Theory 2. Data Structure			
<b>Course Objectives:</b>	1. To provide mathematical approaches for Analysis of Algorithms 2. To understand and solve problems using various algorithmic approaches 3. To analyze algorithms using various methods			
<b>Couse Outcomes:</b>	1. Analyze the running time and space complexity of algorithms. 2. Describe, apply and analyze the complexity of divide and conquer strategy. 3. Describe, apply and analyze the complexity of greedy strategy. 4. Describe, apply and analyze the complexity of dynamic programming strategy 5. Apply backtracking, branch and bound. 6. Apply string matching techniques.			
Module No. & Name	Sub Topics	CO mapped	Hrs./Subtopic	Total Hrs./Module
<b>I. Prerequisite and Course Outline</b>	Prerequisite Concepts and Course Introduction	---	02	02
<b>1.Introduction</b>	1.1 Performance analysis, space, and time complexity Growth of function, Big-Oh, Omega Theta notation Mathematical background for algorithm analysis.	CO2	04	08
	1.2 Complexity class: Definition of P, NP, NP-Hard, NP-Complete		01	
	1.3 Recurrences: The substitution method, Recursion tree method, Master method, Analysis of selection sort, insertion sort.		03	
<b>2.Divide and Conquer Approach</b>	General method, Merge sort, Quick sort, Finding minimum and maximum algorithms and their Analysis, Analysis of Binary search.	CO1	06	06
<b>3.Greedy Method Approach</b>	General Method, Single source shortest path: Dijkstra Algorithm, Fractional Knapsack problem, Job sequencing with deadlines, Huffman Coding, Minimum cost spanning trees: Kruskal and Prim's algorithms	CO3	06	06
<b>4.Dynamic Programming Approach</b>	General Method, Multistage graphs, Single source shortest path: Bellman Ford Algorithm, All pair shortest path: Floyd Warshall Algorithm, Assembly-line scheduling Problem, 0/1 knapsack Problem, Travelling Salesperson problem, Longest common subsequence	CO4	06	06
<b>5.Backtracking and Branch &amp; bound</b>	5.1 General Method, Backtracking: N-queen problem, Sum of subsets, Graph colouring.	CO5	04	09
	5.2 Branch and Bound: Travelling Salesperson Problem, 15 Puzzle problem		05	
<b>6.String</b>	6.1 The Naïve string-matching algorithm, The	CO6	03	04

<b>Matching Algorithms</b>	Rabin Karp algorithm, The Knuth-Morris-Pratt algorithm, Genetic Algorithm			
	6.2 Parallel Algorithms: Finding the maximum, Odd-Even Merge sort Sorting on a mesh		01	
<b>II. Course Conclusion</b>	Recap of Modules, Outcomes, Applications, and Summarization.	---	01	01
<b>Total hours</b>				<b>42</b>
<b>Books:</b>				
<b>Text Books</b>	1.T. H. Cormen, C.E. Leiserson, R. L. Rivest, and C. Stein, "Introduction to algorithms", 2nd Edition, PHI Publication 2005. 2.Ellis Horowitz, Sartaj Sahni, S. Rajsekaran. "Fundamentals of computer algorithms" University Press.			
<b>Reference Books</b>	1.Sanjoy Dasgupta, Christos Papadimitriou, Umesh Vazirani, "Algorithms", Tata McGraw Hill Edition. 2.S. K. Basu, "Design Methods and Analysis of Algorithm", PHI 3.Sara Baase and Allen van Gelder, Computer Algorithms -Introduction to Design and analysis, Third Edition, Pearson Edition, New Delhi, 2000			
<b>Useful Links:</b>				
1. <a href="https://nptel.ac.in/courses/106/106/106106131/">https://nptel.ac.in/courses/106/106/106106131/</a>				
2. <a href="https://swayam.gov.in/nd1_noc19_cs47/preview">https://swayam.gov.in/nd1_noc19_cs47/preview</a>				
3. <a href="https://www.coursera.org/specializations/algorithms">https://www.coursera.org/specializations/algorithms</a>				
4. <a href="https://www.mooc-list.com/tags/algorithms">https://www.mooc-list.com/tags/algorithms</a>				
<b>Continuous Assessment:</b>				
<ul style="list-style-type: none"> <li>• Test-1, Test-2 and Average of T-1 and T-2 (30Marks): Test-1 and Test-2 consists of two class tests of 30 marks each.</li> <li>• Test-1 is to be conducted on approximately 40% of the syllabus completed and Test-2 will be based on remaining contents (approximately 40% syllabus).</li> <li>• Average marks of T-1 and T-2 will be considered.</li> <li>• Internal Assessment (10 Marks): Internal assessment will be based on quizzes /case study/activity conducted by the faculty</li> </ul>				
<b>End Semester Examination (ESE):</b>				
<ul style="list-style-type: none"> <li>• End Semester Exam shall be conducted for Total 60 Marks.</li> <li>• Duration of End Semester Exam shall be 02 Hours 30 Minutes.</li> </ul>				

Course Code	Course Name	Credits (TH+P+TUT)		
AIC403	Database Management System	(3+0+0)		
<b>Prerequisite:</b>	Data Structures			
<b>Course Objectives:</b>	<ol style="list-style-type: none"> <li>1. Learn and practice data modelling using the entity-relationship and developing database designs.</li> <li>2. Understand the use of Structured Query Language (SQL) and learn SQL syntax.</li> <li>3. Apply normalization techniques to normalize the database</li> <li>4. Understand the needs of database processing and learn techniques for controlling the consequences of concurrent data access.</li> </ol>			
<b>Couse Outcomes:</b>	<ol style="list-style-type: none"> <li>1. Explain the fundamentals of a database system</li> <li>2. Design and draw ER and EER diagrams for the real life problem.</li> <li>3. Formulate relational algebra queries.</li> <li>4. Query a database using SQL.</li> <li>5. Apply concepts of normalization to relational database design.</li> <li>6. Explain the concept of transaction, concurrency and recovery.</li> </ol>			
Module No. & Name	Sub Topics	CO mapped	Hrs. /Subtopic	Total Hrs./ Module
<b>I. Prerequisite and Course Outline</b>	Prerequisite Concepts and Course Introduction	---	02	02
<b>1.Introduction Database Concepts</b>	1.1 Introduction, Characteristics of databases, File system v/s Database system, Users of Database system	CO1	02	03
	1.2 Data Independence, DBMS system architecture, Database Administrator		01	
<b>2.Entity–Relationship Data Model</b>	The Entity-Relationship (ER) Model: Entity types: Weak and strong entity sets, Entity sets, Types of Attributes, Keys, Relationship constraints: Cardinality and Participation, Extended Entity-Relationship (EER) Model: Generalization, Specialization and Aggregation	CO2	06	06
<b>3.Relational Model and relational Algebra</b>	3.1 Introduction to the Relational Model, relational schema and concept of keys. Mapping the ER and EER Model to the Relational Model	CO3	03	06
	3.2 Relational Algebra – unary and set operations, Relational Algebra Queries.		03	
<b>4.Structured Query Language (SQL)</b>	4.1 Overview of SQL Data Definition Commands, Data Manipulation commands, Data Control commands, Transaction Control Commands.	CO4	03	09
	4.2 Set and string operations, aggregate function - group by, having. Views in		05	

	SQL, joins, Nested and complex queries, Integrity constraint: key constraints, Domain Constraints, Referential integrity, check constraints			
	4.3 Triggers		01	
<b>5.Relational–Database Design</b>	Pitfalls in Relational-Database designs, Concept of Normalization, Function Dependencies, First Normal Form, 2nd ,3rd, BCNF, multi valued dependencies, 4NF	CO5	04	05
<b>6.Transactions Management and Concurrency</b>	6.1 Transaction concept, Transaction states, ACID properties, Concurrent Executions, Serializability–Conflict and View, Concurrency Control: Lock-based, Timestamp-based protocols.	CO6	10	10
	6.2 Recovery System: Failure Classification, Log based recovery. Deadlock handling			
<b>I. Course Conclusion</b>	Recap of Modules, Outcomes, Applications, and Summarization.	---	01	01
<b>Total hours</b>				<b>42</b>
<b>Books:</b>				
<b>Text Books</b>	<ol style="list-style-type: none"> <li>1. G. K. Gupta “Database Management Systems”, McGraw – Hill.</li> <li>2. Korth, Silberchatz, Sudarshan, “Database System Concepts”, 6th Edition, McGraw – Hill</li> <li>3. Elmasri and Navathe, “Fundamentals of Database Systems”, 5th Edition, Pearson education.</li> <li>4. Peter Rob and Carlos Coronel, “Database Systems Design, Implementation and Management”, Thomson Learning, 5th Edition.</li> </ol>			
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Dr. P.S. Deshpande, SQL and PL/SQL for Oracle 10g, Black Book, Dreamtech Press.</li> <li>2. Gillenson, Paulraj Ponniah, “Introduction to Database Management”, Wiley Publication.</li> <li>3. Sharaman Shah, “Oracle for Professional”, SPD.</li> <li>4. Raghu Ramkrishnan and Johannes Gehrke, “Database Management Systems”, TMH</li> </ol>			
<b>Useful Links:</b>				
1. <a href="https://onlinecourses.nptel.ac.in/noc19_cs46/preview">https://onlinecourses.nptel.ac.in/noc19_cs46/preview</a>				
2. <a href="https://www.edx.org/course/modeling-and-theory">https://www.edx.org/course/modeling-and-theory</a>				
3. <a href="https://www.edx.org/course/databases-5-sql">https://www.edx.org/course/databases-5-sql</a>				
4. <a href="https://www.coursera.org/lecture/sql-data-science/introduction-to-databases-XO9Ak">https://www.coursera.org/lecture/sql-data-science/introduction-to-databases-XO9Ak</a>				
<b>Continuous Assessment:</b>				
<ul style="list-style-type: none"> <li>• Test-1, Test-2 and Average of T-1 and T-2 (30Marks): Test-1 and Test-2 consists of two class tests of 30 marks each.</li> <li>• Test-1 is to be conducted on approximately 40% of the syllabus completed and Test-2 will be based on remaining contents (approximately 40% syllabus).</li> <li>• Average marks of T-1 and T-2 will be considered.</li> <li>• Internal Assessment (10 Marks): Internal assessment will be based on quizzes /case study/activity conducted by the faculty</li> </ul>				
<b>End Semester Examination (ESE):</b>				

- End Semester Exam shall be conducted for Total 60 Marks.
- Duration of End Semester Exam shall be 02 Hours 30 Minutes.

Course Code	Course Name	Credits (TH+P+TUT)		
AIC404	Operating System	(3+0+0)		
<b>Prerequisite:</b>	1. Data Structure 2. Digital Logic & Computer Architecture			
<b>Course Objectives:</b>	1. To introduce basic concepts and functions of operating systems. 2. To understand the concept of process, thread and resource management. 3. To understand the concepts of process synchronization and deadlock. 4. To understand various Memory, I/O and File management techniques.			
<b>Course Outcomes:</b>	1. Describe the objectives, functions and structure of OS 2. Analyse the concept of process management and evaluate performance of process scheduling algorithms. 3. Apply the concepts of synchronization and deadlocks 4. Evaluate performance of Memory allocation and replacement policies 5. Explain the concepts of file management. 6. Apply concepts of I/O management and analyse techniques of disk scheduling.			
Module No. & Name	Sub Topics	CO mapped	Hrs. /Subtopic	Total Hrs./ Module
<b>I. Prerequisite and Course Outline</b>	Prerequisite Concepts and Course Introduction	---	02	02
<b>1. Operating system Overview</b>	1.1 Introduction, Objectives, Functions and Evolution of Operating System	CO1	01	04
	1.2 Operating system structures: Layered, Monolithic and Microkernel		01	
	1.3 Linux Kernel, Shell and System Calls		02	
<b>2. Process and Process Scheduling</b>	2.1 Concept of a Process, Process States, Process Description, Process Control Block	CO2	03	09
	2.2 Uniprocessor Scheduling-Types: Pre-emptive and Non-pre-emptive scheduling algorithms (FCFS, SJF, SRTN, Priority, RR)		03	
	2.3 Threads: Definition and Types, Concept of Multithreading		03	
<b>3. Process Synchronization and Deadlocks</b>	3.1 Concurrency: Principles of Concurrency, Inter-Process Communication, Process Synchronization.	CO3	03	09
	3.2 Mutual Exclusion: Requirements, Hardware Support (TSL), Operating System Support (Semaphores), Producer and Consumer problem.		03	
	3.3 Principles of Deadlock: Conditions and Resource, Allocation Graphs, Deadlock Prevention, Deadlock Avoidance: Banker's Algorithm, Deadlock Detection and Recovery, Dining Philosophers Problem.		03	

<b>4.Memory Management</b>	4.1 Memory Management Requirements, Memory Partitioning: Fixed, Partitioning, Dynamic Partitioning, Memory Allocation Strategies: Best-Fit, First Fit, Worst Fit, Paging and Segmentation, TLB	CO4	05	09
	4.2 Virtual Memory: Demand Paging, Page Replacement Strategies: FIFO, Optimal, LRU, Thrashing		04	
<b>5.File Management</b>	Overview, File Organization and Access, File Directories, File Sharing	CO5	04	04
<b>6.I/O management</b>	I/O devices, Organization of the I/O Function, Disk Organization, I/O Management and Disk Scheduling: FCFS, SSTF, SCAN, CSCAN, LOOK, C-LOOK	CO6	04	04
<b>II. Course Conclusion</b>	Recap of Modules, Outcomes, Applications, and Summarization.	---	01	01
			<b>Total hours</b>	<b>42</b>
<b>Books:</b>				
<b>Text Books</b>	<ol style="list-style-type: none"> <li>1. William Stallings, Operating System: Internals and Design Principles, Prentice Hall, 8th Edition, 2014,</li> <li>2. Abraham Silber Schatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, John Wiley &amp; Sons, Inc., 9th Edition, 2016,</li> </ol>			
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Achyut Godbole and Atul Kahate, "Operating Systems", McGraw Hill Education, 3rd Edition</li> <li>2. Andrew Tannenbaum, "Operating System Design and Implementation", Pearson, 3rd Edition.</li> <li>3. Maurice J. Bach, "Design of UNIX Operating System", PHI</li> <li>4. Sumitabha Das, "UNIX: Concepts and Applications", McGraw Hill, 4th Edition</li> </ol>			
<b>Useful Links:</b>				
1. Introduction to Operating Systems - Course (nptel.ac.in)				
2. NPTEL : Electronics & Communication Engineering - Linux Programming & Scripting				
3. Free Online Course: Introduction to Operating Systems from Swayam   Class Central				
<b>Continuous Assessment:</b>				
<ul style="list-style-type: none"> <li>• Test-1, Test-2 and Average of T-1 and T-2 (30Marks): Test-1 and Test-2 consists of two class tests of 30 marks each.</li> <li>• Test-1 is to be conducted on approximately 40% of the syllabus completed and Test-2 will be based on remaining contents (approximately 40% syllabus).</li> <li>• Average marks of T-1 and T-2 will be considered.</li> <li>• Internal Assessment (10 Marks): Internal assessment will be based on quizzes /case study/activity conducted by the faculty</li> </ul>				
<b>End Semester Examination (ESE):</b>				
<ul style="list-style-type: none"> <li>• End Semester Exam shall be conducted for Total 60 Marks.</li> <li>• Duration of End Semester Exam shall be 02 Hours 30 Minutes.</li> </ul>				

Course Code	Course Name	Credits (TH+P+TUT)		
AIC405	Microprocessors	(3+0+0)		
<b>Prerequisite:</b>	Digital Logic & Computer Architecture			
<b>Course Objectives:</b>	1. To develop background knowledge and core expertise in microprocessor. 2. To study the concepts and basic architecture of 8086 3. To know the importance of different peripheral devices and their interfacing to 8086. 4. To know the design aspects of basic microprocessor. 5. To write assembly language programs in microprocessor for various applications.			
<b>Couse Outcomes:</b>	After successful completion of the course students will be able to: 1. Describe theory related to 8086 processor and peripherals and the Pentium processor. 2. Apply the concepts of 8086 architecture to solve simple problems related to address generation, segmentation etc. 3. Interface peripherals to the 8086. 4. Write simple programs in assembly language. 5. Write macros, subroutines, interrupt service routines. 6. Write interesting applications using DOS interrupts.			
Module No. & Name	Sub Topics	CO mapped	Hrs. /Subtopic	Total Hrs./ Module
<b>I. Prerequisite and Course Outline</b>	Prerequisite Concepts and Course Introduction	---	02	02
<b>1.The Intel 8086</b>	1.1 Intel 8086 Architecture: The execution unit, Flags and registers, BIU, queue, segment registers, pointer and index registers, segmentation, Pins	CO1, CO2	02	04
	1.2 Assembly language, addressing modes.	CO1	02	
<b>2.Assembly language programming</b>	Assembly language program development tools, development and representation of programs, instruction template, program format, data transfer instructions, string instructions, logical instructions, arithmetic instructions, control instructions, directives, structured programming, debugging	CO4	07	07
<b>3.Procedures, Macros, Interrupts</b>	Procedures and Macros, Mixed mode Programming with C-language and assembly language, DOS interrupts- Int 21h, The microprocessor-based PC, DOS operating system, 8086 Interrupts: Interrupt types in 8086, Dedicated interrupts, Software interrupts, Programming examples related to INT 21H (DOS Interrupts)	CO5, CO6	07	07
<b>4.Single Board Computer</b>	Generating the 8086 System Clock and Reset Signals using 8284 clock generator, 8086 Minimum and Maximum Mode CPU, use of bus	CO3	08	08

<b>Design</b>	controller 8288, read and write timing Diagrams, address demultiplexing using latch 8282, 8286,			
<b>5.Supporting Chips</b>	Functional Block Diagram and description of – 8087 coprocessor, Peripheral Controllers - 8255-PPI,8259- PIC and 8237-DMAC, single board computer using 8086	CO2, CO3	08	08
<b>6.Introduction to 32-bit Intel Pentium Architecture</b>	Introduction to 32-bit Intel Pentium Architecture: Features of Pentium Processor, Pentium Superscalar architecture, Pipelining, Branch Prediction, Instruction and Data cache.	CO1	06	06
<b>II. Course Conclusion</b>	Recap of Modules, Outcomes, Applications, and Summarization.	---	01	01
<b>Total hours</b>				<b>42</b>
<b>Books:</b>				
<b>Text Books</b>	<ol style="list-style-type: none"> <li>1. Douglas, V. Microprocessors and Interfacing. Tata McGraw Hill Education Private Limited, 2005.</li> <li>2. Uffenbeck, John E. "The 80x86 family: design, programming, and interfacing", Prentice Hall PTR, 2001.</li> <li>3. Brey, Barry B. The Intel microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, and Pentium Pro processor: architecture, programming, and interfacing. Prentice-Hall, Inc., 1997.</li> </ol>			
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Uffenbeck, John E. The 80x86 family: design, programming, and interfacing. Prentice Hall PTR, 2001.</li> <li>2. Guide, Part. "Intel® 64 and ia-32 architectures software developer's manual." Volume 3B: System programming Guide, Part 2.11 (2011).</li> </ol>			
<b>Useful Links:</b>				
<a href="https://www.intel.in/">https://www.intel.in/</a> / <a href="http://www.intel.com/support/articles/">www /support /articles / processors</a>				
<b>Continuous Assessment:</b>				
<ul style="list-style-type: none"> <li>• Test-1, Test-2 and Average of T-1 and T-2 (30Marks): Test-1 and Test-2 consists of two class tests of 30 marks each.</li> <li>• Test-1 is to be conducted on approximately 40% of the syllabus completed and Test-2 will be based on remaining contents (approximately 40% syllabus).</li> <li>• Average marks of T-1 and T-2 will be considered.</li> <li>• Internal Assessment (10 Marks): Internal assessment will be based on quizzes /case study/activity conducted by the faculty</li> </ul>				
<b>End Semester Examination (ESE):</b>				
<ul style="list-style-type: none"> <li>• End Semester Exam shall be conducted for Total 60 Marks.</li> <li>• Duration of End Semester Exam shall be 02 Hours 30 Minutes.</li> </ul>				

Lab Code	Lab Name	Credits (P+TUT)	
AIL402	Analysis of Algorithms Lab	(1+0)	
<b>Lab Prerequisite:</b>	1. Discrete Structures and Graph Theory 2. Data Structure 3. Basic knowledge of any programming language		
<b>Lab Objectives:</b>	1. To introduce the methods of designing and analyzing algorithms 2. Design and implement efficient algorithms for a specified application 3. Strengthen the ability to identify and apply the suitable algorithm for the given real-world problem. 4. Analyze worst-case running time of algorithms and understand fundamental algorithmic problems.		
<b>Lab Outcomes (LOs):</b>	1. Implement the algorithms using different approaches. 2. Analyze the complexities of various algorithms. 3. Compare the complexity of the algorithms for specific problem. 4. Write accurate documentation for experiments performed. 5. Apply ethical principles like timeliness and adhere to the rules of the laboratory.		
<b>Description:</b> Implementation can be in any language.			
<b>Suggested Practical List:</b>			
Lab No.	Experiment Title	LO mapped	Hrs. /Lab
I.	Lab Prerequisites	---	02
1.	1.1 Introduction	LO1, LO4, LO5	02
	Selection sort, Insertion sort		
2.	2.1 Divide and Conquer Approach		02
	Finding Minimum and Maximum, Merge sort, Quick sort, Binary search		
3.	3.1 Greedy Method Approach		02
	Single source shortest path- Dijkstra		
	Fractional Knapsack		
	Job sequencing with deadlines		
4.	4.1 Dynamic Programming Approach		02
	Single source shortest path-Bellman Ford		
	All pair shortest path- Floyd Warshall		
	0/1 knapsack		
	Travelling salesperson problem		
5.	5.1 Backtracking and Branch & bound	LO3, LO4, LO5	02
	N-queen problem		
	Sum of subsets		
	Graph coloring		
	Travelling Salesperson problem		

	15 Puzzle problem		
6.	6.1 String Matching Algorithms	LO2, LO4, LO5	02
	The Naïve string-matching Algorithms		
	The Rabin Karp algorithm		
	The Knuth-Morris-Pratt algorithm		
<b>Virtual Lab Links:</b>			
<a href="https://de-iitr.vlabs.ac.in">https://de-iitr.vlabs.ac.in</a>			
<b>Term work:</b>			
<ol style="list-style-type: none"> <li>1. Term work should consist of a minimum of 8 experiments.</li> <li>2. Journal must include at least 2 assignments on content of theory and practical of the course “Analysis of Algorithms Lab”.</li> <li>3. The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and minimum passing marks in term work.</li> <li>4. Total 25 Marks (Experiments:-20 marks, Assignments:-05 marks)</li> </ol>			
<b>P&amp;O:</b> P&O examination will be based on experiment list and performance of experiment.			

Lab Code	Lab Name	Credits (P+TUT)	
AIL403	Database Management System Lab	(1+0)	
<b>Lab Prerequisite:</b>	1. Any programming language		
<b>Lab Objectives:</b>	1. To identify, define problem statements and construct conceptual data model for real life applications. 2. To build Relational Model from conceptual model (ER/EER). 3. To apply SQL to store and retrieve data efficiently. 4. To demonstrate notions of normalization for database design.		
<b>Lab Outcomes (LOs):</b>	1. Identify the need of database and define the problem statement for real life applications. 2. Create relational model for real life applications 3. Formulate query using SQL for efficient retrieval of data. 4. Submit the documentation on time before deadline. 5. Write accurate documentation for experiments performed.		
Lab No.	Experiment Title	LO mapped	Hrs./Lab
I.	Lab Prerequisite	---	02
1.	Identify the case study and detail statement of problem. Design an Entity-Relationship (ER)/Extended Entity-Relationship (EER) Model & Mapping ER/EER to Relational schema.	LO1, LO4, LO5	02
2.	Create a database using Data Definition Language (DDL) and apply integrity constraints for the specified case study.	LO2, LO4, LO5	02
3.	Apply DML commands for the specified system & perform simple queries, string manipulation operations and aggregate functions.		02
4.	Implement various join operations, nested and complex queries.	LO3, LO4, LO5	02
5.	Implementation of views and triggers.		02
6.	Implement procedure and functions		02
7.	Use of database connectivity like JDBC.		02
8.	Deploy the application.	LO2, LO3, LO4, LO5	02
<b>Virtual Lab Links:</b>			
<a href="http://vlabs.iitb.ac.in/vlabs-dev/labs/dblab/index.php">http://vlabs.iitb.ac.in/vlabs-dev/labs/dblab/index.php</a>			
<b>Term work:</b>			
1. Term work should consist of a minimum of 8 experiments 2. Journal must include at least 2 assignments on content of theory and practical of the course "Database Management System". 3. The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and minimum passing marks in term work. 4. Total 25 Marks (Experiments:-20 marks, Assignments:-05 marks)			
<b>P&amp;O:</b> P&O examination will be based on experiment list and performance of experiment.			

Lab Code	Lab Name	Credits (P+TUT)	
AIL404	Operating System Lab	(1+0)	
<b>Lab Prerequisite:</b>	Knowledge on Operating system principles		
<b>Lab Objectives:</b>	<ol style="list-style-type: none"> <li>To gain practical experience with designing and implementing concepts of operating systems such as system calls, CPU scheduling, process management, memory management, file systems and deadlock handling using C language in Linux environment.</li> <li>To familiarize students with the architecture of Linux OS.</li> <li>To provide necessary skills for developing and debugging programs in Linux environment.</li> <li>To learn programmatically to implement simple operation system mechanism</li> </ol>		
<b>Lab Outcomes (LOs):</b>	<ol style="list-style-type: none"> <li>Demonstrate basic Operating system Commands, Shell scripts, System Calls and API wrt Linux</li> <li>Implement various process scheduling algorithms and evaluate their performance.</li> <li>Implement and analyze concepts of synchronization and deadlocks.</li> <li>Implement various Memory Management techniques and evaluate their performance.</li> <li>Implement and analyze concepts of virtual memory.</li> <li>Demonstrate and analyze concepts of file management and I/O management techniques.</li> </ol>		
Lab No.	Experiment Title	LO mapped	Hrs./Lab
I.	Lab Prerequisite	---	02
1.	Explore Linux Commands Explore usage of basic Linux Commands and system calls for file, directory and process management. For eg: (mkdir, chdir, cat, ls, chown, chmod, chgrp, ps etc. system calls: open, read, write, close, getpid, setpid, getuid, getgid, getegid, geteuid, sort, grep, awk, etc.)	LO1	02
2.	Linux shell script Write shell scripts to do the following: a. Display OS version, release number, kernel version b. Display top 10 processes in descending order c. Display processes with highest memory usage. d. Display current logged in user and log name. Display current shell, home directory, operating system type, current path setting, current working directory.	LO2	02
3.	Linux- API Implement any one basic commands of Linux like ls, cp, mv and others using kernel APIs.	LO1	02
4.	Linux- Process a.Create a child process in Linux using the fork system call. From the child process obtain the process ID of both child and parent by using getpid and getppid system calls. b.Explore wait and waitpid before termination of process	LO2	02
5.	Process Management: Scheduling	LO2	02

	<p>a. Write a program to demonstrate the concept of non-pre-emptive scheduling algorithms.</p> <p>b. Write a program to demonstrate the concept of pre-emptive scheduling algorithms</p>		
6.	<p>Process Management: Synchronization</p> <p>a. Write a C program to implement solution of Producer consumer problem through Semaphore</p>	LO3	02
7.	<p>Process Management: Deadlock</p> <p>a. Write a program to demonstrate the concept of deadlock avoidance through Banker's Algorithm</p> <p>b. Write a program demonstrate the concept of Dining Philosopher's Problem</p>		02
8.	<p>Memory Management</p> <p>a. Write a program to demonstrate the concept of MVT and MFT memory management techniques</p> <p>b. Write a program to demonstrate the concept of dynamic partitioning placement algorithms i.e. Best Fit, First Fit, Worst-Fit etc.</p>	LO4	02
9.	<p>Memory Management: Virtual Memory</p> <p>a. Write a program to demonstrate the concept of demand paging for simulation of Virtual Memory implementation</p> <p>b. Write a program in C demonstrate the concept of page replacement policies for handling page faults eg: FIFO, LRU etc.</p>	LO5	02
10.	<p>File Management &amp; I/O Management</p> <p>a. Write a C program to simulate File allocation strategies typically sequential, indexed and linked files</p> <p>b. Write a C program to simulate file organization of multi-level directory structure.</p> <p>c. Write a program in C to do disk scheduling - FCFS, SCAN, C-SCAN</p>	LO6	02

**Virtual Lab Links:**

[http://vlabs.iitb.ac.in/vlabs-dev/vlab\\_bootcamp/bootcamp/CRUX/labs/exp1/procedure.html](http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/CRUX/labs/exp1/procedure.html)

**Term work:**

1. Term work should consist of a minimum of 10 experiments
2. Journal must include at least 2 assignments on content of theory and practical of the course "Operating System"
3. The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and minimum passing marks in term work.
4. Total 25 Marks (Experiments:-20 marks, Assignments:-05 marks)

**P&O:** P&O examination will be based on experiment list and performance of experiment.

<b>Project Based Learning Code</b>	<b>Project Based Learning</b>	<b>Credits (P+TUT)</b>
<b>AIPR42</b>	<b>Mini Project Lab 2</b>	<b>(1+0)</b>
<b>PBL Prerequisites:</b>	Mini Project Lab 1	
<b>PBL Objectives:</b>	<ol style="list-style-type: none"> <li>1. To acquaint with the process of identifying the needs and converting it into the problem.</li> <li>2. To familiarize the process of solving the problem in a group.</li> <li>3. To acquaint with the process of applying basic engineering fundamentals to attempt solutions to the problems.</li> <li>4. To inculcate the process of self-learning and research.</li> </ol>	
<b>PBL Outcomes:</b>	<p>Learner will be able to...</p> <ol style="list-style-type: none"> <li>1. Identify problems based on societal /research needs.</li> <li>2. Apply Knowledge and skill to solve societal problems in a group.</li> <li>3. Develop interpersonal skills to work as member of a group or leader.</li> <li>4. Analyze the impact of solutions in societal and environmental context for sustainable development.</li> <li>5. Excel in written and oral communication.</li> <li>6. Demonstrate capabilities of self-learning in a group, which leads to lifelong learning.</li> <li>7. Demonstrate project management principles during project work.</li> </ol>	
<b>Guidelines for Mini Project:</b>		
1.	Project based learning Mini Project Lab-1 should be implemented using Python programming (AIXS45)	
2.	Students shall form a group of 2 to 4 students, while forming a group shall not be allowed less than two or more than three students, as it is a group activity.	
3.	Students should do survey and identify needs, which shall be converted into problem statement for mini project in consultation with faculty supervisor/internal committee of faculties.	
4.	Students shall submit implementation plan in the form of Gantt/PERT/CPM chart, which will cover weekly activity of mini project.	
5.	A logbook to be prepared by each group, wherein group can record weekly work progress, guide/supervisor can verify and record notes/comments.	
6.	Faculty supervisor may give inputs to students during mini project activity; however, focus shall be on self-learning.	
7.	Students in a group shall understand problem effectively, propose multiple solution and select best possible solution in consultation with guide/ supervisor.	
8.	Students shall convert the best solution into working model using Java programming.	
9.	The solution to be validated with proper justification and report to be compiled in standard format of the college.	
10.	With the focus on the self-learning, innovation, addressing societal problems and entrepreneurship quality development within the students through the Mini Projects, it is preferable that a single project of appropriate level and quality to be carried out in two semesters by all the groups of the students. i.e. Mini Project 1 in semester III and IV.	
11	However, based on the individual students or group capability, with the mentor's recommendations, if the proposed Mini Project adhering to the qualitative aspects	

	mentioned above gets completed in odd semester, then that group can be allowed to work on the extension of the Mini Project with suitable improvements/modifications or a completely new project idea in even semester. This policy can be adopted on case by case basis.
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**Term Work:**

The review/ progress monitoring committee shall be constituted by senior faculty members. The progress of mini project to be evaluated on continuous basis, minimum two reviews in each semester. Assessment also considers peer review and ethics observed by faculties and participation involvement.

<b>Distribution of Term work marks for both semesters shall be as below:</b>		<b>Practical Marks</b>
1.	Marks awarded by guide/supervisor based on implementation	10
2.	Peer assessment by team members	05
3.	Marks awarded by review committee	05
4.	Quality of Project report	05

**Review / progress monitoring committee may consider following points for assessment based on project as mentioned in general guidelines**

1.	Students' group shall complete project in all aspects including, <ul style="list-style-type: none"> <li>a. Identification of need/problem</li> <li>b. Proposed final solution</li> <li>c. Procurement of components/system</li> <li>d. Building prototype and testing</li> </ul>
2.	Continuous assessment will be weekly based on logbook. Two presentations will be conducted for review before a panel. <ul style="list-style-type: none"> <li>a. First shall be for finalization of problem and proposed solution</li> <li>b. Second shall be for implementation and testing of solution.</li> </ul>

**Assessment criteria of Mini Project.**

Mini Project shall be assessed based on following criteria;

1.	Quality of survey and identification of problem statement
2.	Innovativeness in solutions
3.	Implementation
4.	Team work
5.	Project report

**Guidelines for Assessment of Mini Project Practical/Oral Examination:**

1.	Report should be prepared as per the guidelines.
2.	Mini Project shall be assessed through a presentation and demonstration of working model by the student project group to a panel of Internal and External Examiners.
3.	Students shall be motivated to participate in poster, project competition on the work in students' competitions.

**Mini Project shall be assessed based on following points.**

1.	Quality of problem and Clarity
2.	Innovativeness in solutions
3.	Cost effectiveness and Societal impact
4.	Full functioning of working model as per stated requirements
5.	Effective use of skill sets
6.	Effective use of standard engineering norms
7.	Contribution of an individual's as member or leader

8.	Clarity in written and oral communication
<b>P&amp;O:</b> P&O examination will be based on mini project implementation.	
<b>Term Work:</b>	
<p>Term work shall be awarded based on</p> <ol style="list-style-type: none"> <li>1. Logbook maintained by each project group and weekly meeting based on the same.</li> <li>2. Students active participation in Technology learning.</li> <li>3. Presenting/Showcasing Learned Technology uses in social /Outreach/ Extension activities / Events/ Competitions/ Trainings/ Internships/ Development programs etc.</li> <li>4. Submission of participation/online course completion certificate with results of regular assignments / tests submission / performance and grades awarded, etc.</li> <li>5. Term work of 25 marks</li> </ol>	

Exposure SAT-V Course Code	Exposure SAT-V Course Name		Credits (P+TUT)
AIXS45	Skill Based learning: Python Programming		(1 + 0)
<b>Skill Prerequisite:</b>	Knowledge of some programming language like C, Java		
<b>Skill Objectives:</b>	1. Basics of Python programming 2. Decision Making, Data structure and Functions in Python 3. Object Oriented Programming using Python 4. Web framework for developing		
<b>Skill Outcomes (SOs):</b>	1. To understand basic concepts in python. 2. To explore contents of files, directories and text processing with python 3. To develop program for data structure using built in functions in python. 4. To explore django web framework for developing python-based web application and basics of NumPy and Pandas 5. To understand Multithreading concepts using python. 6. Apply ethical principles like timeliness and adhere to the rules of the laboratory.		
Module No. & Name	Sub Topics	SO mapped	Hrs/Sub topics
<b>I. Prerequisites and Course Outline</b>	Introduction to python, Features, Applications, Comparison with C and Java	--	--
<b>1. Python basics</b>	1.1 Data types in python, Operators in python, Input and Output	SO1, SO6	01
	1.2 Control statement, Arrays in python		01
	1.3 String and Character in python, Functions, List and Tuples, Dictionaries Exception		01
	1.4 Introduction to OOP, Classes, Objects, Interfaces, Inheritance		01
<b>2. Advanced Python</b>	Files in Python, Directories	SO2, SO6	01
	Building Modules		01
	Packages, Text Processing		01
	Regular expression in python.		01
<b>3. Data Structure in Python</b>	Link List, Stack	SO3, SO6	02
	Queues, Dequeues		02
<b>4. Python Integration Primer.</b>	Graphical User interface, Networking in Python	SO4, SO6	01
	Python database connectivity		01
	Introduction to Django		02
<b>5. Multithreading</b>	Thread and Process, Starting a thread	SO5, SO6	01
	Threading module, Synchronizing threads		02
	Multithreaded Priority Queue		01
<b>6. NumPy and Pandas</b>	Creating NumPy arrays, Indexing and slicing in NumPy, creating multidimensional arrays, NumPy Data types	SO4, SO6	02
	Array Attribute, Indexing and Slicing, Creating array views copies, Manipulating array shapes I/O		02

	Basics of Pandas, Using multilevel series, Series and Data Frames, Grouping, aggregating, Merge Data Frames		02
<b>Textbooks</b>			
	1. Dr. R. Nageswara Rao, “Core Python Programming”, Dreamtech Press		
	2. Beginning Python: Using Python 2.6 and Python 3.1. James Payne, Wrox Publication		
	3. Anurag Gupta, G. P. Biswas, “Python Programming”, McGraw-Hill		
	4. E. Balagurusamy, “Introduction to computing and problem-solving using python”, McGraw Hill Education		
<b>References:</b>			
	1. Learn Python the Hard Way, 3 <sup>rd</sup> Edition, Zed Shaw's Hard Way Series		
	2. Laura Cassell, Alan Gauld, “Python Projects”, Wrox Publication		
<b>Digital material:</b>			
	"The Python Tutorial", <a href="http://docs.python.org/release/3.0.1/tutorial/">http://docs.python.org/release/3.0.1/tutorial/</a>		
	Beginning Perl, <a href="https://www.perl.org/books/beginning-perl/">https://www.perl.org/books/beginning-perl/</a>		
	<a href="http://spoken-tutorial.org">http://spoken-tutorial.org</a>		
	<a href="https://starcertification.org/Certifications/Certificate/python">https://starcertification.org/Certifications/Certificate/python</a>		
<b>Suggested experiments using Python:</b>			
<b>Sr. No.</b>	<b>Title of Experiments</b>		
1	Exploring basics of python like data types (strings, list, array, dictionaries, set, tuples) and control statements.		
2	Creating functions, classes and objects using python. Demonstrate exception handling and inheritance.		
3	Exploring Files and directories a. Python program to append data to existing file and then display the entire file b. Python program to count number of lines, words and characters in a file. Python program to display file available in current directory		
4	Creating GUI with python containing widgets such as labels, textbox, radio, checkboxes and custom dialog boxes.		
5	Menu driven program for data structure using built in function for link list, stack and queue.		
6	Program to demonstrate CRUD ( <b>create, read, update and delete</b> ) operations on database (SQLite/ MySQL) using python.		
7	Creation of simple socket for basic information exchange between server and client.		
8	Creating web application using Django web framework to demonstrate functionality of user login and registration (also validating user detail using regular expression).		
9	Programs on Threading using python.		
10	Exploring basics of NumPy Methods.		
11	Program to demonstrate use of NumPy: Array objects.		
12	Program to demonstrate Data Series and Data Frames using Pandas.		
13	Program to send email and read content of URL.		
<b>Term Work:</b>			

1	An online quiz conducted at the end of every 2-hr session consisting of 5 questions for a total of 10 marks. The average of best 10 quizzes will be considered toward 10 marks out of 20. The MCQ's have to be submitted on the same day.
2	Students should perform minimum 15 experiments. The programs performed along with the screenshot of output have to be submitted within two days. A cover page will be attached stating the aims and objectives. This will be considered towards 10 marks.

Exposure SAT-VI Course Code	Exposure SAT-VI Course Name	Credits			
		TH	P	TUT	Total
AIXS46	<b>Skill-Based Learning (Foreign and Indian Modern Languages)</b>	-	01	-	01
<b>SBL Objectives (SOBs):</b>	<ol style="list-style-type: none"> <li>1. Acquire reading and writing proficiency in the target language</li> <li>2. Understand the common heritage of, and diversity among, countries that speak the target language.</li> <li>3. Communicate and interact effectively with citizens of the target cultures.</li> </ol>				
<b>SBL Outcomes (SOs):</b>	<p>Upon completion of the course, the learners will be able to:</p> <ol style="list-style-type: none"> <li>1. Demonstrate of communicative proficiency in the target language.</li> <li>2. Write the target language in formal expository prose that impede communication.</li> <li>3. Learn through MOOC online courses to adopt hybrid mode of learning</li> </ol>				
<b>Guidelines for Skill-Based Learning (SBL):</b>	Each student have to complete any one MOOC course from NPTEL/Coursera/Udemi sites as given in the list.				
<b>Sr. No.</b>	<b>Courses offered</b>				
1	Introduction to Japanese Language and Culture				
2	German				
3	The Psychology Of Language				
4	Spanish Vocabulary: Meeting People , Cultural Experience, Sports, Travel, and the Home, Careers and Social Events, Spanish Vocabulary Project				
5	A Bridge to the World: Korean Language for Beginners, First Step Korean, Learn to Speak Korean 1, The Korean Alphabet: An Introduction to Hangeul				
6	Complete French Course: Learn French for Beginners				
7	Complete German Course: Learn German for Beginners				
8	Spanish 1-4: Beginner, Elementary, Intermediate and Advanced				
9	Complete Japanese Course: Learn Japanese for Beginners				
10	Complete Korean Course: Learn Korean for Beginners				
11	The Complete Russian Language Course				
12	Spoken Sanskrit: Basic and Intermediate Levels				
13	Applied Linguistics				
14	Fundamental Concepts in Sociolinguistics				
15	Introduction to Basic Spoken sanskrit and intermediate level to Basic Spoken Sanskrit				

#### Online Resources:

Sr No.	Courses Link
1	<a href="https://onlinecourses.nptel.ac.in/noc22_hs84/preview">https://onlinecourses.nptel.ac.in/noc22_hs84/preview</a>
2	<a href="https://onlinecourses.nptel.ac.in/noc22_hs89/preview">https://onlinecourses.nptel.ac.in/noc22_hs89/preview</a>
3	<a href="https://onlinecourses.nptel.ac.in/noc22_hs123/preview">https://onlinecourses.nptel.ac.in/noc22_hs123/preview</a>
4	<a href="https://www.coursera.org/learn/spanish-vocabulary-meeting-people_">https://www.coursera.org/learn/spanish-vocabulary-meeting-people_</a> <a href="https://www.coursera.org/learn/spanish-vocabulary-cultural-experience">https://www.coursera.org/learn/spanish-vocabulary-cultural-experience</a> <a href="https://www.coursera.org/learn/spanish-vocabulary-sports-travel-home">https://www.coursera.org/learn/spanish-vocabulary-sports-travel-home</a>

	<a href="https://www.coursera.org/learn/spanish-vocabulary-careers">https://www.coursera.org/learn/spanish-vocabulary-careers</a> <a href="https://www.coursera.org/learn/spanish-vocabulary-project">https://www.coursera.org/learn/spanish-vocabulary-project</a>
<b>5</b>	<a href="https://www.coursera.org/learn/korean-beginners">https://www.coursera.org/learn/korean-beginners</a> <a href="https://www.coursera.org/learn/learn-korean">https://www.coursera.org/learn/learn-korean</a> <a href="https://www.coursera.org/learn/learn-speak-korean1">https://www.coursera.org/learn/learn-speak-korean1</a> <a href="https://www.coursera.org/learn/the-korean-alphabet-an-introduction-to-hangeul">https://www.coursera.org/learn/the-korean-alphabet-an-introduction-to-hangeul</a>
<b>6</b>	<a href="https://www.udemy.com/course/complete-french-course/">https://www.udemy.com/course/complete-french-course/</a>
<b>7</b>	<a href="https://www.udemy.com/course/complete-german-course-learn-german-for-beginners/">https://www.udemy.com/course/complete-german-course-learn-german-for-beginners/</a>
<b>8</b>	<a href="https://www.udemy.com/course/spanish-101-beginning-spanish-spanish-for-beginners/">https://www.udemy.com/course/spanish-101-beginning-spanish-spanish-for-beginners/</a>
<b>9</b>	<a href="https://www.udemy.com/course/complete-japanese-course-learn-japanese-for-beginners-lvl-1/">https://www.udemy.com/course/complete-japanese-course-learn-japanese-for-beginners-lvl-1/</a>
<b>10</b>	<a href="https://www.udemy.com/course/complete-korean-course-learn-korean-for-beginners-level-1/">https://www.udemy.com/course/complete-korean-course-learn-korean-for-beginners-level-1/</a>
<b>11</b>	<a href="https://www.udemy.com/course/the-complete-russian-language-course/">https://www.udemy.com/course/the-complete-russian-language-course/</a>
<b>12</b>	<a href="https://onlinecourses.nptel.ac.in/noc22_hs114/preview">https://onlinecourses.nptel.ac.in/noc22_hs114/preview</a>
<b>13</b>	<a href="https://onlinecourses.nptel.ac.in/noc22_hs85/preview">https://onlinecourses.nptel.ac.in/noc22_hs85/preview</a>
<b>14</b>	<a href="https://onlinecourses.nptel.ac.in/noc22_hs139/preview">https://onlinecourses.nptel.ac.in/noc22_hs139/preview</a>



**SOMAIYA**  
VIDYAVIHAR

**K J Somaiya Institute of Technology**

(Formerly known as K J Somaiya Institute of Engineering and Information Technology)

An Autonomous Institute permanently affiliated to University of Mumbai

## **Autonomy Scheme-II**

## **Internship Manual**

**(Prepared based on the Guidelines of AICTE  
and University of Mumbai)**

**(with effect from AY 2022-2023)**

## **INTERNSHIP MANUAL**

### **AICTE-INTERNSHIP POLICY STATES THAT:**

- The rise in global competition has prompted organizations to devise strategies to have a talented and innovative workforce to gain a competitive edge.
- Developing an internship policy is an impactful strategy for creating a future talent pool for the industry.
- The Internship program not only helps fresh pass-outs in gaining professional know-how but also benefits, corporate on fresh perspectives on business issues and even discovering future business leaders.
- Competition in the job sector is rising exponentially and securing entry-level jobs is getting very difficult, as the students passing out from technical institutions lack the experience and skills required by industry.
- The main aim of this initiatives is enhancement of the employability skills of the students passing out from Technical Institutions.

### **OBJECTIVES & EXPECTED OUTCOMES:**

Following are the intended objectives of internship training:

1. Will expose Technical students to the industrial environment, which cannot be simulated in the classroom and hence creating competent professionals for the industry.
2. Provide possible opportunities to learn, understand and sharpen the real time technical / managerial skills required at the job.
3. Exposure to the current technological developments relevant to the subject area of training.
4. Experience gained from the 'Industrial Internship' in the classroom will be used in classroom discussions.
5. Create conditions conducive to quest for knowledge and its applicability on the job.
6. Learn to apply the Technical knowledge in real industrial situations.
7. Gain experience in writing Technical reports/projects.
8. Expose students to the engineer's responsibilities and ethics.
9. Familiarize yourself with various materials, processes, products and their applications along with relevant aspects of quality control.
10. Promote academic, professional and/or personal development.
11. Expose the students to future employers.
12. Understand the social, economic and administrative considerations that influence the working environment of industrial organizations.
13. Understand the psychology of the workers and their habits, attitudes and approach to problem solving.

### **BENEFITS OF INTERNSHIP:**

#### **Benefits to Students:**

1. An opportunity to get hired by the Industry/ organization.
2. Practical experience in an organizational setting.

3. Excellent opportunity to see how the theoretical aspects learned in classes are integrated into the practical world. On-floor experience provides much more professional experience which is often worth more than classroom teaching.
4. Helps them decide if the industry and the profession is the best career option to pursue.
5. Opportunity to learn new skills and supplement knowledge.
6. Opportunity to practice communication and teamwork skills.
7. Opportunity to learn strategies like time management, multi-tasking etc in an industrial setup.
8. Opportunity to meet new people and learn networking skills.
9. Makes a valuable addition to their resume.
10. Enhances their candidacy for higher education.
11. Creating networks and social circles and developing relationships with industry people.
12. Provides opportunity to evaluate the organization before committing to a full time position.

#### **Benefits to the Institute:**

- Build industrial relations.
- Makes the placement process easier.
- Improve institutional credibility & branding.
- Helps in retention of the students.
- Curriculum revision can be made based on feedback from Industry/ students.
- Improvement in teaching learning process.

#### **Benefits to the Industry:**

- Availability of ready to contribute candidates for employment.
- Year round source of highly motivated pre-professionals.
- Students bring new perspectives to problem solving.
- Visibility of the organization is increased on campus.
- Quality candidate's availability for temporary or seasonal positions and projects.
- Freedom for industrial staff to pursue more creative projects.
- Availability of flexible, cost-effective work force not requiring a long-term employer commitment.
- Proven, cost-effective way to recruit and evaluate potential employees.
- Enhancement of employer's image in the community by contributing to the educational enterprise.

#### **STANDARD OPERATING PROCEDURE (SOP) FOR INTERNSHIP:**

The general procedure for arranging internship is given below:

**Step 1:** Request Letter/ Email from the Dean, IIC/ HOD and/or IIC members of resp. depts. of the college shall be send to industry to allot various slots of 4-6 weeks during summer vacation as internship periods for the students. Students request letter/profile/ interest areas may be submitted to industries for their willingness for providing the training. (Sample attached)

**Step 2:** Industry will confirm the training slots and the number of seats allocated for internships via Confirmation Letter/ Email. In case the students arrange the training themselves the confirmation letter will be submitted by the students to Dean, IIC/ HOD and/or IIC members of resp. depts. Based on the number of slots agreed to by the Industry, Dean, IIC/ HOD and/or IIC members will allocate the students to the Industry. In addition, the internship slots may be conveyed through Telephonic or Written Communication (by Fax, Email, etc.) by the Dean or other members of the IIC who are particularly looking after the Internship of the students.

**Step 3:** Students on joining Training at the concerned Industry / Organization, submit the Joining Report/

Letters / Email.

**Step 4:** Students undergo industrial training at the concerned Industry / Organization. In-between Faculty Member(s) evaluate(s) the performance of students once/twice by visiting the Industry/Organization and Evaluation Report of the students is submitted to Department IIC Member with the consent of Industry persons/ Trainers.

**Step 5:** Students will submit a training report after completion of internship.

**Step 6:** Training Certificate to be obtained from industry.

**Step 7:** List of students who have completed their internship successfully certificate will be issued by Departments, Sections, Professional bodies, Cells, Committees in collaboration with IIC cell.

**Step 8:** In addition to Step 1 to Step 7, Departments, Sections, Professional bodies, Cells, Committees of KJSIT may organize in house / Industry collaborated internship of 1/2/3/4 weeks duration for students with the same procedure as stated above, with in Principal approval from Principal.

### **GUIDELINES FOR THE STUDENTS:**

Internship/ Placement is a student centric activity. Therefore, the major role is to be played by the students. Deans, IIC/HOD may also include involvement of the student in the following activities:

- Design and Printing of Internship / Placement Brochure – Soft copy as well as Hard copy.
- Preparing list of potential recruiters / Internship providers and past recruiters.
- Internship/ Placement Presentation at various organizations, if required.
- For allotment of internship slots all the students will be required to submit “student internship program application” before the prescribed date

### **SOP FOR INTERNSHIP REPORT :**

#### **STUDENT’S DIARY/ DAILY LOG:**

The main purpose of writing a daily diary is to cultivate the habit of documenting and to encourage the students to search for details. The students should record in the daily training diary the day to day account of the observations, impressions, information gathered and suggestions given, if any. It should contain the sketches & drawings related to the observations made by the students. The diary should also be shown to the Faculty Mentor from time to time. Student’s Diary and Internship Report should be submitted by the students along with attendance record and an evaluation sheet duly signed, if any. It will be evaluated on the basis of the following criteria:

- Regularity in maintenance of the diary.
- Adequacy & quality of information recorded.
- Drawings, sketches and data recorded.
- Thought process and recording techniques used.
- Organization of the information.

After completion of Internship, the student should prepare a comprehensive report to indicate what he/she has observed and learnt in the training period. The training report should be signed by the Internship Supervisor (from Industry/Organisation, if applicable), Faculty Incharge and HOD. The Internship report will be evaluated on the basis of following criteria:

- Originality.
- Adequacy and purposeful write-up.
- Organization, format, drawings, sketches, style, language etc.
- Variety and relevance of learning experience.

- Practical applications, relationships with basic theory and concepts taught in the course. The industrial training of the students will be evaluated in three stages:
- Evaluation by Industry
- Evaluation by faculty supervisor on the basis of site visit(s).
- Evaluation through seminar presentation/viva-voce at the Institute.

**EVALUATION BY INDUSTRY:**

The industry will evaluate the students based on the Punctuality, eagerness to learn, Maintenance of Daily Diary and skill test in addition to any remarks.

**EVALUATION THROUGH SEMINAR PRESENTATION/VIVA-VOCE AT THE INSTITUTE:**

The student will give a seminar based on his/her internship/ training report, as decided by the institute.

The evaluation will be based on the following criteria:

- Quality of content presented.
- Proper planning for presentation.
- Effectiveness of presentation.
- Depth of knowledge and skills.
- Attendance record, daily diary, departmental reports shall also be analyzed along with the Internship Report. Seminar presentation will enable sharing knowledge & experience amongst students & teachers and build communication skills and confidence in students.

**EXAMINATION AND EVALUATION FOR AWARD OF INTERNSHIP COMPLETION**

**CERTIFICATE**

Internship Completion certificate will be awarded to graduating students on completion of minimum 5 Internship modules from Semester 2 to Semester 8 as per the internship policy document.

**COMPLIANCES FOR INTERNSHIP COMPLETION CERTIFICATION:**

1. Completion of 1 internship module will reflect addition of 2 credits so total credits earned will be 2 credits  
x 7 internship modules = 14 credits across Semester 2 to Semester 8.
2. Mandatory to complete minimum 5 internship modules across Semester 2 to Semester 8 for award of Internship Certificate.
3. On completion of 5 Internship modules credit earned = 10
4. On completion of 6 Internship modules credit earned = 12
5. On completion of 7 Internship modules credit earned = 14
6. No credits will be awarded AND / OR No Internship Completion Certificate will be issued for less than 10 credits earned throughout the degree.
7. Internship evaluation will be as per Internship module assessment process defined in Internship Manual course contents, for every individual student across Semester 2 to Semester 8.
8. Departments will submit Internship completion report and credits assigned sheet of every student signed by Department internship coordinator, Class teachers and Head of the Department to Exam Cell during 8<sup>th</sup> Semester ESE time duration of respective batch to generate the internship completion certificate along with the regular grade sheet.
9. No further queries will be entertained if not meeting above compliances and not following the internship modules designed under the guidelines of AICTE Internship policy.

**Internship Scheme & Structure under KJSIT Autonomy Scheme-II wef 2022-23**  
**for Bachelor of FY/SY/TY/LY (CE/IT/AI/ET Technology)**  
**Semester- II-VIII**

**Note:**

As per guidelines and suggestions by AICTE-Internship policy

- 1 Credit = 40 - 45 hours of Internship
- Total 600-700 hour of spending under Internship module courses to be completed for award of Internship Completion Certification along with regular passing gradesheet. (e.g. Total 15 weeks of 5 days/week of 8 hrs/day spent=600hrs for complete degree duration)
- Total weeks of Internship shall be considered based on Hrs spent/Day
- For Internship course, No load to be allotted for mentors in faculty load distribution sheet.

**Internship Modules & Contents Across Semester 2 to Semester 8**

<b>FY: (Sem II)</b>			
<b>Internship Code</b>	<b>Course Name</b>	<b>Hours/Duration</b>	<b>Credits</b>
<b>INT21</b>	<b>Internship-I</b>	80-120 hrs (2-3 Weeks ) Winter Vacation After SEM-I & during SEM-II of FY	<b>02</b>
<b>Prerequisite:</b>	<b>Fundamental knowledge of Engineering and Technology</b>		
<b>Internship Objectives:</b>	<ol style="list-style-type: none"> <li>1. To get acquainted with institute level technical activities and initiatives.</li> <li>2. To participate in department/Institute level technical learning and training initiatives through Professional cells/clubs/committees/bodies.</li> </ol>		
<b>Internship Outcomes:</b>	<p><b>Upon completion of the course, students will be able to:</b></p> <ol style="list-style-type: none"> <li>1. Get practical experience of institutional setting.</li> <li>2. Meet and interact with new people and learn networking, innovation and entrepreneurial skills.</li> <li>3. Promote academic, professional and/or personal development.</li> </ol>		
<b>Activity- Inter/Intra Institutional Activities</b>	<b>Supporting Activities to be completed under Internship</b>		
	• Attending Industry Workshops organised by departments		
	• Working in consultancy or research project initiated by department		
	• Technical festival (participation)		
	• Working in IIC Cell, Entrepreneurship Cell, NISP, IPR cell and/or any other technical professional body/cell/committee/club of the institute		
	• Activities related to Incubation or Innovation		
• Learning in departmental Labs, Tinkering Lab			
<b>Term Work Assessment:</b>			
<b>Duration to be considered for assessment:</b>			
Week Ends/ Semester Break/End of Semester (After ESE & Before Next Term Start )			
<b>Guidelines:</b>	<ol style="list-style-type: none"> <li>1. Batch wise Faculty Supervisor who is the proctor (mentor) of the batch will be allotted as in-charge for the course, at start of the Academic year.</li> <li>2. Students will submit the participation certificate of the activities to the faculty mentors.</li> </ol>		

	<ol style="list-style-type: none"> <li>3. For working in cells related activities, Cell coordinator will submit list of actively involved &amp; participated students of each department, semester wise to all department HODs, verified and authenticated by Dean Students Welfare.</li> <li>4. HODs will circulate the student list to all faculty mentors for consideration of Hours spends under mentioned department activities.</li> <li>5. For department Lab learning, FY HOD will circulate Term End report to all faculty mentors with list of student's undergone innovative learning, verified by department academic coordinator.</li> <li>6. Students will submit evaluation sheet by attaching Xerox copies of Internship &amp; other participation certificates &amp; faculty mentor will verify the Xerox from original copy for assessment purpose.</li> </ol>
<b>TW Marks (25) &amp; Certificate :</b>	<b>Assessment &amp; evaluation based on rubrics :</b> Hours Spent for Internship: max 20 marks Achievement/Recognition: max 05 marks <b>&amp; Internship and Activity Completion/Participation Certificates and Evaluating Report</b>

<b>SY (Sem III)</b>			
<b>Internship Code</b>	<b>Internship Name</b>	<b>Hours/Duration</b>	<b>Credits</b>
<b>INT32</b>	<b>Internship-II</b>	80-120 hrs (2 -3 Weeks) Summer Vacation <b>After SEM-II &amp; during SEM-III of SY</b>	<b>02</b>
<b>Prerequisite:</b>	<b>Fundamental knowledge of program specific tools, instruments, devices and programming languages etc.</b>		
<b>Internship Objectives:</b>	<ol style="list-style-type: none"> <li>1. To get the exposure to Innovation/IPR/ Entrepreneurship/ Startup initiatives</li> <li>2. To participate &amp; experience Incubation, Innovation &amp; Business development culture</li> </ol>		
<b>Internship Outcomes:</b>	<b>Upon completion of the course, students will be able to:</b> <ol style="list-style-type: none"> <li>1. Learn innovation and entrepreneurial skills to supplement engineering knowledge.</li> <li>2. Integrate theoretical aspects learned in classes with the practical world</li> <li>3. Develop an innovative idea to be processed as a start-up</li> </ol>		
<b>Activity- Innovation/ IPR/ Entrepreneurship</b>	<b>Supporting Activities to be completed under Internship</b>		
	<ol style="list-style-type: none"> <li>1. Participation in Innovation related competitions e.g. Hackathons etc.</li> <li>2. Awareness &amp; knowledge sessions about Development of new product/Business Plan/Registration of Start-up</li> </ol>		
	<ol style="list-style-type: none"> <li>3. Participation in all activities of IIC Cell, E-Cell, NISP, IPR Cell like <ul style="list-style-type: none"> <li>● IPR workshop/</li> <li>● Leadership Talk</li> <li>● Idea Design</li> <li>● Innovation/Business Competition</li> </ul> </li> </ol>		
<b>Term Work Assessment:Duration to be considered for assessment:</b>			
Week Ends/ Semester Break/End of Semester (After ESE & Before Next Term Start )			
<b>Guidelines:</b>	<ol style="list-style-type: none"> <li>1. Batch wise Faculty Supervisor who is the proctor (mentor) of the batch will be allotted as in-charge for the course, at start of the Academic year.</li> <li>2. Students will submit the participation certificate of the activities to the faculty mentors.</li> <li>3. For working in cells related activities, Cell coordinator will submit list of actively involved &amp; participated students of each department, semester wise to all department HODs, verified and authenticated by Dean Students Welfare.</li> </ol>		

	<p>4. HODs will circulate the student list to all faculty mentors for consideration of Hours spends under mentioned department activities.</p> <p>5. Department IIC Cell coordinator will collect, maintain each student proofs/reports from all faculty mentors, department internship analysis report will be prepared &amp; submitted to Dean, IIC for AICTE-CII survey data</p> <p>6. Students will submit evaluation sheet by attaching Xerox copies of all participation/ IPR/ Copyright certificates &amp; faculty mentor will verify it with original copies, for assessment purpose.</p>
<b>TW Marks (25) &amp; Certificate :</b>	<p><b>Assessment &amp; evaluation based on rubrics:</b></p> <p>Hours Spent for Internship: max 20 marks</p> <p>Achievement/Recognition: max 05 marks</p> <p><b>&amp; Internship and Activity Completion /Participation Certificates and Evaluating Report</b></p>

<b>SY (Sem IV)</b>			
<b>Internship Code</b>	<b>Internship Name</b>	<b>Hours/Duration</b>	<b>Credits</b>
<b>INT43</b>	<b>Internship-III</b>	80-120 hrs (2 - 3 Weeks) Winter Vacation After <b>SEM-III</b> & during <b>SEM-IV</b> of SY	<b>02</b>
<b>Prerequisite:</b>	<b>Skill sets of engineering and technology specific tools, instruments, devices and programming languages etc.</b>		
<b>Internship Objectives:</b>	<ol style="list-style-type: none"> <li>To get the industrial environment expose for creating competent professionals for the industry.</li> <li>To understand the psychology of the workers and their habits, attitudes and approach to problem solving.</li> </ol>		
<b>Internship Outcomes:</b>	<p><b>Upon completion of the course, students will be able to:</b></p> <ol style="list-style-type: none"> <li>Get an expose to work with the future employers.</li> <li>Familiarize with various materials, processes, products and their applications along with relevant aspects of quality control in product development lifecycle.</li> </ol>		
<b>Activity-Internship</b>	<b>Supporting Activities to be completed under Internship</b>		
	Internships in the field of:		
	● Industries		
	● Government Sector		
	● Non-governmental Organization (NGO)		
● MSMEs			
● Rural Internship			
<b>Term Work Assessment:</b>			
<b>Duration to be considered for assessment:</b>			
Week Ends/ Semester Break/End of Semester (After ESE & Before Next Term Start )			
<b>Guidelines:</b>	<ol style="list-style-type: none"> <li>Batch wise Faculty Supervisor who is the proctor (mentor) of the batch will be allotted as in-charge for the course, at start of the Academic year.</li> <li>Students will submit the participation certificate of the activities to the faculty mentors.</li> <li>For working in cells related activities, Cell coordinator will submit list of actively involved &amp; participated students of each department, semester wise to all department HODs, verified and authenticated by Dean Students Welfare.</li> <li>HOD will circulate the student list to all faculty mentors for consideration of Hours spends under mentioned department activities.</li> </ol>		

	<p>5. Department IIC Cell coordinator will collect, maintain each student proofs/reports from all faculty mentors, department internship analysis report will be prepared &amp; submitted to Dean, IIC for AICTE-CII survey data</p> <p>6. Students will submit evaluation sheet by attaching Xerox copies of all participation/ IPR/ Copyright certificates &amp; faculty mentor will verify it with original copies, for assessment purpose.</p>
<b>TW Marks (25) &amp; Certificate :</b>	<p><b>Assessment &amp; evaluation based on rubrics:</b>  Hours Spent for Internship: max 20 marks  Achievement/Recognition: max 05 marks  &amp; Internship and Activity Completion/Participation Certificates and Evaluating Report.</p>

**TY (Sem V)**

<b>Internship Code</b>	<b>Internship Name</b>	<b>Hours/Duration</b>	<b>Credits</b>
INT54	Internship-IV	80-160 hrs (2 - 4 Weeks) Summer Vacation After SEM-IV & during SEM-V of TY	02

<b>Prerequisite:</b>	<b>List of probable industries and organizations offering internships in Engineering and Technology. Awareness about problem areas in rural India</b>
<b>Internship Objectives:</b>	
<b>Internship Outcomes:</b>	<p><b>Upon completion of the course, students will be able to:</b></p> <ol style="list-style-type: none"> <li>1. Get an opportunity to practice communication and teamwork skills.</li> <li>2. Get an opportunity to learn strategies like time management, multi-tasking etc in an industrial setup.</li> </ol>

<b>Activity-Rural Internships &amp;/ Internships</b>	<b>Supporting Activities to be completed under Internship</b>
	1. Long Term Goal under Rural Development Internships or
	2. Mandatory internship for developing project with:
	● Industries
	● Government Sector
	● Non-governmental Organization (NGO)
	● MSMEs

<b>Term Work Assessment:</b>	
<b>Duration to be considered for assessment:</b>	
Week Ends/ Semester Break/End of Semester (After ESE & Before Next Term Start )	
<b>Guidelines:</b>	<ol style="list-style-type: none"> <li>1. Batch wise Faculty Supervisor who is the proctor (mentor) of the batch will be allotted as in-charge for the course, at start of the Academic year.</li> <li>2. Students will submit the participation certificate of the activities to the faculty mentors.</li> <li>3. For working in cells related activities, Cell coordinator will submit list of actively involved &amp; participated students of each department, semester wise to all department HODs, verified and authenticated by Dean Students Welfare.</li> <li>4. HOD will circulate the student list to all faculty mentors for consideration of Hours spends under mentioned department activities.</li> <li>5. Department IIC Cell coordinator will collect, maintain each student proofs/reports from all faculty mentors, department internship analysis report will be prepared &amp; submitted to Dean, IIC for AICTE-CII survey data</li> </ol>

	6. Students will submit evaluation sheet by attaching Xerox copies of all participation/ IPR/ Copyright certificates & faculty mentor will verify it with original copies, for assessment purpose.
<b>TW Marks (25) &amp; Certificate :</b>	<b>Assessment &amp; evaluation based on rubrics:</b> Hours Spent for Internship: max 20 marks Achievement/Recognition: max 05 marks & Internship and Activity Completion/Participation Certificates and Evaluating Report

<b>TY ( Sem VI)</b>			
<b>Internship Code</b>	<b>Internship Name</b>	<b>Hours/Duration</b>	<b>Credits</b>
<b>INT65</b>	<b>Internship-V</b>	80-160 hrs (2-4 Weeks) Winter Vacation After SEM-V & during SEM-VI of TY	<b>02</b>
<b>Prerequisite:</b>	<b>List of probable industries and organizations offering internships on live projects. Awareness about probable solutions for identified problem areas in rural India</b>		
<b>Internship Objectives:</b>	<ol style="list-style-type: none"> <li>To understand the social, economic and administrative considerations of working environment in industries, government, NGOs and private organizations.</li> <li>Learn to apply the Technical knowledge for solving real life problems.</li> </ol>		
<b>Internship Outcomes:</b>	<b>Upon completion of the course, students will be able to:</b> <ol style="list-style-type: none"> <li>Get an opportunity to get hired by the Industry/ organization.</li> <li>Decide if working in the industry or set up a start-up would be best career option to pursue.</li> </ol>		
<b>Activity- Rural Internships &amp; Internships</b>	<b>Supporting Activities to be completed under Internship</b>		
	1. Long Term Goal under Rural Development Internships or		
	2. Mandatory internship for developing project with:		
	<ul style="list-style-type: none"> <li>● Industries</li> <li>● Government Sector</li> <li>● Non-governmental Organization (NGO)</li> <li>● MSMEs</li> </ul>		
<b>Term Work Assessment:</b>			
<b>Duration to be considered for assessment:</b>			
Week Ends/ Semester Break/End of Semester (After ESE & Before Next Term Start )			
<b>Guidelines:</b>	<ol style="list-style-type: none"> <li>Batch wise Faculty Supervisor who is the proctor (mentor) of the batch will be allotted as in-charge for the course, at start of the Academic year.</li> <li>Students will submit the participation certificate of the activities to the faculty mentors.</li> <li>For working in cells related activities, Cell coordinator will submit list of actively involved &amp; participated students of each department, semester wise to all department HODs, verified and authenticated by Dean Students Welfare.</li> <li>HODs will circulate the student list to all faculty mentors for consideration of Hours spends under mentioned department activities.</li> <li>Department IIC Cell coordinator will collect, maintain each student proofs/reports from all faculty mentors, department internship analysis report will be prepared &amp; submitted to Dean, IIC for AICTE-CII survey data</li> </ol>		

	6. Students will submit evaluation sheet by attaching Xerox copies of all participation/ IPR/ Copyright certificates & faculty mentor will verify it with original copies, for assessment purpose.
<b>TW Marks (25) &amp; Certificate :</b>	<b>Assessment &amp; evaluation based on rubrics:</b> Hours Spent for Internship: max 20 marks Achievement/Recognition: max 05 marks & Internship and Activity Completion/Participation Certificates and Evaluating Report

**LY (Sem VII)**

<b>Internship Code</b>	<b>Internship Name</b>	<b>Hours/Duration</b>	<b>Credits</b>
<b>INT76</b>	<b>Internship-VI</b>	80-160 hrs (2-4 Weeks) <b>Summer Vacation of TY and during SEM-VII of LY</b>	<b>02</b>

<b>Prerequisite:</b>	<b>In depth knowledge about societal/research/innovation/entrepreneurial problems and appropriate applicable solutions available through use of technology.</b>
<b>Internship Objectives:</b>	<ol style="list-style-type: none"> <li>1. To gain the experience in preparing and writing Technical documentation/ reports for product/projects.</li> <li>2. To Identify and analyse the societal/research/entrepreneurial problem in detail to define its scope with problem specific data.</li> <li>3. To develop clarity of presentation based on communication, teamwork and leadership skills.</li> </ol>
<b>Internship Outcomes:</b>	<p><b>Upon completion of the course, students will be able to:</b></p> <ol style="list-style-type: none"> <li>1. Apply the engineering and technical knowledge for problem identification, analysis, design and developing solutions.</li> <li>2. Present and demonstrate the real time problem solution across national/international project competitions and conference.</li> </ol>

<b>Activity- PBL-Major Project A-Work/ Seminars</b>	<b>Supporting Activities to be completed under Internship</b>
	<b>For Sem VII PBL Course-Major Project-A, selected topic:</b>
	1.Review literature through reference papers from reputed conferences/ journals like IEEE, Elsevier, ACM etc. which are not more than 3 years old.
	2.Participate in multiple Project Competitions presenting the Project A solution
	3.Participation in International Conferences presenting the literature review and/or hypothesis for innovative solution.
	4.Participation at institute annual International Conference on Advances in Science and Technology-ICAST & other Conferences /Journals.

<b>Term Work Assessment:</b>
<b>Duration to be considered for assessment:</b>
Week Ends/ Semester Break/End of Semester (After ESE & Before Next Term Start )

<b>Guidelines:</b>	<ol style="list-style-type: none"> <li>1. Batch wise Faculty Supervisor who is the proctor (mentor) of the batch will be allotted as in-charge for the course, at start of the Academic year.</li> <li>2. Students will submit the participation certificate of the activities to the faculty mentors.</li> <li>3. Department IIC Cell coordinator will collect, maintain each student proofs/reports from all faculty mentors, department internship analysis report will be prepared &amp; submitted to Dean, IIC for AICTE-CII survey data</li> </ol>
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	4. Students will submit evaluation sheet by attaching Xerox copies of all participation/ IPR/ Copyright certificates & faculty mentor will verify it with original copies, for assessment purpose.
<b>TW Marks (25) &amp; Certificate :</b>	<b>Assessment &amp; evaluation based on rubrics:</b> Hours Spent for Internship: max 20 marks Achievement/Recognition: max 05 marks <b>&amp; Certificate Based on:</b> 1. Project Competition certificate, 2. Participation in Conferences/Publications and/or proof of ICAST participation & presentation.

<b>LY (Sem VIII)</b>			
<b>Internship Code</b>	<b>Internship Name</b>	<b>Hours/Duration</b>	<b>Credits</b>
<b>INT87</b>	<b>Internship-VII</b>	80-160 hrs (2-4 Weeks) <b>Winter Vacation of Sem VII and During SEM-VIII of LY</b>	<b>02</b>
<b>Prerequisite:</b>	<b>In depth knowledge about filling IPR/ copywriting a product/solution.</b>		
<b>Internship Objectives:</b>	1. To gain the knowledge of filling patent and Copy write. 2. Presenting technology solutions across worldwide problems through competitions and publications.		
<b>Internship Outcomes:</b>	<b>Upon completion of the course, students will be able to:</b> 1. National and international recognition through IPR and/or copy writes and paper publications. 2. Convert problem solution as a business plan for entrepreneurial product.		
<b>Activity- PBL Major Project B Work/Conference Presentation</b>	<b>Supporting Activities to be completed under Internship</b>		
	<b>For Sem VIII PBL Course-Major Project-B, selected topic:</b>		
	1. File for Project solution Copyright and/or File for Project topic IRP/Patent		
	2. Participate at Institute Annual Project Competition-INTECH		
	3. Publish the project solution at reputed International Journals, preference should be given to UGC care list and/or SCI indexed journals.		
<b>Term Work Assessment:</b>			
<b>Duration to be considered for assessment:</b>			
Week Ends and during Semester			
<b>Guidelines:</b>	1. Batch wise Faculty Supervisor who is the proctor (mentor) of the batch will be allotted as in-charge for the course, at start of the Academic year. 2. Students will submit the participation certificate of the activities to the faculty mentors. 3. Department IIC Cell coordinator will collect, maintain each student proofs/reports from all faculty mentors, department internship analysis report will be prepared & submitted to Dean, IIC for AICTE-CII survey data 4. Students will submit evaluation sheet by attaching Xerox copies of all participation/ IPR/ Copyright certificates & faculty mentor will verify it with original copies, for assessment purpose.		
<b>TW Marks (25) &amp; Certificate :</b>	<b>Assessment &amp; evaluation based on rubrics:</b> Hours Spent for Internship: max 20 marks Achievement/Recognition: max 05 marks <b>&amp; Certificate Based on :</b>		

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|--|--|
|  | <ol style="list-style-type: none"><li>1. Project Copyright/ Project IRP</li><li>2. Project Competition certificate (INTECH)</li><li>3. International Journal Publication proof</li></ol> |
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**Dr. S.K Ukarande**  
**Principal**