

B.Tech. in Computer Science and Engineering **with Specialization in Artificial Intelligence and Machine Learning**

Mission of the Department

Mission Stmt - 1	<i>To impart knowledge in cutting edge Computer Science and Engineering technologies in par with industrial standards.</i>
Mission Stmt - 2	<i>To collaborate with renowned academic institutions to uplift innovative research and development in Computer Science and Engineering and its allied fields to serve the needs of society</i>
Mission Stmt - 3	<i>To demonstrate strong communication skills and possess the ability to design computing systems individually as well as part of a multidisciplinary teams.</i>
Mission Stmt - 4	<i>To instill societal, safety, cultural, environmental, and ethical responsibilities in all professional activities</i>
Mission Stmt - 5	<i>To produce successful Computer Science and Engineering graduates with personal and professional responsibilities and commitment to lifelong learning</i>

Program Educational Objectives (PEO)

PEO - 1	<i>Graduates will be able to perform in technical/managerial roles ranging from design, development, problem solving to production support in software industries and R&D sectors.</i>
PEO - 2	<i>Graduates will be able to successfully pursue higher education in reputed institutions.</i>
PEO - 3	<i>Graduates will have the ability to adapt, contribute and innovate new technologies and systems in the key domains of Computer Science and Engineering.</i>
PEO - 4	<i>Graduates will be ethically and socially responsible solution providers and entrepreneurs in Computer Science and other engineering disciplines.</i>
PEO - 5	<i>Graduates will be able to explore recent technological developments related to Systems Engineering.</i>
PEO - 6	<i>Graduates will have the ability to explore research areas and produce outstanding contribution in various areas of Systems Engineering.</i>

Mission of the Department to Program Educational Objectives (PEO) Mapping

	Mission Stmt. - 1	Mission Stmt. - 2	Mission Stmt. - 3	Mission Stmt. - 4	Mission Stmt. - 5
PEO - 1	H	H	H	H	H
PEO - 2	L	H	H	H	H
PEO - 3	H	H	M	L	H
PEO - 4	M	H	M	H	H
PEO - 5	H	H	M	M	H
PEO - 6	M	H	H	H	H

H – High Correlation, M – Medium Correlation, L – Low Correlation

Mapping Program Educational Objectives (PEO) to Program Learning Outcomes (PLO)

	Program Learning Outcomes (PLO)														
	Graduate Attributes (GA)												Program Specific Outcomes (PSO)		
	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
PEO - 1	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
PEO - 2	H	H	H	H	H	L	L	H	L	H	L	H	H	H	H
PEO - 3	H	H	H	H	H	L	L	L	L	L	H	H	H	H	H
PEO - 4	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
PEO - 5	H	L	L	H	H	L	L	L	L	L	H	H	H	H	H
PEO - 6	L	H	H	H	H	H	H	L	L	L	L	L	H	H	L

H – High Correlation, M – Medium Correlation, L – Low Correlation

PSO – Program Specific Outcomes (PSO)

PSO - 1	<i>Ability to Utilize Artificial intelligence and Machine Learning Principles</i>
PSO - 2	<i>Create Machine Intelligence Algorithms</i>
PSO - 3	<i>Ability to Develop systems</i>

Program Structure: B.Tech. in Computer Science and Engineering with Specialization in Artificial Intelligence and Machine Learning

1. Humanities & Social Sciences including Management Courses (H)						
Course Code	Course Title	Hours/ Week			C	
		L	T	P		
18LEH101J	English	2	0	2	3	
18LEH102J	Chinese					
18LEH103J	French					
18LEH104J	German	2	0	2	3	
18LEH105J	Japanese					
18LEH106J	Korean					
18PDH101T	General Aptitude	0	0	2	1	
18PDH102T	Management Principles for Engineers	2	0	0	2	
18PDH103T	Social Engineering	2	0	0	2	
18PDH201T	Employability Skills & Practices	0	0	2	1	
Total Learning Credits					12	

3. Engineering Science Courses (S)						
Course Code	Course Title	Hours/ Week			C	
		L	T	P		
18MES101L	Engineering Graphics and Design	1	0	4	3	
18EES101J	Basic Electrical and Electronics Engineering	3	1	2	5	
18MES103L	Civil and Mechanical Engineering Workshop	1	0	4	3	
18CSS101J	Programming for Problem Solving	3	0	4	5	
18CSS201J	Analog and Digital Electronics	3	0	2	4	
18CSS202J	Computer Communications	2	0	2	3	
Total Learning Credits					23	

5. Professional Elective Courses (E) (Any 6 Elective Courses)						
Course Code	Course Title	Hours/ Week			C	
		L	T	P		
18CSE387T	Genetic algorithm and its Applications	3	0	0	3	
18CSE388T	Artificial Neural networks	3	0	0	3	
18CSE389T	Fuzzy Logic and its Applications	3	0	0	3	
18CSE390T	Computer Vision	3	0	0	3	
18CSE353T	Digital Image Processing	3	0	0	3	
18CSE359T	Natural Language Processing	3	0	0	3	
18CSE479T	Statistical Machine Learning	3	0	0	3	
18CSE480T	Nature Inspired Computing Techniques	3	0	0	3	
18CSE481T	Applied Machine Learning	3	0	0	3	
18CSE482T	Computational Neuroscience	3	0	0	3	
18CSE483T	Intelligent Machining	3	0	0	3	
18CSE484T	Deep Learning	3	0	0	3	
18CSE485T	Robotics: Computational Motion Planning	3	0	0	3	
18CSE486T	Advanced Algorithms	3	0	0	3	
Total Learning Credits					18	

8. Mandatory Courses (M)						
Code	Course Title	L	T	P	C	
18PDM101L	Professional Skills and Practices	0	0	2	0	
18PDM201L	Competencies in Social Skills	0	0	2	0	
18PDM203L	Entrepreneurial Skill Development					

2. Basic Science Courses (B)						
Course Code	Course Title	Hours/ Week			C	
		L	T	P		
18PYB103J	Physics: Semiconductor Physics	3	1	2	5	
18CYB101J	Chemistry	3	1	2	5	
18MAB101T	Calculus and Linear Algebra	3	1	0	4	
18MAB102T	Advanced Calculus and Complex Analysis	3	1	0	4	
18MAB201T	Transforms and Boundary Value Problems	3	1	0	4	
18MAB204T	Probability and Queueing Theory	3	1	0	4	
18MAB302T	Discrete Mathematics for Engineers	3	1	0	4	
18BTB101T	Biology	2	0	0	2	
Total Learning Credits					32	

4. Professional Core Courses (C)						
Course Code	Course Title	Hours/ Week			C	
		L	T	P		
18CSC201J	Data Structures and Algorithms	3	0	2	4	
18CSC202J	Object Oriented Design and Programming	3	0	2	4	
18CSC203J	Computer Organization and Architecture	3	0	2	4	
18CSC204J	Design and Analysis of Algorithms	3	0	2	4	
18CSC205J	Operating Systems	3	0	2	4	
18CSC206J	Software Engineering and Project Management	3	0	2	4	
18CSC207J	Advanced Programming Practice	3	0	2	4	
18CSC301T	Formal Language and Automata	3	0	0	3	
18CSC302J	Computer Networks	3	0	2	4	
18CSC303J	Database Management Systems	3	0	2	4	
18CSC304J	Compiler Design	3	0	2	4	
18CSC305J	Artificial Intelligence	3	0	2	4	
18CSC350T	Comprehension	0	1	0	1	
Total Learning Credits					48	

6. Open Elective Courses (O)						
Course Code	Course Title	Hours/ Week			C	
		L	T	P		
18CSO101T	IT Infrastructure Management	3	0	0	3	
18CSO102T	Mobile Application Development	3	0	0	3	
18CSO103T	System Modeling and Simulation	3	0	0	3	
18CSO104T	Free and Open Source Softwares	3	0	0	3	
18CSO105T	Android Development	3	0	0	3	
18CSO106T	Data Analysis using Open Source Tool	3	0	0	3	
18CSO107T	IOS Development	3	0	0	3	
Total Learning Credits					12	

7. Project Work, Seminar, Internship In Industry/ Higher Technical Institutions (P)						
Course Code	Course Title	Hours/ Week			C	
		L	T	P		
18CSP101L	MOOC / Industrial Training / Seminar - 1	0	0	2	1	
18CSP102L	MOOC / Industrial Training / Seminar - 2	0	0	2	1	
18CSP103L	Project (Phase-I) / Internship (4-6 weeks)	0	0	6	3	
18CSP104L	Project (Phase-II) / Semester Internship	0	0	20	10	
Total Learning Credits					15	

18PDM202L	Critical and Creative Thinking Skills	0	0	2	0
18PDM204L	Business Basics for Entrepreneurs	0	0	2	0
18PDM301L	Analytical and Logical Thinking Skills				
19PDM302L	Entrepreneurship Management				
18LEM101T	Constitution of India	1	0	0	0
18LEM102J	Value Education	1	0	1	0
18GNM101L	Physical and Mental Health using Yoga	0	0	2	0

8. Mandatory Courses (M)						
Course Code	Course Title	Hours/ Week				
		L	T	P	C	
18GNM102L	NSS	0	0	2	0	
18GNM103L	NCC					
18GNM104L	NSO					
18LEM109T	Indian Traditional Knowledge	1	0	0	0	
18LEM110L	Indian Art Form	0	0	2	0	
18CYM101T	Environmental Science	1	0	0	0	

Program Articulation: B.Tech. in Computer Science and Engineering with Specialization in Artificial Intelligence and Machine Learning

Course Code	Course Name	Program Learning Outcomes (PLO)												
		Graduate Attributes										PSO		
		Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	
18CSS101J	Programming for Problem Solving	H	H	M	M	H	L	L	M	H	M	L	H	H
18CSC201J	Data Structures and Algorithms	H	H	H	H	M	L	L	M	H	M	M	H	H
18CSC202J	Object Oriented Design and Programming	H	H	H	H	H	M	L	M	H	H	M	H	H
18CSC203J	Computer Organization and Architecture	H	M	H	M	L	L	L	M	L	L	L	M	M
18CSC204J	Design and Analysis of Algorithms	H	H	H	M	M	L	M	M	M	M	M	H	H
18CSC205J	Operating Systems	H	H	H	H	H	M	L	M	H	M	M	H	M
18CSC206J	Software Engineering and Project Management	H	H	H	H	H	H	H	H	H	H	H	L	M
18CSC207J	Advanced Programming Practice	H	H	M	M	H	L	L	M	H	M	L	H	H
18CSC301T	Formal Language and Automata	H	H	H	H	L	L	L	M	M	L	H	H	H
18CSC302J	Computer Networks	H	H	H	H	H	M	L	M	H	M	M	H	M
18CSC303J	Database Management Systems	H	H	H	H	H	M	L	M	H	M	M	H	M
18CSC304J	Compiler Design	H	H	H	H	M	L	L	L	M	M	L	H	H
18CSC305J	Artificial Intelligence	H	H	H	M	M	L	L	M	M	L	H	H	H
18CSE387T	Genetic Algorithm and its Applications	H	H	H	H	H	M	L	M	H	M	L	H	H
18CSE388T	Artificial Neural networks	H	H	H	M	H	M	L	M	H	M	L	H	H
18CSE389T	Fuzzy Logic and its Applications	H	H	H	H	H	M	L	M	H	M	L	H	H
18CSE390T	Computer Vision	H	H	H	M	M	L	M	H	M	M	M	L	H
18CSE353T	Digital Image Processing	H	H	H	M	H	M	L	M	H	M	M	H	H
18CSE359T	Natural Language Processing	H	H	H	H	H	H	L	M	H	M	M	H	H
18CSE479T	Statistical Machine Learning	H	H	H	H	M	M	L	M	H	M	L	H	H
18CSE480T	Nature Inspired Computing Techniques	H	H	H	H	M	M	M	H	H	M	M	H	H
18CSE481T	Applied Machine Learning	H	H	H	H	M	L	M	H	M	L	H	M	H
18CSE482T	Computational Neuroscience	H	H	H	H	H	M	L	M	H	M	M	H	H
18CSE483T	Intelligent Machining	H	H	H	H	H	M	L	M	H	H	M	H	H
18CSE484T	Deep Learning	H	H	H	H	H	M	L	M	H	M	L	H	H
18CSE485T	Robotics: Computational Motion Planning	H	H	H	H	M	M	M	H	H	M	M	H	H
18CSE486T	Advanced Algorithms	H	H	H	H	M	L	L	M	H	M	M	H	H
18CSP101L	MOOC / Industrial Training / Seminar - 1	H	M	M	M	M	M	M	M	H	H	H	M	H
18CSP102L	MOOC / Industrial Training / Seminar - 2	H	M	M	M	M	M	M	M	H	H	H	M	H
18CSP103L	Project (Phase-I) / Internship (4-6 weeks)	H	H	H	H	H	M	M	H	H	H	H	H	M
18CSP104L	Project (Phase-II) / Semester Internship	H	H	H	H	H	M	M	H	H	H	H	H	M
	Program Average	H	H	M	H	M	L	M	L	M	M	M	H	M

Implementation Plan: B.Tech. in Computer Science and Engineering with Specialization in Artificial Intelligence and Machine Learning

Semester - I					
Code	Course Title	Hours/ Week			C
		L	T	P	
18LEH101J	English	2	0	2	3
18MAB101T	Calculus and Linear Algebra	3	1	0	4
18PYB103J	Physics: Semiconductor Physics	3	1	2	5
18MES101L	Engineering Graphics and Design	1	0	4	3
18EES101J	Basic Electrical and Electronics Engineering	3	1	2	5
18PDM101L	Professional Skills and Practices	0	0	2	0
18LEM101T	Constitution of India	1	0	0	0
18GNM101L	Physical and Mental Health using Yoga	0	0	2	0
Total Learning Credits					20

Semester - II					
Code	Course Title	Hours/ Week			C
		L	T	P	
18LEH10XJ	Chinese / French / German / Japanese/ Korean	2	0	2	3
18MAB102T	Advanced Calculus and Complex Analysis	3	1	0	4
18CYB101J	Chemistry	3	1	2	5
18CSS101J	Programming for Problem Solving	3	0	4	5
18MES103L	Civil and Mechanical Engineering Workshop	1	0	4	3
18PDH101T	General Aptitude	0	0	2	1
18LEM102L	Value Education	1	0	1	0
18GNM10XL	NCC / NSS / NSO	0	0	2	0
Total Learning Credits					21

Semester - III					
Code	Course Title	Hours/ Week			C
		L	T	P	
18MAB201T	Transforms and Boundary Value Problems	3	1	0	4
18BTB101T	Biology	2	0	0	2
18CSS201J	Analog and Digital Electronics	3	0	2	4
18CSC201J	Data Structures and Algorithms	3	0	2	4
18CSC202J	Object Oriented Design and Programming	3	0	2	4
18CSC203J	Computer Organization and Architecture	3	0	2	4
18PDH102T	Management Principles for Engineers	2	0	0	2
18PDM201L	Competencies in Social Skills	0	0	2	0
18PDM203L	Entrepreneurial Skill Development	0	0	2	0
Total Learning Credits					24

Semester - IV					
Code	Course Title	Hours/ Week			C
		L	T	P	
18MAB204T	Probability and Queueing Theory	3	1	0	4
18CSS202J	Computer Communications	2	0	2	3
18CSC204J	Design and Analysis of Algorithms	3	0	2	4
18CSC205J	Operating Systems	3	0	2	4
18CSC206J	Software Engineering and Project Management	3	0	2	4
18CSC207J	Advanced Programming Practice	3	0	2	4
18PDH103T	Social Engineering	2	0	0	2
18PDM202L	Critical and Creative Thinking Skills	0	0	2	0
18PDM204L	Business Basics for Entrepreneurs	0	0	2	0
18CYM101T	Environmental Science	1	0	0	0
Total Learning Credits					25

Semester - V					
Code	Course Title	Hours/ Week			C
		L	T	P	
18MAB302T	Discrete Mathematics for Engineers	3	1	0	4
18CSC301T	Formal Language and Automata	3	0	0	3
18CSC302J	Computer Networks	3	0	2	4
	Professional Elective – 1	3	0	0	3
	Professional Elective – 2	3	0	0	3
	Open Elective – 1	3	0	0	3
	Open Elective – 2	3	0	0	3
18CSP101L	MOOC / Industrial Training / Seminar - 1	0	0	2	1
18PDM301L	Analytical and Logical Thinking Skills	0	0	2	0
19PDM302L	Entrepreneurship Management	1	0	0	0
18LEM109T	Indian Traditional Knowledge	1	0	0	0
Total Learning Credits					24

Semester - VI					
Code	Course Title	Hours/ Week			C
		L	T	P	
18CSC303J	Database Management Systems	3	0	2	4
18CSC304J	Compiler Design	3	0	2	4
18CSC305J	Artificial Intelligence	3	0	2	4
18CSC350T	Comprehension	0	1	0	1
	Professional Elective – 3	3	0	0	3
	Professional Elective – 4	3	0	0	3
	Open Elective – 3	3	0	0	3
18CSP102L	MOOC / Industrial Training / Seminar - 2	0	0	2	1
18PDH201T	Employability Skills and Practices	0	0	2	1
18LEM110L	Indian Art Form	0	0	2	0
Total Learning Credits					24

Semester - VII					
Code	Course Title	Hours/ Week			C
		L	T	P	
	Professional Elective – 5	3	0	0	3
	Professional Elective – 6	3	0	0	3
	Open Elective – 4	3	0	0	3
18CSP103L	Project (Phase-I) / Internship (4-6 weeks)	0	0	6	3
Total Learning Credits					12

Semester - VIII					
Code	Course Title	Hours/ Week			C
		L	T	P	
18CSP104L	Project (Phase-II) / Semester Internship	0	0	20	10
Total Learning Credits					10

BTECH (CSE)
SPECIALIZATION IN ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
SYLLABUS - SEMESTER I TO VIII

Course Code	18LEH101J	Course Name	ENGLISH	Course Category	H	Humanities and Social Sciences including Management	L	T	P	C
							2	0	2	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	English and Foreign Languages		Data Book / Codes/Standards	Nil	

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)
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CLR-1 :	Analyze the importance of communication in personal, professional contexts. Identify proper English pronunciation		1	2	3		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2 :	Strengthen vocabulary and grammar. Enhance listening and writing comprehension. Review films and documentaries		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)		Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLR-3 :	Writing brief paragraphs using appropriate techniques. Enhance their English fluency in speaking																				
CLR-4 :	Write effective essays, stories. Experience workplace communication aspects																				
CLR-5 :	Research on a topic and write a comprehensible academic project reports. Make effective presentations																				
CLR-6 :	Utilize English language skills along with technical skills in build wider career orientations																				
Course Learning Outcomes (CLO):		At the end of this course, learners will be able to:																			
CLO-1 :	Identify types, modes, channels and barriers of communication.distinguish different speech sounds, pronounce correctly	1	70	60		L	H	L	H	H	H	L	H	H	H	-	H	-	-	-	
CLO-2 :	Identify, rectify the errors in the use of grammar and vocabulary. Improve listening and writing skills	2	65	60		L	H	L	H	H	H	L	H	H	H	-	H	-	-	-	
CLO-3 :	Develop a topic idea into a cohesive paragraph with examples. Improve the fluency of speaking skills	3	75	70		L	H	L	H	H	M	L	H	H	H	-	H	-	-	-	
CLO-4 :	Develop ideas into logical and coherent essays. Understand better the workplace culture	3	75	65		L	H	L	H	H	H	L	H	H	H	-	H	-	-	-	
CLO-5 :	Identify the steps involved in writing an academic project report. List and practice skills need for making a presentation	3	75	65		L	H	L	H	H	H	L	H	H	H	-	H	-	-	-	
CLO-6 :	Build listening, speaking, reading, writing abilities in English, To interact with English speaking people.	3	70	65		L	L	L	H	H	H	L	H	H	H	-	H	-	-	-	

		Communication	Vocabulary and Grammar	Discourse Techniques	Workplace Communication	Project Writing
Duration (hour)		12	12	12	12	12
S-1	SLO-1	Definition, process of communication	Words with Foreign roots, Word formation – inflectional, derivational prefixes, suffixes	Sentence structure, Phrases and Clauses	Reading Comprehension, Guidelines questions (referential,critical,interpretative)	Topics for project writing
	SLO-2	Filling in-class worksheets	Quiz - Identifying the borrowed roots and their meanings-Worksheet exercise	Exercise:worksheet, Identifying phrases, clauses, compound, complex sentences	Practice Exercise	Discussion
S-2	SLO-1	Verbal and non-verbal communication	Synonyms and Antonyms and Standard abbreviations	Developing ideas into paragraphs – cohesion markers	Précis-writing Guidelines	Collection of Data – avoiding plagiarism-authenticity and credibility of data
	SLO-2	Individual and group activities - Role play	Context based activity / Learner compiling standard abbreviations from core subject	Identify topic sentence in a paragraph; writing a paragraph based on a topic	Practice Exercise	Collection of data for verification
S-3	SLO-1	LAB: Individual speech sounds	LAB: Listening to long conversations	LAB: Listening to short stories - Science fiction	LAB: Videos on workplace scenario Open Discussion on Workplace Etiquette	LAB: Importance of availing credible resources with examples
	SLO-2	Courseware on speech sounds (Listening and reproducing)	Identify communication contexts, use of making a word list in relation to the	Identify main idea of the given story and narrate a story on the given topic –	speaking language known to everyone, space, polite words, actions, objective	Collecting and compiling resource materials

	Total	100 %	100 %	100 %	100 %	100 %
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CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers					
Experts from Industry	Experts from Higher Technical Institutions			Internal Experts	
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2. Mr. Durga Prasad Bokka, TCS Chennai, durgaprasad@tcs.com	2. Ms. Subashree, VIT, Chennai, subashree@vit.ac.in			2. Ms. Cauveri B, SRMIST	4. Dr. M. M.Umamaheswari, SRMIST

Course Code	18LEH102J	Course Name	CHINESE			Course Category	H	Humanities and Social Sciences including Management				L	T	P	C
											2	0	2	3	
Pre-requisite Courses	Nil				Co-requisite Courses	Nil				Progressive Courses	Nil				
Course Offering Department		English and Foreign Languages			Data Book / Codes/Standards		Nil								

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)
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CLR-1 :	Pronounce Chinese Romanization, know about China and Chinese speaking countries, Read basic Chinese characters		1	2	3		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2 :	Help ask about the need, counting numbers, Greet each other, express time and date in daily conversations		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)		Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Modern Tool Usage	Society & Culture	Environment & Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3		
CLR-3 :	Ask about directions, learn basic conversation on orientation																				
CLR-4 :	Daily activities and asking about places and Chinese etiquette																				
CLR-5 :	List the Chinese festivals and Chinese culture, acquire basic conversational skills																				
CLR-6 :	Utilize Chinese language skills along with technical skills in build wider career orientations																				
Course Learning Outcomes (CLO):		At the end of this course, learners will be able to:																			
CLO-1 :	Pronounce Chinese language, Identify the basic Chinese scripts, tones and greetings		1	60	60		-	-	M	-	M	H	L	M	H	L	-	H	-	-	-
CLO-2 :	Identify basic grammar, count numbers, tell date and time, makeinterrogative sentences and basic conversations		2	65	62		-	-	H	-	H	M	L	M	H	M	-	H	-	-	-
CLO-3 :	Ask different kinds of questions, to tell age using Chinese words		2	68	63		-	-	M	-	M	L	L	M	L	M	-	H	-	-	-
CLO-4 :	Identify the different usage of Chinese grammar and vocabulary and introduce one self		2	69	65		-	-	H	-	H	H	L	M	H	H	-	H	-	-	-
CLO-5 :	Appropriately use different verbs and adjectives in basic conversations		2	72	63		-	-	H	-	H	H	L	M	M	H	-	H	-	-	-
CLO-6 :	Build listening, speaking, reading, writing abilities in Chinese, To interact with Chinese people and understand their culture		2	70	60		-	-	H	-	H	H	L	M	H	H	-	H	-	-	-

Duration (hour)		12	12	12	12	12
S-1	SLO-1	About china, Chinese speaking country, chinese language & culture.	Numbers in Chinese.	Introduction of few basic W/H words and framing basic interrogative sentences	Making of Affirmative negative question in Chinese	Introduction & application of few frequently used construction in Chinese.
	SLO-2	Introduction of initials, finals in Mandarin	Counting numbers and numeric system	Nationality	Conversation to make suggestion, accept of dealing suggestion, make comments.	Introduction & application of few frequentlyused construction in Chinese.
S-2	SLO-1	Tables of combination of initials and finals in Putonghua(Mandarin)	Chinese monetary system, Counting Chinese currency.	Direction in Chinese.	Sentence with nominal predicate, Subject verb construction as its predicate.	Famous Chinese festivals
	SLO-2	Basic greetings, Phrases used in daily life (in pinyin)	Converse to greet others, express needs	Making question with 几, 多少	Fruit related vocabulary, application.	Major Chinese cities
S-3	SLO-1	Tables of combination of initials and finals in Putonghua(Mandarin)	Asking your need	Introducing one's nationality	Asking question with ma , wh words, affermative -negative	Application and usage of construction
	SLO-2	Tables of combination of initials and finals in Putonghua(Mandarin)	Nominal measure word	Asking about nationality	Lianxi	Lianxi
S-4	SLO-1	Prononciation of Pinyin chart	Telling phone number in chinese	Asking price	Asking question with ma , wh words, affermative -negative	Application and usage of construction
	SLO-2	Prononciation of Pinyin chart	Converting numbers	Lianxi	Lianxi	Lianxi
S-5	SLO-1	Introduction of FourTones in Chinese language.	Time & time related greetings,	Politely and formally asking names ,Expressing apology.	MakingChinese sentences with verbal & Adjectival predicate.	Grammar related to 但是, 可是, 以前, 以后, 后来。

	SLO-2	Four Tones and related pronunciation.	Days&Seasons.	Introduction & Application of verbal Measure Word.	Introduction of 地	Introduction & Application of the basic optative verbs like 会, 能, 可以.
S-6	SLO-1	Tonesandhi (一, 不) in Chinese Tone discrimination in Chinese	Sentence patterns in Chinese, S-V-O sentences.Framing simple sentences.	Make sentences with在, and few corelated words like 这儿, 那儿 with example	Few basic verbs and adjectives.	conversation how todescribe likes ,dislikes, interest and hobbies
	SLO-2	Chinese characters. The eight strokes of characters, proper stroke orders.	Introduce 是 and 不是	Important locations used in daily life.	Opposite words.	Conduct conversation how todescribe likes, dislikes.,interest and hobbies
S-7	SLO-1	Pronounce word in proper tone	Vocabulary	Asking about places.	Usage of verbs	Usage of grammar
	SLO-2	Personal Pronouns and relations, Plural forms of pronouns	Asking date and time	lianxi	练习	lianxi
S-8	SLO-1	Writing characters with proper stroke order	Usage of time words in a sentence	Asking about directions.	Usage of adjectives with different adverbs	Asking about interest and hobbies
	SLO-2	Writing characters with proper stroke order	Introducing each other	lianxi	练习	lianxi
S-9	SLO-1	Sentence structure with the adjective 很and Framing sentences, negative of 很。	Weekdays in Chinese, Month, Year&Writing Date.	Profession relatedvocabulary, application withexamples.	Colour and vocabulary, application withexamples.	Conversation how to bergain and purchase products.
	SLO-2	Introduction of adverb 也, Interrogative particle呢, application & Usages.	Introduction of verb 有 and it'snegative form .Nominal measure word.	Basic conversation about persons occupation	describe family members and talk about university and department	conversation how to bergain and purchase products.
S-10	SLO-1	Possesive/ Structural Particle的, application of 的with pronouns.	Framing of basic Interrogative sentences with modal particle吗。	Introduction of interrogative phrase 多大, Tellingone'sage in Chinese.	Sports &Gamesrealatedvocabulary, special usages,	Use of conjugation 还是, 或者with example.
	SLO-2	Writing Chinese characters basic conversation related to greetings	Framing of basic interrogative sentences with modal particle吗。	Introduction of past tense and aspect particle了。	application withexamples.	
S-11	SLO-1	Writing greetings in characters with proper stroke order	Asking simple question	Asking age	Asking about likes and dislikes	Asking about purchasing products
	SLO-2	练习	Asking date	lianxi	Asking about likes and dislikes	Asking about purchasing products
S-12	SLO-1	Basic Expression	Birthday in Chinese	Asking about occupation	Asking about family members	Usage of conjugation
	SLO-2	练习	Grammar – has, have	lianxi	Asking about family members	Usage of conjugation

Learning Resources	1. Liu Xun, New Practical Chinese reader, Beijing Language and Culture University Press, 2008	2. Elementary Chinese Reader- 1, Sinolingua Beijing China, 2007
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Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers					
Experts from Industry	Experts from Higher Technical Institutions			Internal Experts	
1. Dr. Usha Kodandaraman, ABK AOTS, Chennai. drushak@gmail.com	1. Dr. S. P. Dhanavel, IIT Madras, dhanavelsp@iitm.ac.in			1.Ms. Poulomi Ghosal, SRMIST	
2. Mr. Paul Das, NEC, Chennai	2. Ms. Subashree, VIT, Chennai. subashree@vit.ac.in			2. Mr. Soumya Brata Halder, SRMIST	

Course Code	18LEH103J	Course Name	FRENCH	Course Category	H	Humanities and Social Sciences including Management	L	T	P	C
							2	0	2	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	English and Foreign Languages			Data Book / Codes/Standards	Nil

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)
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CLR-1 :	Get to know about France, its culture, heritage and countries speaking French. Build basic abilities to converse in French		1	2	3		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2 :	Identify and ask for information. Describe people with adjectives. Build conversational abilities		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)		Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Modern Tool Usage	Society & Culture	Environment & Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3		
CLR-3 :	Ask for and Provide directions, Identify French educational system, Draft a curriculum vitae																				
CLR-4 :	Tell Time and converse in time related situations, Identify French etiquette																				
CLR-5 :	Appreciate French cuisine and their food habits																				
CLR-6 :	Utilize French language skills along with technical skills in build wider career orientations																				
Course Learning Outcomes (CLO):		At the end of this course, learners will be able to:																			
CLO-1 :	Identify and pronounce French alphabets, Greet, Converse,Introduce, Read, identify basic French grammar		1	70	60		-	-	M	-	M	H	L	M	H	H	-	H	-	-	-
CLO-2 :	Identify French adjectives, verbs ending in"er" and frame simple sentences and make conversations		2	65	60		-	-	H	-	H	M	L	M	H	H	-	H	-	-	-
CLO-3 :	Orient someone by giving directions, Ask for directions, Express possession, conjugate verbs in "ir", Draft curriculum vitae		2	65	60		-	-	L	-	M	L	L	M	L	L	-	H	-	-	-
CLO-4 :	Express and use time, create a routine using reflexive verbs, conjugate a reflexive verb and regular verbs in "re"		3	75	65		-	-	H	-	H	H	L	M	H	H	-	H	-	-	-
CLO-5 :	Paragraph on French food habits and also their own using partitive articles. Alimentation is associated with partitive articles		3	75	65		-	-	H	-	H	H	L	M	M	H	-	H	-	-	-
CLO-6 :	Build listening, speaking, reading, writing abilities in French, To interact with French people and understand French culture		3	70	65		-	-	H	-	H	H	L	M	H	H	-	H	-	-	-

Duration (hour)	12	12	12	12	12
S-1	SLO-1	L'alphabet, Les accents	Les nombres 70 à 100	Les articles contractes (au...)	Les adjectifs démonstratifs
	SLO-2	Les salutations	Les nombres 101 à 1000	Les articles contractes (du...)	La famille
S-2	SLO-1	Les pronoms sujets, Les verbes: être, avoir, s'appeler, habiter	Le genre des noms	Les verbes : Vouloir, pouvoir, devoir	Les 2 groupes verbes
	SLO-2	Les articles indéfinis	le nombre des noms	Les verbes irréguliers	Les verbes : sortir, partir
S-3	SLO-1	L'expression	Comprendre une petite annonce	Faire une enquête	Proposer a qqn pour une sortie
	SLO-2	Les salutations	Rédiger une annonce simple	Ecrire une liste	Proposer a qqn de faire qqc
S-4	SLO-1	Se communiquer en classe	Chercher un logement	Les goûts des autres	Apprécier qqc
	SLO-2	Epeler, s'appeler	Décrire un logement	Les temps libres et les loisirs	Ne pas apprécier qqc
S-5	SLO-1	Les numéros 0 à 69	Le 1 e groupe verbe, les professions	Les adjectifs interrogatifs	Le 3e groupe verbes
	SLO-2	Les jours, les mois, les émotions	Les verbes venir et aller	Les mots interrogatifs	Les vêtements

S-6	SLO-1	Les pays, les couleurs	Le genre des adjectifs	Les verbes pronominaux(1)	Les adverbes de fréquence	Les articles partitifs
	SLO-2	Des portraits de pays francophones	les nombre des adjectifs	Les verbes pronominaux(1)	Les adverbes de temps	Les exp. De quantités
S-7	SLO-1	Présentez- vous	Les vocabulaires des objets	Parler de ses loisirs	Décrire une tenue	Accepter une invitation
	SLO-2	Présenter qqn	Décrire son voisin	Exprimer ses goûts	Décrire les accessoires	refuser une invitation
S-8	SLO-1	S'informer sur qqn	Décrire votre profession	Exprimer une préférence	Parler qqc	Donner son appréciation
	SLO-2	Demander des informations personnelles	La langue, activité recap.	Exprimer une envie, Activité quotidienne	justifier	S'exprimer a table
S-9	SLO-1	Les prépositions de lieu (1)	Les adjectifs possessifs (sing)	Le verbe aller	Le passe compose : avoir	Le pronom « en » de quantité
	SLO-2	Les verbes : parler, habiter	Les adjectifs possessifs (pl)	Le futur proche	Le passe compose : etre	Il faut
S-10	SLO-1	Les articles définis	Les prépositions de lieu(2)	L'heure	L'imparfait (1)	Les festivals du mot
	SLO-2	Les pronoms Personnelles	Les orientations	Les Temps	L'imparfait (2)	Les festivals en France
S-11	SLO-1	Demander poliment	Les pièces, l'équipement	Demander l'heure	Parler d'un film	Donner des instructions (il Faut)
	SLO-2	Répondre poliment	S'informer un logement	Dire l'heure	Féliciter un souhait	Cuisine d'une parisienne d'adoption
S-12	SLO-1	Les vocabulaires d'informatique	Ecrire un portrait	Raconter sa vie sur un blog	Adresser un souhait	Commander au restaurant
	SLO-2	S'inscrire sur un site	La description physique	Justifier	Ecrire une carte postale	Ecrire une recette

Learning Resources	1. SAISONS 1 – Didier - 2017	2. BIENVENUE – Course Book in French – Department of EFL, SRMIST- 2017
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Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers						
Experts from Industry		Experts from Higher Technical Institutions			Internal Experts	
1. Mr.D.Hemachandran, Renault Nissan, Senior Language Specialist		1. Dr. S. P. Dhanavel, IIT Madras, dhanavelsp@iitm.ac.in			1. Dr. K. Anbazhagan, SRMIST	2. Ms. K. Sankari, SRMIST
2. Mr. Durga Prasad Bokka, TCS Chennai, durgaprasad@tcs.com		2. Ms. Judy Niranjala, SIET college for Women, Chennai			3. Mr. J. Sabastian Satish, SRMIST	

Course Code	18LEH104J	Course Name	GERMAN	Course Category	H	Humanities and Social Sciences including Management				L	T	P	C
										2	0	2	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	English and Foreign Languages			Data Book / Codes/Standards	Nil

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)
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CLR-1:	Get to know about Germany, its culture, heritage. Build basic abilities to converse in German		1	2	3		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2:	Identify and ask for information. Introduce oneself. Build conversational abilities																				
CLR-3:	Ask for and Provide directions in German, Identify German cities, buildings and everyday life like cuisine																				
CLR-4:	Develop the ability to read, understand and initiate a conversation																				
CLR-5:	Enable basic conversational skills to behave in a German speaking society, in restaurants and in public places																				
CLR-6:	Utilize German language skills along with technical skills in build wider career orientations																				
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)		Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design,	Modern Tool Usage	Society & Culture	Environment &	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLO-1:	Identify and pronounce German alphabets, Greet, Converse, Introduce, Read, identify basic German grammar		1	70	60		-	-	L	L	M	H	L	H	H	H	-	H	-	-	-
CLO-2:	Compose dialogue between strangers, ask simple information		2	65	55		-	-	M	L	M	H	L	H	H	H	-	H	-	-	-
CLO-3:	Orient someone by giving directions, by using Imperatives and different types of definite & indefinite articles		2	73	60		-	-	M	M	H	M	M	H	H	H	-	H	-	-	-
CLO-4:	Write a dialogue by using different verbs of Accusative articles		3	65	55		-	-	M	M	H	H	M	H	H	H	-	H	-	-	-
CLO-5:	Create conversations in social places like; restaurants, identify and order food varieties		3	65	55		-	-	M	M	H	H	L	H	H	H	-	H	-	-	-
CLO-6:	Build listening, speaking, reading, writing abilities in German, interact with Germans and understand their culture		3	75	65		-	-	H	H	H	H	H	H	H	H	-	H	-	-	-

Duration (hour)	12	12	12	12	12
S-1	SLO-1	Alphabets, Grüßen und Verabschieden.	Umbestimmt Artikel im Nominativ.	T, N, D verbenkonjugationen und Satzschreiben.	Die Uezeiten verstehen und nennen.
	SLO-2	Über Länder, Sprachensprechen in Deutschland, Wichtige Städte in Deutschland.	Zahlen bis 1000 und Wortschatz.	Ordinal Zahlen und Tagezeiten	Zeitangaben machen.
S-2	SLO-1	Zahlen bis 20, Sich und andere Vorstellen.	Plätze und Gebäude benennen, Fragen zu Orten stellen.	Über alles sprechen, Verschiedene Gerichte in Deutschland durch PPT.	Unregelmäßige verbenkonjugationen und Beispiele Satz.
	SLO-2	Telefonnummer und E-mail Adressen nennen.	Negation und Übersetzung.	Buchstabieren und Wortschatz.	"ieren" verben conjugation und Beispielsatz.
S-3	SLO-1	Alphabet Aussprache und hört die grüßen.	Hörübung: Die Telefonnummer.	Hörübung: Aussprache die Umlaute, ö, ü und Beispiele Sätze.	Hörübung: Dem Dialog zuhören und die Zeit schreiben.
	SLO-2	Verabschiedenen Wörtern.	Buchstabieren und Wortschatz.	Hören und buchstabieren.	Übungen.
S-4	SLO-1	Länder, Sprachen, Der Film: Über den Guten Tag und die Telefonnummer.	Der Film: Über die Sehenswürdigkeiten in Deutschland.	Dialog: Über das Essen und seine preispraktizieren.	Mit den Regelmäßigen und Unregelmäßigen verbenkonjugationen schreiben
	SLO-2	Übungen.	Sprechen über den wichtigen Städte in Deutschland.	Übungen.	"ieren" verben konjugationen.
S-5	SLO-1	Über Länder und Sprachensprechen.	Himmelsrichtungen und Verkehrsmittel nennen.	Einen Einkauf Planen und sprechen	Über die Familien sprechen und sich verabreden.

	SLO-2	Hören und buchstabieren.	Nachdem Wegfragen und einem Wegbeschreiben	Gespräche beim Einkauf führen.	Sich für eine verspätung entschuldigen.	Personal pronomen und beispiele Sätze.
S-6	SLO-1	Aussagesatz und personal pronomen in Nominativ und beispiele Sätze.	Texte mit internationalen wörtern verstehen.	Gespräche beim Essen führen.	Einen Termin telefonisch vereinbaren.	Im Restaurant bestellen und bezahlen, überein Ereignis sprechen,
	SLO-2	Über Arbeit, Berufe und Arbeitszeiten sprechen.	Artikel lernen.	W-Fragen Texte verstehen.	Schreiben Sie die Uhrzeiten.	Bestimmt Informationen in Texten finden.
S-7	SLO-1	Übersich und andersprechen.	Hörübung: Schreiben Sie die Zahlen.	Kurzer Dialog über das Einkaufen.	Üben: Wie man den Termin festlegt.	Schreiben eines Briefes über jede gegebene situation.
	SLO-2	Fragen und antworten.	Events im Hamburg.	Übungen: Verben konjugationen.	Hören und buchstabieren.	Übungen: Trennbare Verben konjugationen.
S-8	SLO-1	Sich und andere vorstellen.	Fragen Sie die Wegbeschreibung in dem sie die Bilder sehen.	Kurzer Dialog über das Essen.	Hörübung: Die Zeit durch hören des Dialogs schreiben.	Hörübung und Schreiben: Freizeitaktivitäten.
	SLO-2	W-Fragen.	Lesen und verstehen.	Hören: wie man bestellt.	Übungen.	Satzmithilfsverben.
S-9	SLO-1	Zahlen ab 20 nennen, über Jahreszeiten im Deutschland.	Imperativ mit Sie, Lesen und verstehen.	Wortschatz und Buchstabieren.	Umbestimmt Artikel im Akkusativ.	Untrennbare verben konjugationen. Beispiele Sätze.
	SLO-2	Wochentage und Monate.	Lange und Kurze Vokale.	Schreiben Sie die Sätze.	Zeitangaben mit am, um, von.... bis.	Beispiele Sätze.
S-10	SLO-1	Bestimmt Artikel in Nominativ.	Regelmäßige verben Konjugationen.	Positionen im Satz, Bestimmt Artikel im Akkusativ.	Erklärt die Grammatik Präpositionen im Akkusativ.	Präteritum von Hilfsverben und konjugationen.
	SLO-2	Verwendungen von Hilfsverben.	Satzschreiben.	Akkusativ Verben konjugationen.	Beispiele Sätze im Präpositionen .	Modal verben konjugationen und beispiele Sätze.
S-11	SLO-1	Ja oder Nein Fragen durch PPT.	Der Imperativsätze und auch die Regelmäßige verben	Essen im D-A-CH, Beruferund ums Essen.	Hören und sprechen: die Tagesablauf.	Übung für Modal verben wie, Aussagesatz, Satzfrage.
	SLO-2	Typische Hobbys.	Lernen Sie die Sätze durch PPT.	Hören Sie den dialog.	Schreiben: Die Tagesablauf.	W-Frage und Trennbare verben.
S-12	SLO-1	Der Film: Über den Termin.	Der Film: Die Autofahrt und das Verkehrsmittel.	Der Film: Frühstück bei den Bergs.	Pünktlichkeit in D-A-CH und Der Film: Nie hast du Zeit und Termine.	Der Film: Hast du Zeit? Im Restaurant und Überraschung.
	SLO-2	Über deine Familie.	Claudia Berg in der Arbeit.	Einkaufen planen.	Der Termin und die Verabredung.	Schreiben Sie die Sätze mit Hilfs verben.

Learning Resources	1. Netzwerk – Klett – Langenscheidt, München, 2015	2. Grundkurs Deutsch, Dept. of EFL, SRMIST
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Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers					
Experts from Industry	Experts from Higher Technical Institutions			Internal Experts	
1. Dr. Usha Kodandaraman, ABK AOTS, Chennai. drushak@gmail.com	1. Dr. S. P. Dhanavel, IIT Madras, dhanavelsp@iitm.ac.in			1. Dr. K. Anbazhagan, SRMIST	2. Dr. P. Tamilarasan, SRMIST
2. Mr. Vivek Raghunathan, Health care, vivek.raghunathan@waikatodhb.health.nz	2. Ms. Subashree, VIT, Chennai, subashree@vit.ac.in			3. Ms. Srilitha Srinivasan, SRMIST	

Course Code	18LEH105J	Course Name	JAPANESE	Course Category	H	Humanities and Social Sciences including Management	L	T	P	C
							2	0	2	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	English and Foreign Languages			Data Book / Codes/Standards	Nil

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)
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CLR-1:	Identify the basics of Japan language and the facts of Japan, Make useful expressions and basic conversations.	1	2	3		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2:	Identify someone and ask for information. Physical description of people with adjectives. Focus of basic conversation																			
CLR-3:	Ask and give directions, Use conversation on orientation. Identify the Japan educational system																			
CLR-4:	Create daily activities and tell time. Appreciate Japan etiquette. Conjugate a reflexive verb and 3 rd group of regular verbs																			
CLR-5:	Identify diverse food habits of the Japanese people.																			
CLR-6:	Utilize Japan language skills along with technical skills in build wider career orientations																			
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)		Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLO-1:	Identify, pronounce Japan alphabets, know about Japan, its culture. Greet each other and converse, Introduce oneself	1	70	60		M	L	L	L	M	H	M	H	H	M	L	H	-	-	-
CLO-2:	Describe with the help of Japan adjectives, identify first group verbs ending in e. Frame simple sentences	2	65	65		M	L	L	L	M	H	M	H	H	M	L	H	-	-	-
CLO-3:	Orient someone by giving directions, Express possession and conjugate 2 nd group verbs. Draft their own curriculum vitae	2	65	65		M	L	L	L	M	H	M	H	H	M	L	H	-	-	-
CLO-4:	Express time and use expressions of time in daily conversations, paragraph on daily routine with the help of reflexive verbs	3	75	65		M	L	L	L	M	H	M	H	H	M	L	H	-	-	-
CLO-5:	Create a paragraph on the food habits of the Japan people and also their own using particles.	3	75	65		M	L	L	L	M	H	M	H	H	M	L	H	-	-	-
CLO-6:	Build listening, speaking, reading, writing abilities in Japan, To interact with Japan people and understand Japan culture	3	75	65		M	L	L	L	M	H	M	H	H	M	L	H	-	-	-

Duration (hour)	12	12	12	12	12
S-1	SLO-1	Introduction to Japan	Hiragana Lesson 7 Ma and Ya series.	Lesson 5 – Particles.	Lesson 6 – renshuu and exercises
	SLO-2	Japanese language and culture	ma/ya series related words	Japanese sports.	Religious beliefs,.
S-2	SLO-1	Greetings	Lesson 3 – time - reading	Japanese martial arts.	Lesson 7 – reading and grammar
	SLO-2	Self Introduction	Lesson 3 grammar.Classroom expressions. Kara, made, ni, ne and o	De and to	Ongaku and manga
S-3	SLO-1	Hiragana Lesson 1 (vowels and related words)	Hiragana Lesson 8 Ra/Wa series	Kanji	Common expressions
	SLO-2	Lesson 1– reading.Self introduction	Ra/Wa series related words	iku, miru, yasumu and kau	Body parts (vocabulary).
S-4	SLO-1	Lesson 1 grammar (wa,ka,mo,no,desu/ja arimasen)	Lesson 3 – renshuu and exercises	Revision of complete Hiragana	Explanation of past tense of verbs.
	SLO-2	Days of the week	Family. Festivals of Japan.Omiyage	Revision of all Particles	Kanji – kuchi, ame, hairimasu, kirimasu, ji, han and fun
S-5	SLO-1	Hiragana Lesson 2	Hiragana Lesson 9	Assignment	Lesson 7 reading.
	SLO-2	ka and ga series and related words	Double consonants and related words	Assignment	Lesson 7 exercises

S-6	SLO-1	Lesson 1 – renshuu	Lesson 4 – reading, grammar and vocabulary	Surprise Test	Introduction to Adjectives	Lesson 10 – renshuu and exercises.
	SLO-2	Ojigi and exercises. Numbers and months	Directions. Kanji – person, man, woman, child, tree and book	Surprise Test	I-ending and na-ending adjectives Forms.	Kanji – ookii, chiisai, eki and chuui
S-7	SLO-1	Hiragana Lesson 3	Directions. Kono..., kochira..., yo.	Revision of Hiragana (3 charts),	Lesson 8 Reading	Kanji – daigaku, nen, nihon and nihongo
	SLO-2	sa and za series and related words	I & na-ending adjectives introduction	long vowels and double consonants	Lesson 8 grammar	Places of interest in Japan
S-8	SLO-1	Seasons.	Hiragana Lesson 10 (long vowels and related words).	Review of grammar	Explanation of –masen ka	Food and drink (vocabulary).
	SLO-2	Kore/kono – demonstrative pronouns	Lesson 4 – renshuu	Particles	Explanation of mashou	Transport
S-9	SLO-1	Hiragana Lessons 4 and 5	Hashi	Katakana – introduction	Lesson 8 – renshuu.	Review of particles
	SLO-2	ta/da and na/ha series and related words	Hiragana Lesson 11 (chart 3 and related words).	Katakana – rules	Value your time	Review of Kana and Kanji
S-10	SLO-1	Kore.../kono...-reading, grammar and vocabulary	Counters explanation	Review of lessons 1-5	Kanji - days of the week	Review of verbs and adjectives
	SLO-2	Ni and ga, arimasu/imasu, Dare/donata. Renshuu and Meishi	Kanji – days of the week	Grammar and vocabulary	Japanese food and	Japanese house and living style
S-11	SLO-1	Hiragana Lesson 6 (ba/pa series).	Hiragana – special words like wa, e and o and sentence reading	Katakana vocabulary	Lesson 9 reading	Japanese tea ceremony
	SLO-2	Lesson 2 – exercises. Introduction to time.	Lesson 5 – reading.	Kanji – ikimasu, mimasu, yasumimasu	Lesson 9 grammar	Japanese Religious beliefs.
S-12	SLO-1	Kanji numbers – 13. Time expressions	Lesson 5 Grammar.	Lesson 6 – reading and grammar	Stationery	Japanese Economy
	SLO-2	Colours and basic 5 kanjis (ue, shita, naka, yama and kawa)	Lesson 5 Vocabulary.	Visiting a Japanese home	Transport (vocabulary)	Calligraphy

Learning Resources	1. Minna no Nihon Go, 3A Corporation, Tokyo, Japan, 2002	2. A Basic Course in Japanese – Department of EFL, SRMIST, 2017
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Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers					
Experts from Industry	Experts from Higher Technical Institutions			Internal Experts	
1. Dr. Usha Kodandaraman, ABK AOTS, Chennai. drushak@gmail.com	1. Dr. S. P. Dhanavel, IIT Madras, dhanavelsp@iitm.ac.in			1. Ms. R. Padmajaa, SRMIST	
2. Mr. Paul Das, NEC, Chennai	2. Dr. K. Anbazhagan, SRMIST			2. Mr. B. Vijaya Kumar, SRMIST	

Course Code	18LEH106J	Course Name	KOREAN	Course Category	H	Humanities and Social Sciences including Management	L	T	P	C
							2	0	2	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	English and Foreign Languages		Data Book / Codes/Standards	Nil	

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)
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CLR-1 :	Know about Korea and its culture; to be able to read, write the Korean script, and to introduce oneself and other people		1	2	3		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2 :	Manage daily life living in Korea. Talking daily activities. Asking for and giving directions, describing the location		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)		Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Modern Tool Usage	Society & Culture	Environment & Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3		
CLR-3 :	Be able to shop by asking for the availability of things, and learning about the currency system																				
CLR-4 :	Tell time, to socialize: make appointments, talk about weekend plans/activities																				
CLR-5 :	Communicate about studying Korean and about future career or academic plans																				
CLR-6 :	Utilize Korean language skills along with technical skills in build wider career orientations																				
Course Learning Outcomes (CLO):		At the end of this course, learners will be able to:																			
CLO-1 :	Read, pronounce and write the Korean script, Introduce oneself and other people. Get to know about Korea and its culture		1	70	60		-	-	L	-	H	H	L	M	M	H	-	H	-	-	-
CLO-2 :	Manage daily life in Korea - ask for and give directions, describe locations, count, shop, and talk about daily activities		2	65	65		-	-	L	-	H	M	L	M	H	H	-	H	-	-	-
CLO-3 :	Talk about past activities (past tense), the weather and use the Korean currency		2	65	65		-	-	L	-	M	H	L	M	M	M	-	H	-	-	-
CLO-4 :	Tell time, to socialize: make appointments, talk about weekend plans/activities		3	75	65		-	-	L	-	H	H	L	M	H	H	-	H	-	-	-
CLO-5 :	Communicate about studying Korean and about future career or academic plans		3	75	65		-	-	L	-	H	M	L	M	H	H	-	H	-	-	-
CLO-6 :	Build listening, speaking, reading, writing abilities in Korean, To interact with Korean people and understand Korean culture		3	75	65		-	-	L	-	H	H	L	M	H	H	-	H	-	-	-

Duration (hour)	12	12	12	12	12
S-1	SLO-1 Introduction to Korea and Korean - SLO-2 한글소개, 한국소개	2. 일상생활daily life, new vocab (action, places)	listening & key sentences drilling reading/writing	dialogue1& dialogue2 practice	grammar point 1-그 래서 grammar point1-(으)르 거예요
S-2	SLO-1 single vowels (단모음) SLO-2	grammar point1-아요/ 어요&grammar point2-에가다	5. 쇼핑2 shopping2 new vocab (counter noun)	listening & key sentences drilling reading/writing	dialogue1& dialogue2 practice
S-3	SLO-1 이중모음과자음 double vowels & basic consonants SLO-2	dialogue1& dialogue2 practice	grammar point1-버 니다/ 습니다,- 버 니까/ 습니까&	8. 시간 time new vocab (time)	listening & reading
S-4	SLO-1 쌍자음과음절double consonants & syllables SLO-2	listening & reading/writing	teaching money	Teaching date & weeks	writing for weekend activities
S-5	SLO-1 받침과음절1 Batchim & syllables SLO-2	3. 위치/location new vocab(object /location)	dialogue1& dialogue2practice	grammar point1-에 grammar point2-시-분	11. 한국어 공부(studying Korean) new vocab(pronouns)
S-6	SLO-1 받침과음절2 Batchim & syllables SLO-2	grammar point1-이/가 grammar point2-에있다/없다	listening & key sentences drilling reading/writing	dialogue1& dialogue2practice	grammar point1- 나/저, 내/제 grammar point2-'ㄷ' irregular verbs
S-7	SLO-1 자모 연습. (practices vowels and consonants) SLO-2	dialogue1& dialogue2practice	6. 어제 일과yesterday's daily routine new vocab (action, places)	listening & key sentences drilling reading/writing	dialogue1& dialogue2 practice
S-8	SLO-1 듣기. 교실표현(listening & class terms)	listening & key sentences drilling	grammar point1-있어	9. 약속 appointment new vocab(location& plan	listening & key sentences drilling

	SLO-2		reading/writing	grammar point2- 여/서		reading/writing
S-9	SLO-1	1. 자기 소개 self-introduction, new vocab(nationality, occupation)	4. 쇼핑 shopping new vocab (items to shop)	dialogue1& dialogue2 practice	grammar point1- (으)르 까요	12. 계획(plan) -(으)르 거예요.
	SLO-2				grammar point2- 아요/어요	
S-10	SLO-1	grammar point1- 오/예/요/예요	shopping teaching numbers	listening & key sentences drilling	dialogue1& dialogue2 practice	grammar point1- pro nouns 이/그/저 + 것(things)
	SLO-2	grammar point2- 은/는		reading/writing		grammar point2- 'ㅡ' irregular verbs & dialogue2
S-11	SLO-1	dialogue1& dialogue2 practice	grammar point1- 을/를	7. 날씨 weather new vocab(season& weather)	listening & key sentences drilling	dialogue1& dialogue2 practice
	SLO-2		grammar point2- (으)세요		reading/writing	
S-12	SLO-1	listening & key sentences drilling	dialogue1& dialogue2 practice	grammar point1- 그리고	10. 주말 활동 (weekend activities) new vocab (places& weekend activities)	listening & key sentences drilling
	SLO-2	reading/writing		grammar point2- 안		reading/writing

Learning Resources	1. Sejong Korean 1, The National Institute of the Korean Language. Hawoo Publisher, 2013	
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Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#		Theory	Practice
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice		
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers					
Experts from Industry	Experts from Higher Technical Institutions			Internal Experts	
1. Dr. Usha Kodandaraman, ABK AOTS, Chennai. drushak@gmail.com	1. Dr. S. P. Dhanavel, IIT Madras, dhanavelsp@iitm.ac.in			1. Jang kyung A, SRMIST	
2. Mr. Paul Das, NEC, Chennai	2. Ms. Subashree, VIT, Chennai, subashree@vit.ac.in			2. Ms. Cho Seul Hee, SRMIST	

Course Code	18PDH101T	Course Name	GENERAL APTITUDE	Course Category	H	Humanities and Social Sciences including Management	L	T	P	C
							0	0	2	1

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Career Development Centre	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)
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CLR-1:	Recapitulate fundamental mathematical concepts and skills		1	2	3		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2:	Hone critical thinking skills by analyzing the arguments with explicit and implicit premises																				
CLR-3:	Sharpen logical reasoning through skillful conceptualization,																				
CLR-4:	Identification of relationships between words based on their function, usage and characteristics																				
CLR-5:	nurture passion for enriching vocabulary																				
CLR-6:	Acquire the right knowledge, skill and aptitude to face any competitive examination																				
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)		Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Modern Tool Usage	Society & Culture	Environment & Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3		
CLO-1:	Build a strong base in the fundamental mathematical concepts		2	80	75		L	H	-	H	M	-	-	-	H	H	L	H	-	-	-
CLO-2:	Identify the approaches and strategies to solve problems with speed and accuracy		2	75	70		-	H	-	H	M	-	-	-	H	H	-	H	-	-	-
CLO-3:	Gain appropriate skills to succeed in preliminary selection process for recruitment		2	80	75		-	H	-	H	M	-	-	-	H	H	L	H	-	-	-
CLO-4:	Collectively solve problems in teams and groups		3	75	70		L	H	-	H	M	-	-	-	H	H	-	H	-	-	-
CLO-5:	Build vocabulary through methodical approaches		3	85	80		-	H	-	H	M	-	-	-	H	H	L	H	-	-	-
CLO-6:	Enhance lexical skills through systematic application of concepts and careful analysis of style, syntax, semantics and logic		2	85	80		-	H	-	H	M	-	-	-	H	H	-	H	-	-	-

Duration (hour)		6	6	6	6	6
S-1	SLO-1	Types of numbers, Divisibility tests	Square root, Cube roots, Remainder	Percentage Introduction	Discount	Logarithms Intro
	SLO-2	Solving Problems	Solving Problems	Solving Problems	Solving Problems	Solving Problems
S-2	SLO-1	Introduction to Significance of Verbal Aptitude in Competitive Examinations	Contextual Vocabulary Exercise – Synonyms	Sentence Completion Basic Level Exercises – Single Blank	Reading Comprehension – Introduction	Grammar Rules – A comprehensive Introduction
	SLO-2	Solving Problems	Solving Problems	Solving Problems	Solving Problems	Solving Problems
S-3	SLO-1	LCM and GCD	Identities	Percentage Problems	Simple Interest	Logarithms Rules
	SLO-2	Solving Problems	Solving Problems	Solving Problems	Solving Problems	Solving Problems
S-4	SLO-1	Vocabulary enrichment techniques	Contextual Vocabulary Exercise - Synonyms	Sentence Completion Basic Level Exercises – Double Blank	Reading Comprehension – Summary & Main Idea	Sentence Completion - Grammar
	SLO-2	Solving Problems	Solving Problems	Solving Problems	Solving Problems	Solving Problems
S-5	SLO-1	Unit digit, Number of zeroes, Factorial notation	Fractions and Decimals, surds	Profit and Loss	Compound Interest, Installments	Linear Equations
	SLO-2	Solving Problems	Solving Problems	Solving Problems	Solving Problems	Solving Problems

S-6	SLO-1	Vocabulary enrichment Techniques	Contextual Vocabulary Exercise - Antonyms	Cloze Test	Reading Comprehension – Summary & Main Idea	Spotting Errors
	SLO-2	Solving Problems	Solving Problems	Solving Problems	Solving Problems	Solving Problems

Learning Resources	1. Nishit K. Sinha, <i>The Pearson Guide to Quantitative Aptitude and Data Interpretation for the CAT</i> 2. Dinesh Khattar- <i>The Pearson Guide to QUANTITATIVE APTITUDE for competitive examinations</i> 3. Charles Harrington Elstor, <i>Verbal Advantage: Ten Easy Steps to a Powerful Vocabulary</i> , Random House Reference, 2002 4. Merriam Webster's <i>Vocabulary Builder</i> , Merriam Webster Mass Market, 2010	5. Norman Lewis, <i>How to Read Better and Faster</i> , Goyal, 4 th Edition 6. Franklin GRE Word List, 3861 GRE Words, Franklin Vocab System, 2014 Wiley's GMAT Reading Comprehension Grail, Wiley, 2016 7. Manhattan Prep GRE : <i>Reading Comprehension and Essays</i> , 5th Edition 8. Martin Hewings, <i>Advanced Grammar in Use</i> . Cambridge University Press, 2013

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	-	40%	-	30%	-	30%	-	30%	-	30%
	Understand										
Level 2	Apply	-	40%	-	40%	-	40%	-	40%	-	40%
	Analyze										
Level 3	Evaluate	-	20%	-	30%	-	30%	-	30%	-	30%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers							
Experts from Industry		Experts from Higher Technical Institutions				Internal Experts	
1. Mr. Pratap Iyer, Study Abroad Mentors, pratap.iyer30@gmail.com		1. Mr Nishith Sinha, dueNorth India Academics LLP, nsinha.alexander@gmail.com				1. Dr. P. Madhusoodhanan, SRMIST	2. Dr. M. Snehalatha, SRMIST
2. Mr Ajay Zenner, Career Launcher, ajay.z@careerlauncher.com		2. Dr.Dinesh Khattar, Delhi University, dinesh.khattar31@gmail.com				3. Mr Jayapragash J, SRMIST	4. Mrs. Rukmani, SRMIST

Course Code	18PDH102T	Course Name	MANAGEMENT PRINCIPLES FOR ENGINEERS	Course Category	H	Humanities and Social Sciences including Management	L	T	P	C
							2	0	0	2

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Career Development Centre	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):		The purpose of learning this course is to:	Learning			Program Learning Outcomes (PLO)														
CLR-1 :	Acquire knowledge about the fundamental concepts of organization and management		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2 :	Make decision strategies, planning process, tools and techniques		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Modern Tool Usage	Society & Culture	Environment & Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3		
CLR-3 :	Inculcate the traits needed to be an effective leader and familiarize with the organizational structures and design																			
CLR-4 :	Gain valuable insights into strategic process, formulation and implementation																			
CLR-5 :	Utilize the intricacies involved in cultural and ethical issues of people																			
CLR-6 :	Utilize the dimensions of the planning-organizing-leading-controlling (P-O-L-C) framework																			
Course Learning Outcomes (CLO):		At the end of this course, learners will be able to:																		
CLO-1 :	Observe and evaluate the various influencing factors on the current practice of organization and management		3	80	75	-	H	-	-	L	-	H	H	M	-	M	-	-	-	-
CLO-2 :	Use the techniques and tools of planning and make prudent decisions		2	80	75	-	M	-	-	H	-	H	H	M	-	H	-	-	-	-
CLO-3 :	Identify how organizations adapt to uncertain environment, identify techniques managers use to influence and control the internal environment		2	80	75	-	L	-	-	M	-	H	H	H	-	M	-	-	-	-
CLO-4 :	Apply and execute management goals		2	80	75	-	L	-	-	M	-	H	M	H	-	M	-	-	-	-
CLO-5 :	Manage people and deal with cultural and ethical issues		3	80	75	-	H	-	-	H	-	H	H	H	-	H	-	-	-	-
CLO-6 :	Utilize the basic fundamentals of managing organizations and utilize optimal resources		3	80	75	-	H	-	-	M	-	M	M	H	-	M	-	-	-	-

Duration (hour)	6	6	6	6	6
S-1	SLO-1	Organization	Information technology and the new workplace	Organisational control	Strategic management
	SLO-2	The Individual and the Organization	Precautions Measures	Control in the Business Setting	Role of Strategy in Management
S-2	SLO-1	Management	Information and decision making	Motivation	Evaluating the Business Environment
	SLO-2	Primary Functions of Management	Styles of Decision Making	Importance of Employee Motivation	Common Frameworks for Situational Analysis
S-3	SLO-1	Role of management in organisation	The decision-making process	Leadership	Goals and Process
	SLO-2	Advantages of Managing People Well	Barriers to Individual Decision Making	Effective Leader	strategic competitiveness
S-4	SLO-1	Types of Managers	Planning	Organising	Different Strategies
	SLO-2	Role of managers	Planning and Mission	Purpose of Organization	Stages and Types of Strategy
S-5	SLO-1	management Thought	The planning process	organisational design	Strategy formulation
	SLO-2	Management Roles	The Planning Cycle	Common Organizational Structures	Bridging the Gaps
S-6	SLO-1	Environmental Factors	tools, techniques and processes	Factors Impacting Organizational Design	Strategy implementation

	SLO-2	<i>Internal and External Factors</i>	<i>Putting It Together: Planning and Mission</i>	<i>Contingencies</i>	<i>Overcoming Hindrances</i>	<i>Cultural Issues</i>
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Learning Resources	9. Schermerhorn, J.R., <i>Introduction to Management</i> , 13 th ed., Wiley, 2017 10. Harold Koontz, Heinz Weihrich, <i>Essentials of management: An International & Leadership Perspective</i> , 10 th ed., Tata McGraw -Hill Education, 2015	11. Stephen Robbins, Mary Coulter, <i>Fundamentals of Management</i> , 9 th ed., Pearson Education, 2016 12. Samuel C. Certo, Tervis Certo, <i>Modern management: concepts and skills</i> , 12 th ed., Pearson, 2012 13. Charles W. L. Hill, Steven Mcshane, <i>Principles of Management</i> McGraw Hill Education, 2017
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Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#		Theory	Practice
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice		
Level 1	Remember	40%	-	30%	-	30%	-	30%	-	30%	-
	Understand										
Level 2	Apply	40%	-	40%	-	40%	-	40%	-	40%	-
	Analyze										
Level 3	Evaluate	20%	-	30%	-	30%	-	30%	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers					
Experts from Industry	Experts from Higher Technical Institutions			Internal Experts	
1. Mr. Pratap Iyer, Study Abroad Mentors, Mumbai, pratap.iyer30@gmail.com	1. Dr. A.K. Sheik Manzoor, Anna University, sheikmanzoor@annauniv.edu			1. Mr. Mohamed Ibrahim. A. U., SRMIST	
2. Mr. Ajay Zenner, Career Launcher, ajay.z@careerlauncher.com	2. Dr. Devamainthan, University of Madras			2. Mr. Muthu Manivannan, SRMIST	

Course Code	18PDH103T	Course Name	SOCIAL ENGINEERING	Course Category	H	Humanities and Social Sciences including Management	L	T	P	C
							2	0	0	2

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Career Development Centre	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):		The purpose of learning this course is to:		Learning				Program Learning Outcomes (PLO)														
CLR-1 :	create personal awareness and responsibility			1	2	3		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2 :	learn about environment and approach towards social issues			Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)		Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Modern Tool Usage	Society & Culture	Environment & Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3		
CLR-3 :	train students on social competencies to become self reliant, resourceful and industrious																					
CLR-4 :	understand social entrepreneurship																					
CLR-5 :	develop a mindset to contribute to the society																					
CLR-6 :	apply knowledge, passion and skills in the pursuit of humanitarian goals																					
Course Learning Outcomes (CLO):		At the end of this course, learners will be able to:																				
CLO-1 :	identify and addresses needs of social responsibilities			2	80	75		-	-	-	-	M	M	H	H	H	-	-	-	-	-	-
CLO-2 :	resolve social problems			3	80	75		-	-	-	-	H	L	M	H	M	-	-	-	-	-	-
CLO-3 :	understand social responsibility competencies and CSR activities			2	80	75		-	-	-	-	M	L	L	H	H	-	-	-	-	-	-
CLO-4 :	build a business plan to meet social needs			3	80	75		-	-	-	-	M	L	H	H	M	-	-	-	-	-	-
CLO-5 :	gain real time experience through student social responsibility project and presentation			3	80	75		-	-	-	-	H	M	H	H	M	-	-	-	-	-	-
CLO-6 :	possess an in-depth knowledge of social engineering and effect a social change in the society			3	80	75		-	-	-	-	H	M	M	M	M	-	-	-	-	-	-

Duration (hour)	6	6	6	6	6
S-1	SLO-1	Introduction	Environment and society	Social responsibility competencies	Social entrepreneurship
	SLO-2	Importance of Social Engineering	Contribution towards environment	Social responsibility competencies	Social entrepreneurship
S-2	SLO-1	Personal awareness	Social issues	Social responsibility competencies- Profiles	Social Entrepreneur
	SLO-2	Types of responsibilities	Social issues	Social responsibility competencies- Facets	Types of Social Entrepreneurs
S-3	SLO-1	Social Change	Group discussion on social Issues	Contributing to community	Success stories of social entrepreneur
	SLO-2	Social Change	Group discussion on social Issues	Contributing to community	Impact of social entrepreneurs in society
S-4	SLO-1	Vision towards society	Group discussion on social Issues	Value diversity and Building relationships	Business Plan
	SLO-2	Mission towards society	Group discussion on social Issues	Value diversity and Building relationships	Business Plan
S-5	SLO-1	Individual social responsibility(ISR)	Social Marketing	Corporate social responsibility	Business Plan
	SLO-2	Individual social responsibility(ISR)	Social Marketing	Types of CSR	Business Plan
S-6	SLO-1	Case study	Non profitable organizations	Government Policies on CSR	Business Plan

	SLO-2	Case study	Types of NGO	Government Policies on CSR	Business Plan	Report Analysis
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Learning Resources	1. Joel Makeower, <i>Beyond The Bottom Line: Putting Social Responsibility to work for your Business and the World</i> , Oct, 1995 2. Simen Sinek, <i>Start with Why, How great leaders Inspire Everyone to Take Action</i> , Penguin UK, 2011 3. Adam Grant, <i>Give and Take: Why Helping others drives our success</i> , Orion Publishing Group, 2014 4. David Bornstien, <i>How to change the world</i> , Oxford University Press, 2007	5. Nicholls, Alex, ed., <i>Social Entrepreneurship – New Models of Sustainable Social Change</i> , Oxford University Press, 2008 6. Ronald R. Sims, <i>Ethics and Corporate Social Responsibility: Why Giants fall</i> , 2003 7. Robert A. Rohm, <i>Positive Personality Profiles</i> , Personality Insights, Inc, 2006
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Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40%	-	30%	-	30%	-	30%	-	30%	-
	Understand										
Level 2	Apply	40%	-	40%	-	40%	-	40%	-	40%	-
	Analyze										
Level 3	Evaluate	20%	-	30%	-	30%	-	30%	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers					
Experts from Industry	Experts from Higher Technical Institutions			Internal Experts	
1. Mr. Vijay Nair – Director, Education Matters, vijayn@edmat.org	1. Dr. A.K. Sheik Manzoor, Anna University, sheikmanzoor@annauniv.edu			Mrs. Kavitha Srisaran, SRMIST	
2. Mr. Ajay Zenner, Career Launcher, ajay.z@careerlauncher.com	2. Dr Vanitha. J., Loyola College, vanithaj@loyolacollege.edu			Mr. Priyanand P., SRMIST	

Course Code	18PYB103J	Course Name	PHYSICS: SEMICONDUCTOR PHYSICS	Course Category	B	Basic Sciences	L	T	P	C
							3	1	2	5

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Physics and Nanotechnology			Data Book / Codes/Standards	Nil

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)
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CLR-1 :	Introduce band gap and fermi level in semiconductors		1	2	3		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2 :	Explain the concept of carrier transport mechanism in p-n and metal semiconductor junction		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)		Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Modern Tool Usage	Society & Culture	Environment & Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3		
CLR-3 :	Provide an insight on semiconductor optical transitions and photovoltaic effect																				
CLR-4 :	Procure knowledge of electrical and optical measurements in semiconductor																				
CLR-5 :	Develop necessary skills for low dimensional semiconductor material processing and characterization																				
CLR-6 :	Utilize the concepts in physics for the understanding of engineering and technology																				
Course Learning Outcomes (CLO):		At the end of this course, learners will be able to:																			
CLO-1 :	Identify the energy band in solids and electron occupation probability		2	85	75		H	H	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-2 :	Analyze the working of optoelectronic devices		2	75	70		H	H	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-3 :	Apply the knowledge to the development of new and novel optoelectronic devices		2	80	75		H	-	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-4 :	Identify the working mechanism of electrical and optical measurements		2	75	70		H	H	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	Utilize the knowledge of the low dimensional semiconductor material fabrication and characterization.		2	80	70		H	-	H	-	-	-	-	-	-	-	-	-	-	-	-
CLO-6 :	Apply the concepts of semiconductor physics in real time applications		2	80	70		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Duration (hour)	18	18	18	18	18
S-1	SLO-1	Classical Free electron theory	Intrinsic semiconductor	Concept of optical transitions in bulk semiconductors	Concept of electrical measurements
	SLO-2	Quantum Free electron theory	Fermi level on carrier-concentration and temperature in Intrinsic semiconductor	optical absorption process	Two-point probe technique
S-2	SLO-1	Density of states	Extrinsic semiconductors	Concept of recombination process	Four-point probe technique-linear method
	SLO-2	Energy band in solids	Fermi level on carrier-concentration and temperature in extrinsic semiconductors	Optical recombination process	Four-point probe technique-Van der Pauw method
S-3	SLO-1	Kronig-Penney model	Explanation for carrier generation	Explanation for spontaneous emission	Significance of carrier density
	SLO-2	Kronig-Penney model	Explanation for recombination processes	Explanation for stimulated emission	Significance of resistivity and Hall mobility
S-4	SLO-1	Solving problems	Solving problem	Solving problem	Solving problem
	SLO-2	Solving problems	Solving problem	Solving problem	Solving problem
S-5-6	SLO-1	Basics of experimentation	Study of I-V characteristics of a light dependent resistor (LDR)	Characterization of pn junction diode (Forward Bias)	Determine Particle Size of Semiconductor Laser
	SLO-2	E-k diagram	Carrier transport - diffusion and drift current	Joint density of states in semiconductor	Hot-point probe measurement
S-7	SLO-2	Direct and Indirect band gap	Continuity equation	Density of states for photons	capacitance-voltage measurements
					Applications of CNT

S-8	SLO-1	Concept of phonons	p-n junction	Explanation of transition rates	Extraction of parameters in a diode	Fabrication technique-CVD
	SLO-2	Concept of Brillouin Zone	Biasing concept in p-n junction	Fermi's golden rule	I-V characteristics of a diode	Fabrication technique-PVD
S-9	SLO-1	Energy band structure of semiconductor-Brillouin zone	Metal-semiconductor junction -Ohmic contact	Concept of optical loss	Principle of Deep-level transient spectroscopy (DLTS)	Characterizations techniques for low dimensional systems
	SLO-2	Concept of effective mass	Metal-semiconductor junction - Schottky junction	Concept of optical gain	Instrumentation of DLTS	XRD-Powder method
S-10	SLO-1	Solving problems	Solving problem	Solving problem	Solving problem	Solving problem
	SLO-2	Solving problems	Solving problem	Solving problem	Solving problem	Solving problem
S 11-12	SLO-1	Determine Hall coefficient of Semiconductor material	Determine Band Gap of semiconductor-Four probe method	Repeat/Revision of experiments	Attenuation, propagation characteristic of optical fiber cable using laser source	Determine lattice parameters using powder XRD
	SLO-2					
S-13	SLO-1	Classification of electronic materials	Semiconductor materials of interest for optoelectronic devices	Basic concepts of Photovoltaics	Significance of band gap in semiconductors	Principle of electron microscopy
	SLO-2	Fermi level	Photocurrent in a P-N junction diode	Photovoltaic effect	Concept of absorption and transmission	Scanning electron microscopy
S-14	SLO-1	Probability of occupation	Light emitting diode	Applications of Photovoltaic effect	Fundamental laws of absorption	Transmission electron microscopy
	SLO-2	Influence of donors in semiconductor	Classification of Light emitting diode	Determination of efficiency of a PV cell	Instrumentation of UV-Vis spectroscopy	Atomic force microscope
S-15	SLO-1	Influence of acceptors in semiconductor	Optoelectronic integrated circuits	Theory of Drude model	Determination of band gap by UV-Vis spectroscopy	Heterojunctions
	SLO-2	Non-equilibrium properties of carriers	Organic light emitting diodes	Determination of conductivity	Concept of Photoluminescence	Band diagrams of heterojunctions
S-16	SLO-1	Solving problems	Solving problem	Solving problem	Solving problem	Solving problem
	SLO-2	Solving problems	Solving problem	Solving problem	Solving problem	Solving problem
S 17-18	SLO-1	Determine Band Gap of semiconductor-Post Office Box method	Study of V-I and V-R characteristics of a solar cell	To verify Inverse square law of light using a photo cell.	Characteristic of p-n junction diode under reverse bias	Mini Project
	SLO-2					

Learning Resources	1. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc. 1995. 2. B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc., 2007.	3. S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley 2008. 4. A. Yariv and P. Yeh, Photonics: Optical Electronics in Modern Communications, Oxford University Press, New York 2007.
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Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#		Theory	Practice
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice		
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers					
Experts from Industry	Experts from Higher Technical Institutions			Internal Experts	
Dr. Vinay Gupta, National Physical Laboratory, guptavinay@nplindia.org	Prof. C.Vijayan, IITM, Chennai, cvijayan@iitm.ac.in			Dr.C. Preferential Kala, SRMIST	
	Prof.S.Balakumar, University of Madras, balakumar@unom.ac.in			Dr.M.Krishnamohan, SRMIST	

Course Code	18CYB101J	Course Name	CHEMISTRY	Course Category	B	Basic Sciences	L	T	P	C
							3	1	2	5

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Chemistry	Data Book / Codes/Standards	Periodic Table		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)
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CLR-1 :	Utilize the atomic and molecular manipulation towards the design of new materials		1	2	3		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2 :	Employ various spectroscopic techniques in identifying the structure and correlate it with their properties		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)		Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Modern Tool Usage	Society & Culture	Environment & Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3		
CLR-3 :	Exploit the periodic properties of elements for bulk property manipulation towards technological advancement																				
CLR-4 :	Address concepts related to electrochemistry, such as corrosion, using thermodynamic principles																				
CLR-5 :	Employ various organic reactions towards the design of fine chemical and drug molecules for industries																				
CLR-6 :	Utilize the basic chemistry principles applied in various engineering problems and identify appropriate solutions																				
Course Learning Outcomes (CLO):		At the end of this course, learners will be able to:																			
CLO-1 :	Analyze atomic, molecular orbitals of organic, inorganic molecules to identify structure, bonding, molecular energy levels	2	70	65		H	-	H	-	-	-	-	-	-	-	-	-	-	-	-	
CLO-2 :	Utilize the principles of spectroscopic technique in analysing the structure and properties of molecules	2	80	70		H	-	-	H	H	-	-	-	-	-	-	-	-	-	-	
CLO-3 :	Rationalize bulk properties using thermodynamic considerations and periodic properties of elements	2	75	60		-	H	-	-	-	-	-	-	-	-	-	-	-	-	-	
CLO-4 :	Utilize the concepts of thermodynamics in understanding thermodynamically driven chemical reactions	2	70	70		H	H	-	H	-	-	-	-	-	-	-	-	-	-	-	
CLO-5 :	Perceive the importance of stereochemistry in synthesizing organic molecules applied in pharmaceutical industries	2	80	70		-	H	H	-	-	-	-	-	-	-	-	-	-	-	-	
CLO-6 :	Utilize concepts in chemistry for technological advancement based on electronic, atomic and molecular level modification	2	75	65		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Duration (hour)	18	18	18	18	18
S-1	SLO-1	Schrodinger equation-introduction	Crystal field theory-Explanation	surface characterization techniques – XPS - Introduction	Hard soft acids and bases
	SLO-2	Schrodinger equation-Derivation	Crystal field theory-Explanation	surface characterization techniques – XPS - Explanation	Hard soft acids and bases
S-2	SLO-1	Particle in a box solutions	Energy level diagrams for transition metal ions	Diffraction and scattering of solids	Thermodynamic functions: energy
	SLO-2	Applications for conjugated molecules	Energy level diagrams for transition metal ions	Explanation	Entropy and free energy
S-3	SLO-1	Forms of the hydrogen atom wave functions	Magnetic properties of transition compounds	Ionic, dipolar interactions	Estimation of entropy
	SLO-2	plots of these functions to explore their spatial variations	Magnetic properties of transition compounds	Van der Waals interactions	Estimation of free energies.
S-4	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-5-6	SLO-1	Lab Introduction	Estimate of amount of chloride content in a water sample.	Determine strength of a mixture of acetic and hydrochloric acid by conductometry.	Determine adsorption of oxalic/acetic acid from aqueous soln. by activated charcoal
	SLO-2				
S-7	SLO-1	Molecular orbitals of diatomic molecules-Homonuclear	Principles of spectroscopy-Introduction	Equations of state of real gases	Free energy and emf. Cell potentials
	SLO-2	Heteronuclear diatomic molecules	Principles of spectroscopy-Explanation	critical phenomena	The Nernst equation and applications
S-8	SLO-1	Equations for atomic orbitals	Selection rules-Introduction	Effective nuclear charge, penetration of orbitals	Acid base, oxidation reduction

	SLO-2	Equations for molecular orbitals	selection rules-Explanation	variations of s, p, d and f orbital energies of atoms in the periodic table	Solubility equilibria	Examples
S-9	SLO-1	Energy level diagrams of diatomic-introduction	Electronic spectroscopy -Introduction	Electronic configurations, atomic and ionic sizes	Water chemistry	Cyclization
	SLO-2	Energy level diagrams of diatomic-explanation	Electronic spectroscopy-Explanation	Electronic configurations, atomic and ionic sizes	Water chemistry	Ring opening reactions
S-10	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S 11-12	SLO-1	Determine amount of sodium carbonate, sodium hydroxide in a mixture by titration	Determine strength of an acid using pH meter	Determine ferrous ion using potassium dichromate by potentiometric titration	Determine rate constant of Acid hydrolysis of an ester	Experiment - Repeat - 3
	SLO-2					
S-13	SLO-1	π -molecular orbitals of butadiene	Rotational spectroscopy of diatomic molecules	ionization energies, electron affinity and electronegativity	Corrosion	Synthesis of a commonly used drug molecule-Introduction
	SLO-2	π -molecular orbitals of benzene	Rotational spectroscopy of diatomic molecules	ionization energies, electron affinity and electronegativity	Corrosion	Synthesis of a commonly used drug molecule-Examples
S-14	SLO-1	Aromaticity-Introduction	Vibrational spectroscopy of diatomic molecules.	Polarizability, oxidation states	Representations of 3 dimensional structures	Synthesis of a commonly used drug molecule-Introduction
	SLO-2	Aromaticity-explanation	Applications of vibrational and rotational spectroscopy of diatomic molecule	Polarizability, oxidation states	structural isomers and stereoisomers	Synthesis of a commonly used drug molecule-Examples
S-15	SLO-1	Crystal field theory-Introduction	Nuclear magnetic resonance - Introduction	Coordination numbers and geometries	Configurations and symmetry and chirality	Question & Answer
	SLO-2	Crystal field theory-Introduction	Nuclear magnetic resonance - Explanation	Coordination numbers and geometries	enantiomers, diastereomers	Question & Answer
S-16	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S 17-18	SLO-1	Determine hardness (Ca^{2+}) of water using EDTA – complexometry method	Determine strength of an acid by conductometry	Determine molecular weight of a polymer by viscosity average method	Experiment - Repeat - 1	Demonstration Practical Session
	SLO-2					

Learning Resources	1. B. H. Mahan, R. J. Meyers, University Chemistry, 4 th ed., Pearson publishers, 2009.	4.B. L. Tembe, Kamaluddin, M. S. Krishnan, Engineering Chemistry (NPTEL Web-book) http://nptel.ac.in/downloads/122101001/
	2. M. J. Sienko, R. A. Plane, Chemistry: Principles and Applications, 3 rd ed., McGraw-Hill publishers, 1980	
	3. C. N. Banwell, Fundamentals of Molecular Spectroscopy, 5 th ed., McGraw-Hill publishers, 2013	5. Peter W. Atkins, Julio de Paula, James Keeler, Physical Chemistry, 11 th ed., Oxford publishers, 2018
		6. K. P. C. Vollhardt, N. E. Schore, Organic Chemistry: Structure and Function 7 th ed., Freeman, 2014

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#		Theory	Practice
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice		
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers								
Experts from Industry			Experts from Higher Technical Institutions			Internal Experts		
1. Dr. Sudarshan Mahapatra, Encube Ethicals Pvt. Ltd, sudarshan.m@encubeethicals.com			1. Prof. G. Sekar, IIT Madras, gsekar@iitm.ac.in			1. Prof. M. Arthanareeswari, SRMIST		
2. Dr. Shanmukhaprasad Gopi, Dr. Reddy's Laboratories, shanmukhaprasadg@drreddys.com			2. Prof. Vivek Polshettiwar, TIFR Mumbai, vivekpol@tifr.res.in			2. Dr. K. K. R. Datta, SRMIST		

Course Code	18MAB101T	Course Name	CALCULUS AND LINEAR ALGEBRA	Course Category	B	Basic Sciences	L	T	P	C
							3	1	0	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Mathematics	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)
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CLR-1 :	Application of Matrices in problems of Science and Engineering		1	2	3		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2 :	Utilize Taylor series, Maxima minima, composite function and Jacobian in solving real-time application problems																				
CLR-3 :	Apply the concept of Differential Equations in problems of Science and Engineering																				
CLR-4 :	Utilize the concepts of radius of curvature, evolute, envelope in problems of Science and Engineering																				
CLR-5 :	Application of Sequences and Series in all problems involving Science and Engineering																				
CLR-6 :	Utilize appropriate mathematical techniques for the different solutions required in Science and Engineering applications																				
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)		Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLO-1 :	Apply Matrices, Eigenvalues and Eigen Vectors Reduce to Quadratics form in Science and Engineering problem solving		2	80	80		H	-	H	-	-	-	-	-	H	-	-	H	-	-	-
CLO-2 :	Apply Maxima and Minima, Jacobian, and Taylor series to solve problems in Science and Engineering		2	85	80		H	-	-	H	H	-	-	-	-	-	-	-	-	-	-
CLO-3 :	Solve the different types of Differential Equations in Science and Engineering applications		2	85	80		-	H	-	-	-	-	-	H	-	-	H	-	-	-	-
CLO-4 :	Identify Radius, Centre, envelope and Circle of curvature and apply them in the problem solving		2	90	90		H	H	-	H	-	-	-	-	H	-	-	H	-	-	-
CLO-5 :	Apply convergence and divergence of series using different test and apply sequences and Series in the problem solving		2	90	80		-	H	H	-	-	-	-	-	H	-	-	H	-	-	-
CLO-6 :	Identify, Analyze and Apply mathematical techniques to arrive at solutions in Science and Engineering		2	90	90		H	-	H	-	-	-	-	-	H	-	-	H	-	-	-

Duration (hour)	12	12	12	12	12
S-1	SLO-1	Characteristic equation	Functions of two variables – Partial derivatives	Linear equations of second order with constant coefficients when $PI=0$ or exp.	Radius of Curvature – Cartesian coordinates
	SLO-2	Eigen values of a real matrix	Total differential	Linear equations of second order with constant coefficients when $PI=\sin x$ or $\cos x$	Radius of Curvature – Cartesian coordinates
S-2	SLO-1	Eigen vectors of a real matrix	Total differential	Linear equations of second order with constant coefficients when $PI=\text{polynomial}$	Radius of Curvature – Polar coordinates
	SLO-2	Eigen vectors of a real matrix	Taylor's expansion with two variables up to second order terms	Linear eqn. of second order with constant coefficients when $PI=\exp.$ with $\sin x / \cos x$	Radius of Curvature – Polar coordinates
S-3	SLO-1	Properties of Eigen values	Taylor's expansion with two variables up to third order terms	Linear eqn. of second order with constant coefficients when $PI=\exp.$ with polynomial	Circle of curvature
	SLO-2	Cayley – Hamilton theorem	Maxima and Minima	Linear eqn. of 2 nd order with const. coeff. when $PI=\text{polynomial}$ with $\sin x$ or $\cos x$	Circle of curvature
S-4	SLO-1	Problem solving using tutorial sheet 1	Problem solving using tutorial sheet 4	Problem solving using tutorial sheet 6	Problem solving using tutorial sheet 11
	SLO-2	Problem solving using tutorial sheet 1	Problem solving using tutorial sheet 4	Problem solving using tutorial sheet 6	Applications of Radius of curvature in engineering
S-5	SLO-1	Finding A inverse using Cayley – Hamilton theorem	Maxima and Minima	Linear equations of second order variable coefficients	Centre of curvature

	SLO-2	Finding higher powers of A using Cayley – Hamilton theorem	Maxima and Minima	Linear equations of second order variable coefficients	Centre of curvature	Raabe's root test.
S-6	SLO-1	orthogonal reduction of a symmetric matrix to diagonal form	Maxima and Minima	Homogeneous equation of Euler type	Centre of curvature	Covergent of Exponential Series
	SLO-2	orthogonal reduction of a symmetric matrix to diagonal form	Constrained Maxima and Minima by Lagrangian Multiplier method	Homogeneous equation of Legendre's Type	Evolute of a parabola	Cauchy's Root test
S-7	SLO-1	orthogonal reduction of a symmetric matrix to diagonal form	Constrained Maxima and Minima by Lagrangian Multiplier method	Homogeneous equation of Legendre's Type	Evolute of an ellipse	Log test
	SLO-2	orthogonal reduction of a symmetric matrix to diagonal form	Constrained Maxima and Minima by Lagrangian Multiplier method	Equations reducible to homogeneous form	Envelope of standard curves	Log test
S-8	SLO-1	Problem solving using tutorial sheet 2	Problem solving using tutorial sheet 5	Problem solving using tutorial sheet 9	Problem solving using tutorial sheet 12	Problem solving using tutorial sheet 15
	SLO-2	Problem solving using tutorial sheet 2	Problem solving using tutorial sheet 5	Problem solving using tutorial sheet 9	Applications of Curvature in engineering	Problem solving using tutorial sheet 15
S-9	SLO-1	Reduction of Quadratic form to canonical	Jacobians of two Variables	Equations reducible to homogeneous form	Beta Gamma Functions	Alternating Series: Leibnitz test
	SLO-2	Quadratic form to canonical form by orthogonal transformations	Jacobians of Three variables	Variation of parameters	Beta Gamma Functions and Their Properties	Alternating Series: Leibnitz test
S-10	SLO-1	Quadratic form to canonical form by orthogonal transformations	Jacobians problems	Variation of parameters	Sequences – Definition and Examples	Series of positive and Negative terms.
	SLO-2	Orthogonal matrices	Jacobians Problems	Simultaneous first order equations with constant co-efficient.	Series – Types of Convergence	Series of positive and Negative terms.
S-11	SLO-1	Reduction of quadratic form to canonical form	Properties of Jacobians and Problems	Simultaneous first order equations with constant co-efficient.	Series of Positive terms – Test of Convergence-	Absolute Convergence
	SLO-2	Reduction of quadratic form to canonical form	Properties of Jacobians and problems	Simultaneous first order equations with constant co-efficient.	Comparison test – Integral test-	Conditional Convergence
S-12	SLO-1	Problem solving using tutorial sheet 3	Application of Taylor's series Maxima Minima Jacobians in Engineering	Problem solving using tutorial sheet 10	Problem solving using tutorial sheet 13	Problem solving using tutorial sheet 13
	SLO-2	Applications of Matrices in Engineering	Application of Taylor's series Maxima Minima Jacobians in Engineering	Applications of Differential Equation in engineering	Problem solving using tutorial sheet 13	Applications Convergence of series in engineering

Learning Resources	1. B. H. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006. 2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010. 3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008	4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010 5. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002 6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008
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Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Understand										
Level 2	Apply	40 %	-	40 %	-	40 %	-	40 %	-	40%	-
	Analyze										
Level 3	Evaluate	20 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers					
Experts from Industry	Experts from Higher Technical Institutions			Internal Experts	
1. Mr.V.Maheshwaran, CTS, Chennai, maheshwaranv@yahoo.com	1. Dr.K.C.Sivakumar, IIT, Madras, kcskumar@iitm.ac.in			1. Dr. A. Govindarajan, SRMIST	
2. Dr. Sricharan Srinivasan, Wipro Technologies, sricharanms@gmail.com	2. Dr. Nanjundan, Bangalore University, nanzundan@gmail.com			2. Dr. Srinivasan, SRMIST	

Course Code	18MAB102T	Course Name	ADVANCED CALCULUS AND COMPLEX ANALYSIS	Course Category	B	Basic Sciences	L	T	P	C
							3	1	0	4

Pre-requisite Courses		Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Mathematics	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)
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CLR-1:	Evaluate Double and triple Integral and apply them in problems in Engineering Industries		1	2	3		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2:	Evaluate Surface, Volume Integral are Application of Gauss theorem, Stokes and Green's theorem in Engineering fields																				
CLR-3:	Transform engineering problems into ODE, PDE and Integrals and solve them using Laplace / complex analytic methods																				
CLR-4:	To know the properties of Complex functions and apply them in the all Engineering fields																				
CLR-5:	Evaluate improper integrals involving complex functions using Residue theorem and apply them in Engineering fields																				
CLR-6:	Identify how Engineering problems can be transformed in to simple mathematical constructs and solve the same																				
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																				
CLO-1:	Evaluate multiple integrals using change of variables		3	9	9		H	-	H	-	-	-	-	-	H	-	-	H	-	-	-
				5	0																
CLO-2:	Apply techniques of vector calculus in problems involving Science and Engineering. Solving Ordinary Differential Equations		3	9	8		H	-	-	H	H	-	-	-	-	-	-	-	-	-	-
				0	5																
CLO-3:	Apply techniques of Laplace Transforms and inverse transform for problems in Science and Engineering		2	8	8		-	H	-	-	-	-	-	-	H	-	-	H	-	-	-
				5	0																
CLO-4:	Apply complex analytic functions and its properties in solving problems		3	8	8		H	H	-	H	-	-	-	-	H	-	-	H	-	-	-
				0	0																
CLO-5:	Evaluate improper integrals using Residue theorem involving problems in Science and Engineering		2	8	9		-	H	H	-	-	-	-	-	H	-	-	H	-	-	-
				0	0																
CLO-6:	Create mathematical constructs for engineering problems and identify solutions to solve them		3	9	8		H		H	-	-	-	-	-	H	-	-	H	-	-	-
				0	0																

Duration (hour)	12	12	12	12	12
S-1	SLO-1	Evaluation of double integration Cartesian and plane polar coordinates	Review of vectors in 2,3 dimensions	Laplace Transforms of standard functions	Definition of Analytic Function – Cauchy Riemann equations
	SLO-2	Evaluation of double integration of plane polar coordinates	Gradient, divergence,	Transforms properties	Cauchy Riemann equations
S-2	SLO-1	Evaluation of double integration of plane polar coordinates	curl – Solenoidal	Transforms of Derivatives and Integrals	Properties of analytic function functions
	SLO-2	Evaluation of double integration of plane polar coordinates	Irrational fields	Transform of derivatives and integrals	Determination of analytic function using – Milne-Thomson's method
S-3	SLO-1	Evaluation of double integral by changing of order of integration	Vector identities (without proof) – Directional derivatives	Initial value theorems (without proof) and verification for some problems	Determination of analytic function using – Milne-Thomson's method
	SLO-2	Evaluation of double integral by changing of order of integration	Line integrals	Final value theorems (without proof) and verification for some problems	Determination of analytic function using – Milne-Thomson's method
S-4	SLO-1	Problem solving using tutorial sheet 1	Problem solving using tutorial sheet 4	Problem solving using tutorial sheet 7	Problem solving using tutorial sheet 10
	SLO-2	Problem solving using tutorial sheet 1	Problem solving using tutorial sheet 4	Problem solving using tutorial sheet 7	Problem solving using tutorial sheet 10
S-5	SLO-1	Evaluation of double integral by changing of order of integration	Line integrals	Inverse Laplace transforms using partial fractions	Conformal mappings: magnification
					Laurent's expansions with simple problems

	SLO-2	Area as a double integral (Cartesian)	Surface integrals	Inverse Laplace transforms using Partial fractions	Conformal mappings: rotation	Singularities
S-6	SLO-1	Area as a double integral (Cartesian)	Surface integrals	Inverse Laplace transforms using second shifting theorem	Conformal mappings: inversion	Types of Poles and Residues
	SLO-2	Area as a double integral (polar)	Volume Integrals	LT using Convolution theorem - problems only	Conformal mappings: inversion	Types of Poles and Residues
S-7	SLO-1	Area as a double integral (polar)	Green's theorem (without proof),	LT using Convolution theorem - problems only	Conformal mappings: reflection	Cauchy's residue theorem (without proof)-
	SLO-2	Triple integration in Cartesian coordinates	Green's theorem (without proof),	ILT using Convolution theorem - problems only	Conformal mappings: reflection	Contour integration: Unit circle.
S-8	SLO-1	Problem solving using tutorial sheet 2	Problem solving using tutorial sheet 5	Problem solving using tutorial sheet 8	Problem solving using tutorial sheet 11	Problem solving using tutorial sheet 14
	SLO-2	Problem solving using tutorial sheet 2	Problem solving using tutorial sheet 5	Problem solving using tutorial sheet 8	Problem solving using tutorial sheet 11	Problem solving using tutorial sheet 14
S-9	SLO-1	Conversion from Cartesian to polar in double integrals	Gauss divergence theorem (without proof), verification	LT of periodic functions - problems only	bilinear transformation	Contour integration: Unit circle.
	SLO-2	Conversion from Cartesian to polar in double integrals	Gauss divergence theorem (without proof) applications to cubes.	LT of periodic functions - problems only	bilinear transformation	Contour integration: Unit circle
S-10	SLO-1	Triple integration in Cartesian coordinates	Gauss divergence theorem (without proof) applications to parallelepiped.	Solve linear second order ordinary diff. equations with constant coefficient only	bilinear transformation	Contour integration: semicircular contour.
	SLO-2	Triple integration in Cartesian coordinates	Stoke's theorems (without proof) – Verification	Solve linear second order ordinary diff. equations with constant coefficient only	bilinear transformation	Contour integration: semicircular contour.
S-11	SLO-1	Triple integration in Cartesian coordinates	Stoke's theorems (without proof) – Applications to cubes	Solution of Integral equation and integral equation involving convolution type	Cauchy's integral theorem (without proof)	Contour integration: semicircular contour.
	SLO-2	Volume using triple Integral	Stoke's theorems (without proof) – Applications to parallelepiped only.	Solution of Integral equation and integral equation involving convolution type	Cauchy's integral theorem applications	Contour integration: semicircular contour.
S-12	SLO-1	Problem solving using tutorial sheet 3	Problem solving using tutorial sheet 6	Problem solving using tutorial sheet 9	Problem solving using tutorial sheet 12	Problem solving using tutorial sheet 15
	SLO-2	Application of Multiple integral in engineering	Application of Line and Volume Integrals in engineering	Application of Laplace Transform in engineering	Application of Bilinear Transformation and Cauchy Integral in engineering	Application Contour integration in engineering

Learning Resources	1. B. H. Erwin kreyszig, <i>Advanced Engineering Mathematics</i> , 9th Edition, John Wiley & Sons, 2006. 2. B. S. Grewal , <i>Higher Engineering Mathematics</i> , Khanna Publishers, 36th Edition, 2010. 3. Veerarajan T. , <i>Engineering Mathematics for first year</i> , Tata McGraw-Hill, New Delhi, 2008	4. Ramana B.V. , <i>Higher Engineering Mathematics</i> , Tata McGraw Hill New Delhi, 11 th Reprint, 2010 5. G.B. Thomas and R.L. Finney , <i>Calculus and Analytic geometry</i> , 9th Edition, Pearson, Reprint, 2002 6. N.P. Bali and Manish Goyal , <i>A text book of Engineering Mathematics</i> , Laxmi Publications, Reprint, 2008
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Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Understand										
Level 2	Apply	40 %	-	40 %	-	40 %	-	40 %	-	40%	-
	Analyze										
Level 3	Evaluate	20 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

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Experts from Industry	Experts from Higher Technical Institutions			Internal Experts	
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2. Dr. Sricharan Srinivasan, Wipro Technologies, sricharanms@gmail.com	2. Dr. Nanjundan, Bangalore University, nanzundan@gmail.com			2. Dr. Srinivasan, SRMIST	

Course Code	18MAB201T	Course Name	TRANSFORMS AND BOUNDARY VALUE PROBLEMS	Course Category	B	Basic Sciences	L	T	P	C
							3	1	0	4

Pre-requisite Courses	18MAB102T	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Mathematics	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):		The purpose of learning this course is to:	Learning			Program Learning Outcomes (PLO)														
			1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1:	Describe types of Partial differential equations interpret solutions relate PDE to the respective branches of engineering																			
CLR-2:	Relate Fourier series expansion in solving problems under RMS value and Harmonic Analysis.																			
CLR-3:	Infer the most general form to the PDE and relate to half range sine and cosine series, as the case may be																			
CLR-4:	Evaluate the various types of integral transforms																			
CLR-5:	Conclude that the purpose of studying z transform is to solve linear difference equations having constant coefficients																			
CLR-6:	Predicting the importance of PDE, Fourier series, Boundary value problems and Fourier ,Z – transform applications																			
Course Learning Outcomes (CLO):		At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLO-1:	Determine Partial differential equation		2	8	8	M	H	L	-	-	-	-	-	M	-	-	H	-	-	-
CLO-2:	Explain the expansion of a discontinuous function as an infinite form of trigonometric sine and cosine series.		2	8	8	M	H	-	M	M	-	-	-	M	L	-	H	-	-	-
CLO-3:	Decide a proper form of solution for the differential equations which are of hyperbolic and parabolic type		2	8	8	M	H	-	-	-	-	-	-	M	-	-	H	-	-	-
CLO-4:	justify the relationship between aperiodic signals and linear combination of exponentials.		2	8	8	M	H	-	M	-	-	-	-	M	L	-	H	-	-	-
CLO-5:	Relate signal analysis with that of z transform		2	8	8	M	H	L	-	-	-	-	-	M	-	-	H	-	-	-
CLO-6:	Relate PDE, Fourier series, Boundary value problems, Fourier and Z transforms		2	8	8	L	L	L	H	H	H	L	H	H	H	-	H	-	-	-

Duration (hour)		12	12	12	12	12
S-1	SLO-1	Formation of partial differential equation by eliminating arbitrary constants	Introduction of Fourier series - Dirichlet's conditions for existence of Fourier Series	Classification of second order partial differential equations	Introduction of Fourier Transforms	Introduction of Z-transform
	SLO-2	Formation of partial differential equation by eliminating two or more arbitrary constants	Fourier series –related problems in $(0, 2\pi)$	Method of separation of variables	Fourier Transforms- problems	Z-transform-elementary properties
S-2	SLO-1	Formation of partial differential equation by eliminating arbitrary functions	Fourier series –related problems in $(-\pi, \pi)$	One dimensional Wave Equation and its possible solutions	Properties of Fourier transforms	Z-transform- change of scale property, shifting property
	SLO-2	Formation of partial differential equation by eliminating two or more arbitrary functions	Change of interval Fourier series –related problems in $(0, 2l)$	One dimensional Wave Equation-initial displacement with zero initial velocity-type 1 Algebraic function	Standard results of Fourier transform	Z-transform of $a^n, \frac{1}{n}, \frac{1}{n+1}$
S-3	SLO-1	Formation of partial differential equation by eliminating arbitrary functions of the form $\phi(u, v) = 0$	Fourier series –related problems in $(-l, l)$	One dimensional Wave Equation-initial displacement with zero initial velocity-type 2 Trigonometric function	Fourier Sine Transforms - problems	Z-transform of $\frac{1}{n^2}, \frac{1}{(n+1)^2}$
	SLO-2	Solution of first order non-linear partial differential equations-standard type I $F(p, q)=0$	Fourier series –half range cosine series related problems $(0, \pi)$	One dimensional Wave Equation-initial displacement with zero initial velocity-type 3 – Midpoint of the string is displaced	Fourier Cosine Transforms - problems	Z-transform of $r^n \cos n\theta$
S-4	SLO-1	Problem solving using tutorial sheet 1	Problem solving using tutorial sheet 4	Problem solving using tutorial sheet 7	Problem solving using tutorial sheet 10	Problem solving using tutorial sheet 13
	SLO-2					

S-5	SLO-1	Solution of first order nonlinear partial differential equations-standard type –II Clairaut's form	Fourier series –half range cosine series related problems (0, l)	One dimensional Wave Equation-initial displacement with non-zero initial velocity Type 1 Algebraic function	Properties of Fourier sine Transforms	Z-transform of $r^n \sin n\theta$
	SLO-2	Solution of first order non-linear partial differential equations-standard type III $F(z, p, q)=0$	Fourier series –half range sine series related problems (0, π)	One dimensional Wave Equation-initial displacement with non-zero initial velocity Type 2 Trigonometric function	Fourier sine Transforms applications	Initial value theorem
S-6	SLO-1	Solution of first order non-linear partial differential equations-standard type-IV separation of variable $f(x, p) = g(y, q)$	Fourier series –half range sine series related problems (0, l)	Wave Equation-initial displacement with non-zero initial velocity Type 3 split function	Properties of Fourier cosine Transforms	Final value theorem
	SLO-2	Lagrange's linear equation: Method of grouping	Parseval's Theorem (without proof)-related problems in Fourier series	One dimensional heat equation and its possible solutions	Fourier cosine Transforms applications	Inverse Z-transform- long division method
S-7	SLO-1	Lagrange's linear equation: Method of multipliers	Parseval's Theorem (without proof)-related problems in cosine series	One dimensional heat equation related problems	Convolution of two function	Inverse Z-transform, related problems, long division method
	SLO-2	More problems in Lagrange's linear equation: Method of multipliers	Parseval's Theorem (without proof)-related problems in sine series	One dimensional heat equation -Steady state conditions	Convolution Theorem	Inverse Z-transform, Partial fraction method
S-8	SLO-1	Problem solving using tutorial sheet 2	Problem solving using tutorial sheet 5	Problem solving using tutorial sheet 8	Problem solving using tutorial sheet 11	Problem solving using tutorial sheet 14
	SLO-2					
S-9	SLO-1	Linear Homogeneous partial differential equations of second and higher order with constant coefficients-CF and PI Type 1: e^{ax+by}	Introduction to Harmonic Analysis	One dimensional heat equation -Steady state conditions more problems	Parseval's Identity for Fourier transform	Inverse Z-transform, Partial fraction method related problems
	SLO-2	PI Type 2: $\sin(ax+by)$ or $\cos(ax+by)$	Harmonic Analysis for finding harmonic in (0, 2π)	One dimensional heat equation -Steady state conditions with zero velocity	Parseval's Identity for Fourier sine & cosine transforms	Inverse Z-transform - residue theorem method
S-10	SLO-1	Type 3: PI of polynomial	Harmonic Analysis for finding harmonic in (0, $2l$)	One dimensional heat equation -Steady state conditions with zero velocity more problems	Parseval's Identity for Fourier sine & cosine transforms applications	Inverse Z-transform - residue theorem method-problems
	SLO-2	Type 4 Exponential shifting $e^{ax+by} f(x, y)$	Harmonic Analysis for finding harmonic in periodic interval (0, T)	One dimensional heat equation -Steady state conditions with zero velocity more related problems	Fourier Transforms Using Differentiation property	Convolution theorem (without proof)
S-11	SLO-1	Linear Homogeneous partial differential equations of second and higher order with constant coefficients type 5 General rule	Harmonic Analysis for finding cosine series	Steady state conditions and Non-zero boundary conditions- related problems	Solving integral equation	Convolution theorem applications
	SLO-2	Applications of Partial differential equations in Engineering	Harmonic Analysis for finding sine series	Steady state conditions and Non-zero boundary conditions- more problems	Self-reciprocal using Fourier Transform, sine and cosine transform	Solution of linear difference equations with constant coefficients using Z-transform
S-12	SLO-1	Problem solving using tutorial sheet 3	Problem solving using tutorial sheet 6	Problem solving using tutorial sheet 9	Problem solving using tutorial sheet 12	Problem solving using tutorial sheet 15
	SLO-2	Problem solving using tutorial sheet 3	Problem solving using tutorial sheet 6	Problem solving using tutorial sheet 9	Problem solving using tutorial sheet 12	Problem solving using tutorial sheet 15

Learning Resources	1. B. H. Erwin kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2006	4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 3rd Edition, 2010
	2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43rd Edition, 2015	6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, for third semester, Laxmi Publications, 3rd Edition, 2014
	3. Veerarajan T., Transforms and Partial Differential Equations, Tata McGraw-Hill, New Delhi, 2012	

Learning Assessment											
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		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#		Theory	Practice
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice		
Level 1	Remember	40 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Understand										
Level 2	Apply	40 %	-	40 %	-	40 %	-	40 %	-	40%	-
	Analyze										
Level 3	Evaluate	20 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

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Course Code	18MAB204T	Course Name	PROBABILITY AND QUEUEING THEORY	Course Category	B	Basic Sciences	L	T	P	C
							3	1	0	4

Pre-requisite Courses	18MAB102T	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Mathematics	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):		The purpose of learning this course is to:	Learning			Program Learning Outcomes (PLO)														
CLR-1 :	Apply and evaluating probability using random variables		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2 :	Gain the knowledge and acquire the application of distribution to find the probability using Theoretical distributions		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Modern Tool Usage	Society & Culture	Environment & Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3		
CLR-3 :	To Assess the appropriate model and apply and soling any realistic problem situation to determine the probability																			
CLR-4 :	To interpret the decision using Markov queueing applications																			
CLR-5 :	To construct chain of decisions from the past situations using Monroviens																			
CLR-6 :	Interpret random variables and Queueing theory in engineering problems.																			
Course Learning Outcomes (CLO):		At the end of this course, learners will be able to:																		
CLO-1 :	Solving problems on Discrete and Continuous Random variables		3	85	80	M	H	L	-	-	-	-	M	-	-	H	-	-	-	-
CLO-2 :	Identifying Distribution and solving the problems in Discrete and Continuous Distribution		3	85	80	M	H		M	M	-	-	M	L	-	H	-	-	-	-
CLO-3 :	Decision Models using sampling techniques in Large and Small samples		3	85	80	M	H	-	-	-	-	-	M	-	-	H	-	-	-	-
CLO-4 :	Solving Queueing problems using Kendall's notation		3	85	80	M	H	-	-	-	-	-	M	L	-	H	-	-	-	-
CLO-5 :	To Evaluate the probability in uncertain situations using Markov chain rule		3	85	80	M	H	L	M	-	-	-	M	-	-	H	-	-	-	-
CLO-6 :	Solving and analyzing the problems in random variables and Queueing theory.		3	85	80	M	H	-	-	-	-	-	M	-	-	H	-	-	-	-

Duration (hour)		12	12	12	12	12
S-1	SLO-1	Probability Basic concepts and Axioms	Discrete Probability distribution	Sampling distribution, Null Hypothesis, Alternate Hypothesis	Introduction to F-test	Markov Process and Introduction of a Markov Chain
	SLO-2	Conditional probability, Multiplication theorem	Introduction to Binomial distribution	One tailed test, two tailed test	Problems on F-test	Past and Future - Step and State
S-2	SLO-1	Discrete and continuous Random variables	MGF, Mean, Variance of Binomial distribution	Level of significance, Critical region	Chi square test -Goodness of fit	One step Transition Probability N step transition Probability
	SLO-2	Probability mass function, cdf	Applications of Binomial distribution	Large samples test	Problems on Chi square test -Goodness of fit	Chapman-kolmogorov theorem definition
S-3	SLO-1	Continuous Random variables	Fit a Binomial distribution.	Student - t test Single Proportion	Problems on Chi-square test Independent-Attributes	Initial Probability distribution problems Using Markov Chain
	SLO-2	pdf and cdf applications	Introduction to Poisson Distribution	Two Sample proportions	Problems on Chi-square test Independent-Attributes with standard distributions	Initial Probability distribution problems Using Markov Chain
S-4	SLO-1	Problem solving using tutorial sheet 1	Problem solving using tutorial sheet 4	Problem solving using tutorial sheet 7	Problem solving using tutorial sheet 10	Problem solving using tutorial sheet 13
	SLO-2					
S-5	SLO-1	Expectation and Variance	MGF, Mean, Variance of Poisson distribution	Large sample test- Single Mean	Introduction to Queueing Theory and Applications. Kendall, notation	Classification of States of a Markov Chain
	SLO-2	Problems on Expectation and Variance	Applications of Poisson Distribution	Difference of Means	Introduction to M/M/1 : infinity/ FIFO	Irreducible, Non irreducible, a period, Persistent, Non null Persistent
S-6	SLO-1	Moment Generating Function	Fit a Poisson Distribution	Problems on difference of Means	Ls, Lq, Ws, Wq	Problems on Classification of a Markov Chain
	SLO-2	Problems on MGF	Introduction, MGF Mean, Variance of Geometric distribution	Applications of Difference of Means	M/M/1 :infinity /FIFO problems	Problem on Classification of a Markov Chain

S-7	SLO-1	Functions of Random variables	Applications of Geometric Distribution, problems on Memory less property	Introduction to small samples	M/M/1 :Infinity /FIFO problems	Classification of states of a Markov Chain
	SLO-2	Problems on Functions of Random variable	Introduction , MGF, Mean, Variance of Uniform Distribution	Introduction to small Samples	M/M/1 :Infinity /FIFO problems	Stationary and steady state
S-8	SLO-1	Problem solving using tutorial sheet 2	Problem solving using tutorial sheet 5	Problem solving using tutorial sheet 8	Problem solving using tutorial sheet 11	Problem solving using tutorial sheet 14
S-9	SLO-1	Tchebycheffs inequality	Applications of Uniform Distribution problems	Problems on single mean -small samples	Single Server Model with Finite System Capacity, Characteristics of the Model (M/M/1) : (K/FIFO)	Problems on Classification-State-stationary using Markov Chain
	SLO-2	Introduction to theoretical distribution	Introduction , MGF, Mean, Variance of Exponential distribution	Problems on single mean -small samples	Effective arrival rate	Problems on Stationary and steady state
S-10	SLO-1	Formula and application of Tchebycheffs inequality	Applications of Exponential distribution problems	Problems on difference of mean-small samples	Problems on Model (M/M/1) : (K/FIFO)	Problems on Ergodicity using Markov Chain
	SLO-2	Applications of chebychevs inequality	Introduction to Normal distribution	Problems on difference of mean-small samples	Problems on Model (M/M/1) : (K/FIFO)	Problems on Ergodicity using Markov Chain
S-11	SLO-1	Applications of chebychevs inequality using distribution	Applications of Normal distribution problems	Applications of paired - t test	Problems on Model (M/M/1) : (K/FIFO)	Problems on Ergodicity
	SLO-2	Problems practice using chebychevs inequality	Practical applications of Normal distribution	Problems of paired - t test.	Problems on Model (M/M/1) : (K/FIFO)	Problems on Ergodic and Non Ergodic Using Markovchains
S-12	SLO-1	Problem solving using tutorial sheet 3	Problem solving using tutorial sheet 6	Problem solving using tutorial sheet 9	Problem solving using tutorial sheet 12	Problem solving using tutorial sheet 15
	SLO-2	Applications of random variables in engineering	Applications of distribution to find the probability using Theoretical distributions	Applications of solving any realistic problem situation to determine the probability	Applications of Queueing decision models	Applications of constructing chain of decisions from the past situations using Monrovians

Learning Resources	1. Veerarajan T, Probability , Statistics and Random Processes, Tata Mc.Graw Hill, 1st Reprint 2004	4. Trivedi K S, Probability and Statistics with reliability, Queueing and Computer Science Applications, prentice Hall of India, New Delhi, 1984
	2. S.C. Gupta, V.K.Kapoor, Fundamentals of Mathematical Statistics, 9 th ed.,, Sultan Chand & Sons, 1999	
	3. Gross. D and Harri.C.M. Fundamentals of Queueing theory, John Wiley and Sons, 1985	
		5. Allen .A.O . , Probability Statistics and Queueing theory, Academic Press

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#		Theory	Practice
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice		
Level 1	Remember	40 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Understand										
Level 2	Apply	40 %	-	40 %	-	40 %	-	40 %	-	40%	-
	Analyze										
Level 3	Evaluate	20 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers							
Experts from Industry				Experts from Higher Technical Institutions			
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				1. Dr. A. Govindarajan, SRMIST			
				2. Dr.V. Srinivasan, SRMIST			

Course Code	18MAB302T	Course Name	DISCRTE MATHEMATICS FOR ENGINEERS	Course Category	BS	Basic Sciences	L	T	P	C
							3	1	0	4

Pre-requisite Courses	18MAB101T	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Mathematics	Data Book / Codes/Standards	nil		

Course Learning Rationale (CLR):		The purpose of learning this course is to:			Learning			Program Learning Outcomes (PLO)																		
CLR-1 :	Apply set theory, functions and relations in storage, communication and manipulation of data				Level of Thinking (Bloom)	1	2	3	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2 :	Apply number theory concepts in computer engineering such as public key crypto system.																									
CLR-3 :	Apply mathematical reasoning in computer science such as design of computer circuit, verification of programs.																									
CLR-4 :	Learning about groups, rings and fields. Solving problems on coding theory.																									
CLR-5 :	Using graph models in computer network and shortest path problems Apply graph coloring in problems involving scheduling and assignments.																									
CLR-6 :	Apply mathematical reasoning, combinatorial analysis, algebraic structures and graph theory in solving mathematical problems as applied to the respective branches of Engineering.																									
Course Learning Outcomes (CLO):		At the end of this course, learners will be able to:																								
CLO-1 :	Problem solving in sets, relations and functions.				3	85	80	M	H	L									M	L		H				
CLO-2 :	Solving problems in basic counting principles, inclusion exclusion and number theory.				3	85	80	M	H		M	M							M			H				
CLO-3 :	Solving problems of mathematical logic, inference theory and mathematical induction.				3	85	80	M	H										M			H				
CLO-4 :	Gaining knowledge in groups, rings and fields. Solving problems in coding theory.				3	85	80	M	H		M								M			H				
CLO-5 :	Gaining knowledge in graphs and properties. Learning about trees, minimum spanning trees and graph coloring.				3	85	80	M	H	L									M	L		H				
CLO-6 :	Learning mathematical reasoning, combinatorial analysis, algebraic structures and graph theory.				3	85	80	M	H										M			H				

		Learning Unit / Module 1	Learning Unit / Module 2	Learning Unit / Module 3	Learning Unit / Module 4	Learning Unit / Module 5
Duration (hour)		12	12	12	12	12
S-1	SLO-1	Sets and examples. Operations on sets.	Permutation and Combination	Propositions and Logical operators	Binary operation on a set- Groups and axioms of groups.	Basic concepts - Basic Definitions- degree and Hand shaking theorem.
	SLO-2	Laws of Set theory- Proving set identities using laws of set theory.	Simple problems using addition and product rules.	Truth values and truth tables.	Properties of groups.	Some Special Graphs – complete, regular and bipartite graphs.
S-2	SLO-1	Partition of a set – examples.	Principle of inclusion and exclusion	Propositions generated by a set- Symbolic writing using conditional and biconditional connectives.	Permutation group, equivalence classes with addition modulo m and multiplication modulo m.	Isomorphism of graphs – necessary conditions.
	SLO-2	Cartesian product of sets.	Problems using inclusion and exclusion principle.	Writing converse inverse and contra positive of a given conditional.	Cyclic groups and properties.	Isomorphism- simple examples.
S-3	SLO-1	Relations – Properties.	Pigeon-hole principle and generalized pigeon-hole principle.	Tautology, contradiction and contingency-examples.	Subgroups and necessary and sufficiency of a subset to be a subgroup.	Paths, cycles and circuits.
	SLO-2	Equivalence relation and partial order relation	Problems on pigeon-hole principle.	Proving tautology and contradiction using truth table method.	Group homomorphism and properties.	Connectivity in undirected graphs – connected graphs and odd degree vertices.
S-4	SLO-1	Problem solving using tutorial sheet 1	Problem solving using tutorial sheet 4	Problem solving using tutorial sheet 7	Problem solving using tutorial sheet 10	Problem solving using tutorial sheet 13
	SLO-2	Poset - Graphs of relations Digraphs	Divisibility and prime numbers.	Equivalences – truth table method to prove equivalences.	Rings- definition and examples..Zero devisors.	Eulerian and Hamiltonian graphs.
S-5	SLO-1	Hasse diagram – problems.	Fundamental theorem of arithmetic – problems.	Implications- truth table method to prove implications.	Integral domain- definition , examples and properties.	Necessary and sufficient condition for a graph to be Eulerian-examples.

S-6	SLO-1	Closures of relations- examples	Finding prime factorization of a given number.	Laws of logic and some equivalences.	Fields – definition, examples and properties.	Matrix representation of graphs- adjacent and incidence matrices and examples.
	SLO-2	Transitive closure and warshall's algorithm	Some more problems using fundamental theorem of arithmetic.	Proving equivalences and implications using laws of logic.	Coding Theory – Encoders and decoders- Hamming codes.	Isomorphism using adjacency.
S-7	SLO-1	Functions – definitions, domain and range of a function - examples	Division algorithm- greatest common divisor and properties- problems.	Rules of inference – Rule P, Rule T and Rule CP	Hamming distance. Error detected by an encoding function.	Digraphs – in degree and out degree – Hand shaking theorem.
	SLO-2	Types of functions- one- one and onto- bijection- examples.	Euclid's algorithm for finding GCD(a,b)- examples..	Direct proofs	examples.	Verification of hand shaking theorem in digraphs.
S-8	SLO-1	Problem solving using tutorial sheet 2	Problem solving using tutorial sheet 5	Problem solving using tutorial sheet 8	Problem solving using tutorial sheet 11	Problem solving using tutorial sheet 14
	SLO-2	Composition of functions – examples.	Problems using Euclid's algorithm.	Problems using direct method.	Error correction using matrices.	Graph colouring – chromatic number-examples.
S-9	SLO-1	Associativity of composition of functions – Identity and inverse of functions.	Least common Multiple(LCM)- relation between LCM and GCD.	Problems using CP rule.	Problems on error correction using matrices.	Four colour theorem(statement only) and problems.
	SLO-2	Necessary and sufficiency of existence of inverse of a function.	Problems on LCM.	Inconsistency and indirect method of proof.	Group codes-error correction in group codes-parity check matrix.	Trees – definitions and examples. Properties.
S-10	SLO-1	Uniqueness of identity	Finding LCM and GCD using prime factorization.	Inconsistent premises and proof by contradiction (indirect method).	Problems on error correction in group codes.	Properties continued.
	SLO-2	Inverse of composition	Finding GCD and LCM using Euclid's algorithm.	Principle of mathematical induction.	Procedure for decoding group codes.	Spanning trees – examples.
S-11	SLO-1	Checking if a given function is bijection and if so, finding inverse, domain and range- problems.	More problems on GCD and LCM.	Problems based on Mathematical Induction	Problems on decoding group codes.	Kruskal's algorithm for minimum spanning trees.
	SLO-2	Problem solving using tutorial sheet 3	Problem solving using tutorial sheet 6	Problem solving using tutorial sheet 9	Problem solving using tutorial sheet 12	Problem solving using tutorial sheet 15
Learning Resources	1. Kenneth H.Rosen, Discrete Mathematics and its Application, Seventh edition, Tata McGraw-Hill Publishing company PVT .Ltd., New Delhi, 2012.					
	2. Tremblay J. P. and Manohar R., Discrete Mathematical Structures with applications to Computer Science, Tata Mc Graw Hill Publishing Co., 35 th edition,2008.					
	3. Narsing Deo, Graph Theory with applications to Engineering and Computer science, Prentice-Hall of India pvt. Ltd., New Delhi, 2004.					
	4. C.L. Liu, Elements of Discrete Mathematics, 4th Edition, McGraw Higher ED, 2012.					
	5. T.Veerarajan, Discrete Mathematics with Graph Theory and Combinatorics, Tata McGraw Hill, 2015.					

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Understand										
Level 2	Apply	40 %	-	40 %	-	40 %	-	40 %	-	40%	-
	Analyze										
Level 3	Evaluate	20 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

Course Designers

(a) Experts from Industry

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Course Code	18BTB101T	Course Name	BIOLOGY	Course Category	B	Basic Sciences	L	T	P	C
							2	0	0	2

Pre-requisite Courses	Nil		Co-requisite Courses	Nil		Progressive Courses	Nil	
Course Offering	Department	Biotechnology			Data Book / Codes/Standards		Nil	

Course Learning Rationale (CLR):	<i>The purpose of learning this course is to:</i>
CLR-1:	<i>Recall the cell structure and function from its organization</i>
CLR-2:	<i>Discuss molecular and biochemical basis of an organism</i>
CLR-3:	<i>Compare enzyme reaction and photosynthesis</i>
CLR-4:	<i>Explain different types of biosensors</i>
CLR-5:	<i>Analyze the different types of bioremediation</i>
CLR-6:	<i>Relate the concept of nervous and immune system pertaining to diseases</i>

Course Learning Outcomes (CLO):		At the end of this course, learners will be able to:			Level of	Expected	Expected	Engineer	Problem	Design &	Analysis	Research	Modern	Society	Environment	Sustainability	Ethics	Individual	Communit	Project N	Life Long	PSO - 1	PSO - 2	PSO - 3
CLO-1 :	Describe the cell growth, metabolism and reproduction.	1	80	80	L	H	H	H	-	M	L	H	H	H	-	H	L	H	H	L	H	H	H	H
CLO-2 :	Explain the concepts and experiments in biochemistry	2	85	75	M	H	M	M	-	M	H	H	H	H	-	H	L	H	H	L	H	H	H	H
CLO-3 :	Recognize the significance of photosynthesis	2	75	80	M	H	M	M	M	-	M	H	H	H	-	H	L	H	H	L	H	H	H	H
CLO-4 :	Discuss the different methods in enzyme catalytic functions	2	85	80	L	H	H	H	-	-	H	L	L	H	-	H	M	H	H	M	H	H	H	H
CLO-5 :	Analyze the role of biosensors and its applications	3	85	75	L	H	H	M	-	M	H	H	H	L	-	H	H	H	H	H	H	H	H	H
CLO-6 :	Explain the concepts of nervous system disorder and the diseases associated with it	2	80	80	M	H	H	L	H	M	M	H	H	H	-	H	H	H	H	H	H	H	H	H

Duration (hour)		6	6	6	6	6
S-1	SLO-1	Basics of cell biology: Relevance to Engineers	Biochemistry: Macromolecules, Biodiversity and its importance	Bioenergetics and metabolism	Molecular machines and motors	Nervous system: History of neuroscience
	SLO-2	Cell basic unit of life, Evidence for cell theory	Chemistry of life	Enzymes as biological catalysts, Significance of enzymes	Properties of ATP based protein molecular machines	Glial cells, Neurons
S-2	SLO-1	Cell structure and function	Biochemistry and human biology, DNA replication	Thermodynamics of enzymes	FOF1 ATP synthase motors, Coupling and coordination of motors	Action potential, Organization of nervous system
	SLO-2	Genetic Information, Protein structure	Transcription, Protein synthesis	Factors affecting enzyme activity, Effect of inhibitors on enzyme activity	Bacterial flagellar motor, Cytoskeleton	Central Nervous system, Peripheral nervous system
S-3	SLO-1	Cell metabolism	Eukaryotic and prokaryotic protein synthesis difference	Mechanism of enzyme action	Microtubules	Diseases of nervous system
	SLO-2	Carbohydrate metabolism, Fatty acid metabolism	Concept of genetic code, Stem cells	Enzyme strategies, Restriction enzymes	Microfilaments, Intermediate filaments	Computer- based neural networks
S-4	SLO-1	Homeostasis	Source of stem cells, Classification of stem cells	NMP kinases, Photosynthesis	Kinesin linear motor, Dynein motor	Immune system
	SLO-2	Pathways that alter homeostasis, Cell growth	Human embryonic stem cell, Importance and applications of stem cells	Light reactions, Photosystems	Biosensor	Fluid systems of the body, Innate immune system
S-5	SLO-1	Reproduction	Therapeutic cloning	ATP synthesis in chloroplasts	Resonant biosensors, Glucose biosensors	Cells of innate immune system, Adaptive immunity
	SLO-2	Eukaryotic cell division, Mitosis	Regenerative medicine	Calvin cycle	Bio detectors, Biosensor detection in pollutants	Diseases of immune system, Immune engineering
S-6	SLO-1	Meiosis, Cell differentiation	Bone tissue engineering	Significance of photosynthesis	Bioremediation	Cell signaling
	SLO-2	Neural crest	Gene therapy	Metabolism, Glycolysis	Bioventing and bio augmentation	Cell- surface receptors

Learning Resources	1. S.Thyagarajan, N.Selvamurugan, R.A.Nazeer et.al., <i>Biology for engineers</i> McGraw Hill Education. 2012	2. Norman Lewis, Gabi Nindi Waite, Lee R. Waite et.al., <i>Applied Cell and Molecular Biology for Engineers</i> . McGraw-Hill Education. 2007
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Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40%	-	30%	-	30%	-	30%	-	30%	-
	Understand										
Level 2	Apply	40%	-	40%	-	40%	-	40%	-	40%	-
	Analyze										
Level 3	Evaluate	20%	-	30%	-	30%	-	30%	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	
# CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,											

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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Course Code	18MES101L	Course Name	ENGINEERING GRAPHICS AND DESIGN	Course Category	S	Engineering Sciences	L	T	P	C
							1	0	4	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Mechanical Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)
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CLR-1:	Utilize engineering graphic fundamentals. apply the same to draw/evaluate engineering curves and projection of objects	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2:	Draw projection of solid objects like prisms, cylinders, pyramids and cones used in various engineering objects	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - I	PSO - II	PSO - III
CLR-3:	Draw the projection of combination of solids, and section of solids. Create building plans for construction																		
CLR-4:	Create 3D part models. Develop its surfaces using solid-modeling software for effectiveness, clarity, accuracy, portability																		
CLR-5:	Evaluate the assembly of engineering component parts. Create 2D drawings for assembly of engineering components																		
CLR-6:	Draw, Create, Evaluate, Interpret engineering 2D and 3D surfaces of engineering components using modeling software																		

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1:	Identify engineering graphics. Draw objects like points, lines, planes, and solids in perspective & orthographic projections	3	90	85	H	H	L	L	L	H	L	H	L	H	L	L	L	L	L
CLO-2:	Draw projection of solids like prism, cylinder, pyramid and cone inclined in general positions, obtain auxiliary views	2	95	90	M	M	L	L	M	H	H	L	L	H	L	L	L	L	L
CLO-3:	Draw projection of combination of solids made out of primitives, draw the section of solids, create building plans	3	90	85	H	H	M	M	H	H	H	M	H	L	H	L	L	L	L
CLO-4:	Create 3D part models. Develop its surfaces with solid modeling software for effectiveness, clarity, accuracy, portability	3	90	85	H	H	H	H	H	H	H	L	H	L	H	M	L	M	M
CLO-5:	Evaluate the assembly of parts including interference of parts. Create 2D drawings of assembly of parts	3	85	80	H	H	M	H	H	H	H	L	H	L	H	L	M	L	L
CLO-6:	Draw graphics of engineering pans with point, line, plane, solids, in perspective and orthographic projections	2	90	85	M	M	L	M	L	L	L	H	L	L	L	L	L	L	L

	Engineering graphics and Projection	Projection of solids using CAD software	Projections of combination of solids	Part Modeling and Drawing	Assembly Modeling and Drawing
Duration (hour)	15	15	15	15	15
S-1	SLO-1 Principles, Standards, Conventions	Introducing CAD Software, layers, dimensions, tolerance, annotations	Combinations of solids, Constructive Solid Geometry(CSG), Boolean operations	3D modelling, parametric, non- parametric, parts of CSG, surface, wireframe, shaded	Part/ component model creation for assembly.
	SLO-2 Angle Projection, Symbols, Dimensions	Create, modify, customize, print using CAD	Creating combination of solids, isometric, perspective views, shaded, wire-frame	Rendered models, background, shadows, multi-view, isometric, perspective views	Study of various widely used assembly of parts like flanged joint, universal joint etc.
S-2	SLO-1 2D Geometric Constructions	Demo: Menu, Toolbars, Drawing Area, Dialog box, windows, Shortcut menus	Constructive Solid Geometry, Boolean operations, Creating combination of solids	3D modelling, parametric, non- parametric, parts of CSG, surface, wireframe, shaded	Creation of parametric parts for assembly
	SLO-2 2D Geometric Constructions	Command Line, Status Bar, Different zoom methods, Create, Select, Erase objects	isometric, perspective, shaded, wire-frame	Rendered models, background, shadows, multi-view, isometric, perspective views	non- parametric parts for assembly
S-3	SLO-1 Conic Curves ellipse by eccentricity method	Draw straight lines, rectangle, polar, absolute, relative	Constructive Solid Geometry, Boolean operations, Creating combination of solids	Viewing models in multi-view, isometric, and perspective views	Creation of parametric parts for assembly
	SLO-2 Conic Curves ellipse by eccentricity method	Orthographic constraints, Ortho ON, snap to objects manually, automatically drawing lines, arcs, circles, polygons, create, edit, use layers, extend lines	isometric, perspective, shaded, wire-frame	Viewing models in multi-view, isometric, and perspective views	non- parametric parts for assembly
S-4	SLO-1 Cycloids, Epicycloids		Constructive Solid Geometry, Boolean operations, Creating combination of solids	Modelling industrial part drawings	Creation of parametric parts for assembly
	SLO-2 Hypocycloid	Dimensioning objects, annotations	isometric, perspective, shaded, wire-frame	Modelling industrial part drawings	non- parametric parts for assembly
S-5	SLO-1 Involute of a Square, Circle	Demo: drawing page, print, units/ scale/ limits settings, standards for dimensioning ISO, ANSI Std. dimensioning, tolerancing	Constructive Solid Geometry, Boolean operations, Creating combination of solids	Design new components as a team	Creation of parametric parts for assembly
	SLO-2 Spirals		isometric, perspective, shaded, wire-frame	Design new components as a team	non- parametric parts for assembly
S-6	SLO-1 Introduction to perspective projection with terminologies and concepts	Projection of solid prisms and cylinders inclined to both the planes	Section of right regular solid with axis perpendicular to one principal planes and cutting plane perpendicular to any one principle plane true shape of the section	3D Part to 2D Drawingsgeometric dimensioning and tolerancing annotations	Simple assembly of parts,
	SLO-2 Orthographic multiview and isometric projection	change of position method, reference line method / auxiliary projections,		generating 2D from 3D models, printing drawings, generating sectional views	associated part and assembly
S-7	SLO-1 Perspective projection of a point, line	Projection of solid prisms and cylinders inclined to both the planes	Section of right regular solid with axis perpendicular to one principal planes and	Geometric dimensioning and tolerancing annotations	Simple assembly of parts,
	SLO-2 Perspective projection of a planes, solids	Change of position method	cutting plane perpendicular to any one principle plane true shape of the section	Geometric dimensioning and tolerancing annotations	associated part and assembly
S-8	SLO-1 Orthographic multiview of point, line	Projection of solid prisms and cylinders inclined to both the planes	Section of right regular solid with axis perpendicular to one principal planes and	Generating 2D drawings from 3D models	Simple assembly of parts,

	SLO-2	Orthographic multiview of planes, solids	Reference line method	cutting plane perpendicular to any one principle plane true shape of the section	Generating 2D drawings from 3D models	associated part and assembly
S-9	SLO-1	Isometric projection of a point, line	Auxiliary projections	Section of solids with axis inclined to both the planes and cutting plane perpendicular to any one principal plane only.	Generating sectional views	Simple assembly of parts,
	SLO-2	Isometric projection of planes, solids	Auxiliary projections		Generating sectional views	associated part and assembly
S-10	SLO-1	Isometric to orthographic multiview sketching	Viewing isometric and perspective views, shaded, wire-frame models	Sectional plan elevation, and sectional side-view of Building/ dwelling, include windows, doors, fixtures, etc.	Printing drawings to printer or as .pdf	Simple assembly of parts,
	SLO-2	Orthographic multiview to isometric sketch	Oblique prismatic solids and its projections		Printing drawings to printer or as .pdf	associated part and assembly
S-11	SLO-1	Orthographic multiview projection of lines inclined to both planes	Projection of solid pyramids and cones inclined to both the planes	Building/ Dwelling drawing, Terminology, conventions, sectional plan and side-view of Building/ dwelling, include windows, doors, fixtures, etc.	Development of surfaces: un-cut, & cut right/ oblique regular solids	Assembly Drawings: exploded view with assembly annotations part details
	SLO-2	Orthographic multiview projection of planes inclined to planes, auxiliary projection	change of position method and reference line method/ auxiliary projections,		Simple position with cutting planes perpendicular to any one principal plane	Printing assembly drawings to printer and as pdf
S-12	SLO-1	Projection of lines inclined to both the planes	Projection of solid pyramids and cones inclined to both the planes	Sectional plan elevation, and sectional side-view of Building/ dwelling, include windows, doors, fixtures, etc.	Development of surfaces: un-cut, & cut right/ oblique regular solids	Exploded view with assembly annotations
	SLO-2	true length, true inclinations, traces of lines	Change of position method		Simple position with cutting planes perpendicular to any one principal plane	part details
S-13	SLO-1	Projection of lines inclined to both the planes	Projection of solid pyramids and cones inclined to both the planes	Sectional plan elevation, and sectional side-view of Building/ dwelling, include windows, doors, fixtures, etc.	Development of surfaces: un-cut, & cut right/ oblique regular solids	Exploded view with assembly annotations
	SLO-2	true length, true inclinations, traces of lines	Change of reference line method		Simple position with cutting planes perpendicular to any one principal plane	part details
S-14	SLO-1	Finding shortest distance between a point and a plane	Auxiliary projections	Sectional plan elevation, and sectional side-view of Building/ dwelling, include windows, doors, fixtures, etc.	Design of real time surface-development	Exploded view with assembly annotations
	SLO-2	Shortest distance between two lines	Auxiliary projections		Design of real time surface-development	part details
S-15	SLO-1	shortest distance between point and plane	Viewing isometric and perspective views, shaded, wire-frame models	Sectional plan elevation, and sectional side-view of Building/ dwelling, include windows, doors, fixtures, etc.	Design of real time surface-development	Printing assembly drawings
	SLO-2	shortest distance between point and plane	Oblique pyramidal solids and projections		Design of real time surface-development	Printing assembly drawings

Learning Resources	1. Bhatt, N.D., Engineering Drawing (First Angle Projection), 53 rd ed., Charotar Publishing House, 2017	7. Narayanan, K. L., Kannaiah, V., Engineering Graphics, Scitech Publications, 2010
	2. Bethunc, J., Engineering Graphics with AutoCAD 2017, Pearson Education, 2016	8. Luzzader, Warren J., Duff John M., Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Prentice Hall of India Pvt. Ltd., 2005.
	3. Khristofor Artemyevich Arustamov, Problems in projective geometry, MIR Publishers, Moscow, 1972	9. Mohammad Dashtbaz, Chris Gorse, Alice Moncaster (eds.), Building Information Modelling, Building Performance, Design and Smart Construction, Springer 2017
	4. Natarajan, K.V., A Text Book of Engineering Graphics, 21st Edition, Dhanalakshmi Pub., 2012	10. User Manual of Respective CAD Softwares
	5. Shah. M. B., Rana, B. C., Engineering Drawing, Pearson Education, Pvt. Ltd., 2005	
	6. Jeyapoovan. T., Engineering Drawing and Graphics using AutoCAD, Vikas Pub. House, 2015	

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	-	40%	-	30%	-	30%	-	30%	-	30%
	Understand	-	40%	-	40%	-	40%	-	40%	-	40%
Level 2	Apply	-	40%	-	40%	-	40%	-	40%	-	40%
	Analyze	-	20%	-	30%	-	30%	-	30%	-	30%
Level 3	Evaluate	-	20%	-	30%	-	30%	-	30%	-	30%
	Create	-	20%	-	30%	-	30%	-	30%	-	30%
Total	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1.Dr. R. Kalimuthu, ISRO,	1.Dr. Ramkumar P, IIT Madras, ramkumar@iitm.ac.in	1. Mr. D. Kumaran, SRMIST
2.Dr. A. Velayutham, DRDO,	2. Dr. Sourav Rakshit, IIT Madras, srakshit@iitm.ac.in	2. Mr. S. Balamurugan, SRMIST

Note: For all B.Tech Programmes other than Civil, Mechanical, Automobile, Aerospace and Mechatronics, the entire course would be conducted using CAD Software only.

Course Code	18EES101J	Course Name	BASIC ELECTRICAL & ELECTRONICS ENGINEERING	Course Category	S	Engineering Sciences	L	T	P	C
							3	1	2	5

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Electrical & Electronics Engineering			Data Book / Codes/Standards	Nil

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)
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CLR-1:	Analyze given electric circuits consisting of active and passive components	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2:	Identify the parts, functions and working of motors, generators and transformers that function in AC and DC	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLR-3:	Utilize the basic electronic devices and circuits																		
CLR-4:	Utilize transducers for measuring displacement, pressure, flow, sound, light, temperature, chemical changes etc.,																		
CLR-5:	Build simple logical circuits using Boolean expressions. Identify elements in a communication system																		
CLR-6:	Utilize the basic electrical circuits, machines, electronic devices, transducers and digital system principles and operations																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1:	Analyze basic theory utilized in electrical circuits and its circuits	3	75	70	H	M	L	L	M	-	M	M	M	M	-	M	-	-	-
CLO-2:	Identify working principle of direct current and alternative current machines such as transformers, motors and generators	2	75	70	H	M	L	L	M	-	M	M	M	M	-	M	-	-	-
CLO-3:	Operate the basic electronic devices. Identify their uses and construction features	3	75	70	H	-	L	L	M	-	M	M	M	M	-	M	-	-	-
CLO-4:	Identify the different types of transducers used in measurement of various physical parameters	3	75	70	H	-	L	M	M	-	M	M	M	M	-	M	-	-	-
CLO-5:	Apply binary logic and Boolean expressions for digital circuit design, Identify elements in a communication Systems	3	75	70	H	M	M	M	M	-	M	M	M	M	-	M	-	-	-
CLO-6:	Identify the basic electrical circuits, machines, electronic devices, transducers and digital system principles and operations	3	75	70	-	-	L	M	M	-	M	M	M	M	-	M	-	-	-

Duration (hour)		Electrical Circuits	D.C Machines& A.C Machines	Electronic Devices	Transducers	Digital Systems
18		18	18	18	18	18
S-1	SLO-1	Introduction to DC and AC circuits	Sinusoids, Generation of AC, Average, RMS values, Form and peak factors	Safety measures in electrical systems	Transducer function and requirements	Number systems, binary codes
	SLO-2	Active and Passive two terminal elements	Analysis of single phase AC circuit, Real, Reactive, Apparent power, Power factor	Types of wiring, wiring accessories	Classification: Active and Passive	Binary arithmetic
S-2	SLO-1	Ohms law, Voltage-Current relation, Power, Energy	Magnetic materials, B-H Characteristics Simple magnetic circuits	House wiring for staircase, fluorescent lamp, LED lamp & corridor wiring	Displacement: Capacitive, Inductive, Variable Inductance	Boolean algebra, laws and theorems
	SLO-2	R,L,C Circuits, Voltage and Current Sources	Faraday's laws, induced emfs and inductances.	Basic principles of earthing, Types of earthing. Grounding in DC circuits	Linear Variable Differential Transformer	Simplification of Boolean expression
S-3	SLO-1	Kirchoff's current law	1 - phase transformers: Construction, types, ideal, practical transformer	Basic principles and classification of instruments	Electromechanical: Pressure, Flow, Accelerometer, Potentiometer etc.	Logic Gates and Operations
	SLO-2	Kirchoff's voltage law	EMF equation, Regulation, Efficiency	Moving coil and moving iron instruments	Strain Gauge	Simplification of Boolean expression
S-4	SLO-1	Problem Solving Session	Problem Solving Session	Problem Solving Session	Problem Solving Session	Problem Solving Session
	SLO-2	Problem Solving Session	Problem Solving Session	Problem Solving Session	Problem Solving Session	Problem Solving Session
S-5	SLO-1	Lab 1: Verification of Kirchoff's Law	Lab 4: Transformer Operation, Efficiency	Lab 7: Types of wiring (fluorescent lamp wiring, staircase wiring, godown wiring)	Lab 10: Measurement using LVDT and Strain Gauge	Lab 13: Verification of Boolean expression using logic gates
	SLO-2	Mesh Current Analysis	Construction, working of DC Generators	Overview of Semiconductors	Chemical: pH probes, Electro galvanic Sensor etc.,	SOP and POS Expressions
S-7	SLO-1	Nodal Voltage Analysis	Types of DC generators	PN junction diode	Electroacoustic: Mic, Speaker, Piezoelectric, Sonar, Ultrasonic	Standard forms of Boolean expression
	SLO-2	Thevenin's Theorem	Characteristics of Generators	Zener diode	Tactile, Geophones, Hydrophone	Simplify using Boolean Expressions
S-8	SLO-1	Norton's Theorem	Armature reaction, Losses	Diode circuits: rectifiers, half and full wave	Electrooptical: LED, Laser, Photodiode, Photoresistor, Phototransistor	Minterm and Maxterm
	SLO-2	Maximum Power Transfer Theorem	Power stages of DC generators	Bridge type rectifier, filter circuit	Photoconductive cell, photovoltaic cell, solar cell	K-Map Simple Reduction Technique
S-9	SLO-1	Star- Delta Transformation	Working and types of DC motors, Characteristics, Starters	Clippers and clampers	LED, infrared emitters, LCD, optocouplers	Two, Three and Four Variable K-Map
	SLO-2	Problem Solving Session	Problem Solving Session	Problem Solving Session	Problem Solving Session	Problem Solving Session

	SLO-2					
S 11-12	SLO-1 SLO-2	Lab 2: Verification of all Theorems	Lab 5: Demo of DC Machine & Parts	Lab 8: Characteristics of semiconductor devices	Lab 11: Measurement using Electro acoustic and Electrooptical transducers	Lab 14: Reduction using Digital Logic Gates
S-13	SLO-1	Resistive Circuit Analysis	Construction, working of AC Generators	BJT construction, operation	Thermoelectric: Resistance Temperature Detectors	Principles of Communication
	SLO-2	Superposition, Convolution	Types of AC generators	BJT characteristics (CB, CE and CC configurations) and uses	Thermocouple	Block diagram of a Communication System
S-14	SLO-1	RL Circuit Transient Analysis	Characteristics of AC Generators, Losses	JFET construction, operation	Thermister	Amplitude Modulation
	SLO-2	RC & RLC Transient Analysis	Single Phase and Three Phase Machines	JFET characteristics (CS configuration) and uses.	Electrostatic: Electrometer	Frequency Modulation
S-15	SLO-1	Three Phase Systems, Connections	Working and types of AC motors	MOSFET construction, operation	Electromagnetic: Antenna, Hall effect, Magnetic Cartridge etc.,	Phase Modulation
	SLO-2	Relation between Line and Phase	Induction, Squirrel Cage, Synchronous	MOSFET characteristics (CS configuration) and uses	Radioacoustic: Geiger Muller Tubes, Radio receiver, Radio transmitter	Demodulation
S-16	SLO-1 SLO-2	Problem Solving Session	Problem Solving Session	Problem Solving Session	Problem Solving Session	Problem Solving Session
S 17-18	SLO-1 SLO-2	Lab 3: Time Domain Analysis (RL, RC)	Lab 6: Demo of AC Machine & Parts	Lab 9: Wave shaping circuits	Lab 12: Measurement using Thermoelectric and Electromagnetic	Lab 15: Demo of Transmission and Reception using MODEM

Learning Resources	1. Dash.S.S, Subramani.C, Vijayakumar.K, Basic Electrical Engineering, 1st ed., Vijay Nicole, 2013 2. Jegatheesan.R, Analysis of Electric Circuits, Tata McGraw-Hill, 2014 3. P. S. Bimbhra, Electrical Machinery, 7 th ed., Khanna Publishers, 2011	4. R. Muthusubramanian, S. Salivahanan, "Basic Electrical and Electronics Engineering, Tata McGraw-Hill, 2012 5. Moris M. Mano, Digital Design, 3 rd ed., Pearson, 2011
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Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
Total	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr.S.Paramasivam, Danfoss, Industries Pvt Ltd., paramsathya@yahoo.com	1. Dr.K.S.Swarup, IIT Madras, ksswarup@itm.ac.in	1. Dr.K.Vijayakumar, SRMIST
2. Dr. Sricharan Srinivasan, Wipro Technologies, sricharanms@gmail.com	2. Dr. Rajeev Sukumaran, IIT Madras, rajeev@wmail.iitm.ac.in	2. Dr.S.S.Dash, SRMIST

Course Code	18MES103L	Course Name	CIVIL AND MECHANICAL ENGINEERING WORKSHOP	Course Category	S	Engineering Sciences	L	T	P	C
							1	0	4	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Civil Engineering & Mechanical Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)
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CLR-1:	Practice machining and glass cutting shop floor trade	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2:	Practice arc & gas welding, and fitting and make new assemblies according to various dimensions and tolerances	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLR-3:	Practice basic carpentry joints and sheet metal shop floor practices.																		
CLR-4:	Practice casting, moulding, & smithy trades																		
CLR-5:	Practice and make G.I & P.V.C. plumbing trade																		
CLR-6:	Practice machining, glass cutting, welding, fitting, carpentry, sheet metal, casting, moulding, smithy and plumbing																		

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLO-1:	Machine in a lathe. Drill using drilling machines. Cut glass. Create new components according to specifications	1	90	85	H	L	H	L	M	H	H	L	M	L	L	H	M	M	M
CLO-2:	Weld joints using arc & gas welding. Fit pipes and fixtures. Make new assembly for given dimensions, and tolerances	1	90	85	H	L	H	L	M	M	H	L	M	L	L	M	L	L	L
CLO-3:	Practice basic carpentry joints used in house hold furniture items, and sheet metal items used shop floor practices	1	90	85	H	L	H	L	M	M	H	L	M	L	L	M	L	L	L
CLO-4:	Practice casting, moulding, & smithy trades	2	90	85	H	L	M	L	M	H	H	L	L	L	L	M	L	L	L
CLO-5:	Make G.I & P.V.C. pipe line connections used in the plumbing trade	2	90	85	H	L	H	L	M	H	M	L	L	L	L	M	L	L	L
CLO-6:	Practice basic skills of machining, glass cutting, welding, fitting, carpentry, sheet metal, casting, mouldings, smithy and plumbing	2	90	85	H	L	H	L	M	H	H	L	M	L	L	M	L	L	L

	Machining, Drilling, Tapping, Glass cutting	Welding (Arc and Gas) and fitting	Carpentry and Sheet metal	Casting, moulding and smithy	Plumbing (G.I and P.V.C)
Duration (hour)	15	15	15	15	15
S-1	SLO-1: Machining: Basics of Machining Processes Equipment's	Basics of Metal Arc welding operations, Equipment's	Basics of Carpentry operations, Equipment's	Basics of Casting, processes, Equipment's	Basics of Plumbing practices for G.I and P.V.C.
	SLO-2: Tools and demonstration of machining to produce models	Tools and demonstration of producing models	Tools and demonstration of producing models	Tools and demonstration of producing models	Tools and demonstration of producing models
S 2-5	SLO-1: Simple turning of cylindrical surface on MS rod using lathe machine tool	Butt joint of two metal plates using arc welding process	Cross halving joint of two wooden pieces at perpendicular direction	To make the mould using stepped flange	Plumbing of bathroom/ kitchen fittings using G.I. fittings
	SLO-2: Simple turning of cylindrical surface on MS rod using lathe machine tool	Lap joint of two metal plates overlapping on one another using arc welding process.	To make duster from wooden piece using carpentry tools.	To make the mould using stepped flange	Plumbing of bathroom/ kitchen fittings using G.I. fittings
S-6	SLO-1: Basics of drilling and tapping processes, Equipment's, tools	Basics of gas welding operations, Equipment's,	Basics of Sheet metal operations, Equipment's	Basics of injection moulding and processes, Equipment's,	PVC Plumbing of bathroom/ kitchen fittings using P.V.C. fittings
	SLO-2: Demonstration of drilling and tapping to produce models.	Tools and demonstration of producing models	Tools and demonstration of producing sheet metal models	Tools and demonstration of producing models	Tools and demonstration of producing models
S 7-10	SLO-1: Generate hole on a metal piece	MIG welding of metal plates	To make Rectangular shaped tray using GI sheet	To make plastic models using injection moulding of simple part	Plumbing of bathroom/ kitchen fittings using P.V.C. fittings
	SLO-2: Generate internal thread on a metal piece	TIG welding of metal plates	To make bigger size scoop using GI sheet.	To make plastic models using injection moulding of simple part	Plumbing of bathroom/ kitchen fittings using P.V.C. fittings
S-11	SLO-1: Basics of Glass cutting processes, Equipment's.	Basics of fitting practice, tools and method of producing models	Basics of different geometrical shapes in Sheet metal operations	Basics of Smithy processes, Equipment's,	Basics of Plumbing practices for G.I pipe lines and fittings for pumps and machines
	SLO-2: Tools and demonstration of producing models	Tools and demonstration of producing models	Equipment's, tools and demonstration of producing models	Tools and demonstration of producing models	Equipment's, tools and demonstration of producing models.
S 12-15	SLO-1: Make glass panels for boxes	Step fitting of two metal plates using fitting tools	To make geometrical shape like frustum, Cone and Prism using G.I sheet	To forge chisel from MS rod using black smithy	Plumbing of pipe lines and fitting for Pumps using G.I fittings
	SLO-2:				

Learning Resources	1. Jeyachandran K., Natarajan S. & Balasubramanian S., A Primer on Engineering Practices Laboratory, Anuradha Publications, 2007 2. Jeyapoovan T., Saravanapandian M. & Pranitha S., Engineering Practices Lab Manual, Vikas Publishing House Pvt.Ltd, 2006.	5. Kannaiah P. & Narayana K.L., Manual on Workshop Practice, Scitech Publications, 1999. 6. Hajra Choudhury S.K., Hajra Choudhury A.K., Nirjhar Roy S.K., Elements of Workshop Technology, Vol.I & Vol.II 2010, Media promoters and publishers private limited, Mumbai. 7. Rao P.N., Manufacturing Technology, Vol. I & Vol. II, Tata McGrawHill, 2017.
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	3. Bawa H.S., <i>Workshop Practice</i> , Tata McGraw, 2007. 4. Rajendra Prasad A. & Sarma P.M.M.S., <i>Workshop Practice</i> , Sree Sai Publication, 2002.	8. Gopal T.V, Kumar. T, Murali. G, <i>A first course on workshop practice – Theory, Practice and Work Book</i> , Suma Publications, Chennai, 2005.
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Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	-	40%	-	30%	-	30%	-	30%	-	30%
	Understand										
Level 2	Apply	-	40%	-	40%	-	40%	-	40%	-	40%
	Analyze										
Level 3	Evaluate	-	20%	-	30%	-	30%	-	30%	-	30%
	Create										
Total	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1.Dr. R. Kalimuthu, ISRO,	1.Dr. Ramkumar P, IIT Madras, ramkumar@itm.ac.in	1. Mr.A.Thirugnanam, SRMIST
2.Dr. A. Velayutham, DRDO,	2. Dr. Sourav Rakshit, IIT Madras, srakshit@itm.ac.in	2. Dr. S. Prabhu, SRMIST

Course Code	18CSS101J	Course Name	PROGRAMMING FOR PROBLEM SOLVING	Course Category	S	Engineering Sciences	L	T	P	C
							3	0	4	5

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computer Science and Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)
CLR-1:	Think and evolve a logically to construct an algorithm into a flowchart and a pseudocode that can be programmed	1 2 3	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
CLR-2:	Utilize the logical operators and expressions to solve problems in engineering and real-time	Level of Thinking (Bloom)	Engineering Knowledge
CLR-3:	Store and retrieve data in a single and multidimensional array	Expected Proficiency (%)	Problem Analysis
CLR-4:	Utilize custom designed functions that can be used to perform tasks and can be repeatedly used in any application	Expected Attainment (%)	Design & Development
CLR-5:	Create storage constructs using structure and unions. Create and Utilize files to store and retrieve information		Analysis, Design, Research
CLR-6:	Create a logical mindset to solve various engineering applications using programming constructs in C		Modern Tool Usage
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:		Society & Culture
CLO-1:	Identify methods to solve a problem through computer programming. List the basic data types and variables in C		Environment & Sustainability
CLO-2:	Apply the logic operators and expressions. Use loop constructs and recursion. Use array to store and retrieve data		Ethics
CLO-3:	Analyze programs that need storage and form single and multi-dimensional arrays. Use preprocessor constructs in C		Individual & Team Work
CLO-4:	Create user defined functions for mathematical and other logical operations. Use pointer to address memory and data		Communication
CLO-5:	Create structures and unions to represent data constructs. Use files to store and retrieve data		Project Mgt. & Finance
CLO-6:	Apply programming concepts to solve problems. Learn about how C programming can be effectively used for solutions		Life Long Learning
			PSO - 1
			PSO - 2
			PSO - 3

Duration (hour)	21	21	21	21	21
S-1	SLO-1 Evolution of Programming & Languages	Relational and logical Operators	Initializing and Accessing 2D Array	Passing Array Element to Function	Initializing Structure, Declaring structure variable
	SLO-2 Problem solving through programming	Condition Operators, Operator Precedence	Initializing Multidimensional Array	Formal and Actual Parameters	Structure using typedef, Accessing members
S-2	SLO-1 Creating algorithms	Expressions with pre / post increment operator	Array Programs – 2D	Advantages of using Functions	Nested structure Accessing elements in a structure array
	SLO-2 Drawing flowcharts	Expression with conditional and assignment operators	Array Contiguous Memory	Processor Directives and #define Directives	Array of structure Accessing elements in a structure array
S-3	SLO-1 Writing pseudocode	If statement in expression	Array Advantages and Limitations	Nested Preprocessor Macro	Passing Array of structure to function
	SLO-2 Evolution of C language, its usage history	L value and R value in expression	Array construction for real-time application Common Programming errors	Advantages of using Functions	Array of pointers to structures
S 4-7	SLO-1 Lab 1: Algorithm, Flow Chart, Pseudocode	Lab 4: Operators and Expressions	Lab 7: Arrays - Multidimensional	Lab 10: Functions	Lab 13: Structures & Unions
	SLO-2				
S-8	SLO-1 Input and output functions: Printf and scanf	Control Statements – if and else	String Basics	Pointers and address operator	Bit Manipulation to structure and Pointer to structure
	SLO-2 Variables and identifiers	else if and nested if, switch case	String Declaration and Initialization	Size of Pointer Variable and Pointer Operator	Union Basic and declaration
S-9	SLO-1 Expressions	Iterations, Conditional and Unconditional branching	String Functions: gets(), puts(), getchar(), putchar(), printf()	Pointer Declaration and dereferencing pointers	Accessing Union Members Pointers to Union
	SLO-2 Single line and multiline comments	For loop	String Functions: atoi, strlen, strcat, strcmp	Void Pointers and size of Void Pointers	Dynamic memory allocation, malloc, realloc, free
S-10	SLO-1 Constants, Keywords	While loop	String Functions: sprintf, sscanf, strcmp, strcpy, strstr, strtok	Arithmetic Operations	Allocating Dynamic Array
	SLO-2 Values, Names, Scope, Binding, Storage Classes	do while, goto, break, continue	Arithmetic Characters on Strings	Incrementing Pointers	Multidimensional array using dynamic memory allocation.
S 11-14	SLO-1 Lab 2: Input and Output Statements	Lab 5: Control Statements	Lab 8: Strings	Lab 11: Pointers	Lab 14: Structures & Unions
	SLO-2				

S-15	SLO-1	Numeric Data types: integer	Array Basic and Types	Functions declaration and definition	Constant Pointers	file: opening, defining, closing, File Modes, File Types
	SLO-2	Numeric Data types: floating point	Array Initialization and Declaration	Types: Call by Value, Call by Reference	Pointers to array elements and strings	Writing contents into a file
S-16	SLO-1	Non-Numeric Data types: char and string	Initialization: one Dimensional Array	Function with and without Arguments and no Return Values	Function Pointers	Reading file contents
	SLO-2	Increment and decrement operator	Accessing, Indexing one Dimensional Array Operations	Function with and without Arguments and Return Values	Array of Function Pointers	Appending an existing file
S-17	SLO-1	Comma, Arrow and Assignment operator	One Dimensional Array operations	Passing Array to Functions with return type	Accessing Array of Function Pointers	File permissions and rights
	SLO-2	Bitwise and Sizeof operator	Array Programs – 1D	Recursion Functions	Null Pointers	Changing permissions and rights
S-18-21	SLO-1 SLO-2	Lab 3: Data Types	Lab 6: Arrays – One Dimensional	Lab 9: Functions	Lab 12: Pointers	Lab 15: File Handling

Learning Resources	1. Zed A Shaw, <i>Learn C the Hard Way: Practical Exercises on the Computational Subjects You Keep Avoiding (Like C)</i> , Addison Wesley, 2015	3. Bharat Kinariwala, <i>Tep Dobry, Programming in C</i> , eBook
	2. W. Kernighan, Dennis M. Ritchie, <i>The C Programming Language</i> , 2 nd ed. Prentice Hall, 1996	4. http://www.c4learn.com/learn-c-programming-language/

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
Level 2	Apply Analyze	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 3	Evaluate Create	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Sainarayanan Gopalakrishnan, HCL Technologies, saijgk@gmail.com	1. Prof. Janakiram D, IIT Madras, djram@iitm.ac.in	1. Dr. Christhu Raj M R, SRMIST
2. Dr. Sricharan Srinivasan, Wipro Technologies, sricharanms@gmail.com	2. Dr. Rajeev Sukumaran, IIT Madras, rajeev@wmail.iitm.ac.in	2. Dr. B. Amutha, SRMIST

Course Code	18CSS201J	Course Name	ANALOG AND DIGITAL ELECTRONICS	Course Category	S	Engineering Sciences	L	T	P	C
							3	0	2	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computer Science and Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)
CLR-1:	Identify the applications of analog electronics	1 2 3	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
CLR-2:	Identify the applications of digital logic families	Level of Thinking (Bloom)	Engineering Knowledge
CLR-3:	Design the combinational and sequential logic circuits	Expected Proficiency (%)	Problem Analysis
CLR-4:	Implement the combinational and sequential logic circuits	Expected Attainment (%)	Design & Development
CLR-5:	Analyze the design of counters and registers		Analysis, Design, Research
CLR-6:	Utilize the concepts in real time scenarios		Modern Tool Usage
			Society & Culture
			Environment & Sustainability
			Ethics
			Individual & Team Work
			Communication
			Project Mgt. & Finance
			Life Long Learning
			PSO - 1
			PSO - 2
			PSO - 3
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:		
CLO-1:	Identify the analog and digital components in circuit design	1 80 70	H H - - - - - - - - - - - - - - - -
CLO-2:	Analyze the combinational and sequential logic circuits	2 85 75	H H - - - - - - - - - - - - - - - -
CLO-3:	Apply gates and flip-flops in circuit design	2 75 70	H - H H - - - - - - - - - - - - - - -
CLO-4:	Use simulation package and realize	2 85 80	H H H H H - - - - - - - - - - - - - - -
CLO-5:	Apply HDL code and synthesize	2 85 75	H - H H H - - - - - - - - - - - - - - -
CLO-6:	Build the circuits in bread board and demonstrate and FGPA	3 80 70	- - H H - H - - - H - - H - - - - - - -

	Introduction to Analog electronics	Logic Families	Combinational Logic Circuits	Sequential Logic circuits	Registers & Counters
Duration (hour)	15	15	15	15	15
S-1	SLO-1 Characteristics of BJT (CB, CE and CC configurations) and DC biasing	Transistor as a Switch	Quine-McCluskey minimization technique	Sequential circuits, Latch and Flip-Flops	Registers and Types of Registers- Serial In - Serial Out, Serial In - Parallel out
	SLO-2 BJT Uses	Characteristics of Digital ICs	Combinational Circuits	RS Flip-Flops,	Parallel In - Serial Out, Parallel In - Parallel Out
S-2	SLO-1 Characteristics and uses of JFET (CS, Common Drain and Common Gate)	DL, RTL	Multiplexer	Gated Flip-Flops	Universal Shift Register
	SLO-2 Differences between BJT and JFET	DTL,TTL	Demultiplexer	Edge-triggered RS FLIP-FLOP	Applications of Shift Registers
S-3	SLO-1 Transistor Amplifier: CE amplifier	ECL	Decoder	Edge-triggered D FLIP-FLOPs	Synchronous Counters
	SLO-2 Transistor Amplifier: CC, CB amplifier	ILL	Encoder	Edge-triggered T FLIP-FLOPs	Asynchronous Counters
S 4-5	SLO-1 Lab 1:Design and Implement Half and Full Wave Rectifiers using simulation	Lab 4: Design and implement transistor as a switch	Lab 7:Design and implement code converters using logic gates simulation	Lab 10:HDL implementation of Flip-Flop	Lab 13: Implement SISO, SIPO, PISO and PIPO shift registers using Flip- flops
	SLO-2 Power Amplifiers: Different classes of Amplifiers and its operation-Class A	Characteristics and uses of MOSFET (CS, Common drain and Common gate)	Binary adder	Edge-triggered JK FLIPFLOPs	Changing the Counter Modulus
S-6	SLO-2 Class B, AB and C	MOSFET Logic	Binary adder as subtractor	JK Master-slave FLIP-FLOP	Decade Counters
S-7	SLO-1 Operational Amplifiers: Ideal v/s practical Op-amp	PMOS,NMOS	Carry look ahead adder	Analysis of Synchronous Sequential Circuit, State Equation, State table	Presetable counters
	SLO-2 Performance Parameters	CMOS Logic	Decimal adder	State Diagram	Counter Design as a Synthesis problem
S-8	SLO-1 Applications: Peak detector, Comparator, Inverting, Non-Inverting Amplifiers	Propagation delay	Magnitude Comparator	Synthesis of sequential circuit using Flip-Flops	Seven segment Display and A Digital Clock.
	SLO-2 Problem solving session	Problem solving session	Problem solving session	Problem solving session	Problem solving session
S 9-10	SLO-1 Lab 2: Design and implement Schmitt trigger using Op-Amp (simulation)	Lab 5: Design CMOS Inverter, measure propagation delay for rising & falling edge	Lab 8: Design and implement using simulation the combinational circuits	Lab 11: Design and implement using simulation; Synchronous sequential circuits	Lab 14:HDL for Registers and Counters
	SLO-2				

S-11	SLO-1	Effect of positive and Negative Feedback Amplifiers,	Tristate Logic	Read Only Memory	Asynchronous sequential circuit	D/A Conversion
	SLO-2	Analysis of Practical Feedback Amplifiers	Tristate Logic Applications	Arithmetic Logic Unit	Transition Table	Types of D/A Converters
S-12	SLO-1	Oscillator Operation	FPGA Basics	Programmable Logic Arrays	State table	Problem
	SLO-2	Crystal Oscillator	Introduction to HDL and logic simulation	HDL Gate and Data Flow modeling	Flow table	A/D Conversion
S-13	SLO-1	Overview of UJT, Relaxation Oscillator, 555 Timer	HDL System primitives, user defined primitives, Stimulus to the design	HDL Behavioral modeling	Analysis of asynchronous sequential circuits	Types of A/D conversion
	SLO-2	Problem solving session	Problem solving session	Problem solving session	Problem solving session	Problem solving session
S 14-15	SLO-1	Lab 3: Design and implement using simulator a rectangular waveform generator (Op-Amp relaxation oscillator)	Lab 6: HDL Program to realize delay and stimulus in simple circuit	Lab 9: HDL program for combinational circuits	Lab 12: HDL program for Sequential circuits	Lab 15: Design and Implement an A/D Converter.
	SLO-2					

Learning Resources	1. Robert L. Boylestad & Louis Nashelsky, <i>Electronic Devices & Circuit Theory</i> , 11th ed., Pearson, 2013	4. Douglas A, G.K. Kharate, <i>Digital Electronics</i> , Oxford university Press, 2012
	2. Anil K Maini, Varsha Agarwal: <i>Electronic Devices and Circuits</i> , Wiley, 2012	5. M. Morris R. Mano, Michael D. Ciletti, <i>Digital Design: With an Introduction to the Verilog HDL, VHDL, and SystemVerilog</i> , 6 th ed., Pearson, 2018
	3. Paul Tuinenga, <i>SPICE: A Guide to Circuit Simulation and Analysis Using PSpice</i> , 3rd ed., Prentice-Hall, 1995,	6. A.P. Malvino, <i>Electronic Principles</i> , 7th Edition, Tata McGraw Hill Publications, 2013

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Devi Jayaraman, Virtusa, devij@virtusa.com	1. Dr. J. Dhalia Sweetlin, Anna University, jdsweetlin@mitindia.edu	1. Dr. Annapurani Panaiyappan.K, SRMIST
2. Dr. Viswanadhan, Teken BIM Technologies, viswanathan_alladi@yahoo.com	2. Dr. B. Latha, Sairam Engineering College, hod.cse@sairam.edu.in	2. Dr. D. Anitha, SRMIST 3. Ms. Kayalvizhi J, SRMIST

Course Code	18CSS202J	Course Name	COMPUTER COMMUNICATIONS	Course Category	S	Engineering Sciences	L	T	P	C
							2	0	2	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computer Science and Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):		The purpose of learning this course is to:	Learning			Program Learning Outcomes (PLO)														
CLR-1:	Understand the basic services and concepts related to Internetwork		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2:	Understand the layered network architecture		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLR-3:	Acquire knowledge in IP addressing					H	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLR-4:	Exploring the services and techniques in physical layer					H	-	H	-	-	-	-	-	-	-	-	-	M	-	-
CLR-5:	Understand the functions of Data Link layer					H	H	-	-	-	-	-	-	-	-	-	-	M	-	M
CLR-6:	Implement and analyze the different Routing Protocols					H	H	-	-	-	-	-	-	-	-	-	-	-	-	-
Course Learning Outcomes (CLO):		At the end of this course, learners will be able to:																		
CLO-1:	Apply the knowledge of communication		2	80	70	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-2:	Identify and design the network topologies		3	85	75	H	-	H	-	-	-	-	-	-	-	-	-	M	-	-
CLO-3:	Design the network using addressing schemes		3	75	70	H	H	-	-	-	-	-	-	-	-	-	-	M	-	M
CLO-4:	Identify and correct the errors in transmission		1	85	80	H	H	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-5:	Identify the guided and unguided transmission media		1	85	75	H	-	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-6:	Design and implement the various Routing Protocols		3	80	70	H	H	H	H	H	-	-	-	-	-	-	-	M	-	M

Duration (hour)	12	12	12	12	12
S-1	SLO-1 Evolution of Computer Networks, Network categories	IPv4 Addressing, Address space	Line coding: Unipolar scheme	Framing, Flow Control Mechanisms	Forward Techniques, Forwarding Process
	SLO-2 Data Transmission Modes, Network topologies	Dotted Decimal Notation. Classful Addressing	Polar schemes, Bipolar schemes	Sender side Stop and Wait Protocol, Receiver side Stop and Wait Protocol	Routing Table
S-2	SLO-1 Circuit Switching and Packet Switching	Subnet Mask	Amplitude shift keying, Frequency shift keying	Goback N ARQ, Selective Reject ARQ	Intradomain Routing and Interdomain Routing
	SLO-2 Protocols and standards	Subnetting	Phase shift keying, Pulse code Modulation, Delta Modulation	CRC, Checksum	Static Routing and Dynamic Routing
S 3-4	SLO-1 Lab 1: IP Addressing	Lab 4: Router Configuration (Creating Passwords, Configuring Interfaces)	Lab 7: RIP v1	Lab 10: EIGRP Authentication and Timers	Lab 13: Examining Network Address Translation (NAT)
S-5	SLO-1 Layers in the OSI model, Functions of Physical layer, data link layer	Special Addresses	Multiplexing: FDM	Types of Errors	Distance Vector Routing, Problem Solving
	SLO-2 Functions of Network layer, Transport layer	Special Addresses	Multiplexing: FDM	Types of Errors	Link state Routing
S-6	SLO-1 Functions of Session, Presentation layer and Application layer	Classless Addressing	TDM	Forward Error correction	Problem solving
	SLO-2 TCP/IP protocol suite, Link layer protocols	Problem Solving	WDM	CSMA, CSMA/CD	Path vector Routing
S 7-8	SLO-1 Lab 2: Subnetting (VLSM)	Lab 5: Basic Switch Configuration: Vlan	Lab 8: RIP v2	Lab 11: Single-Area OSPF Link Costs and Interface	Lab 14: BGP Configuration
S-9	SLO-1 Network layer protocols	Private Address, NAT, Supernetting	Guided Media: Twisted Pair, Coaxial Cable, Fiber optic cable	Hamming Distance	RIP v1, RIP v2
	SLO-2 Transport layer protocols	Hub, Repeaters, Switch	Unguided media: Radio waves	Correction Vs Detection	OSPF
S-10	SLO-1 Serial and Parallel Transmissions	Bridge	Microwaves	HDLC	EIGRP
	SLO-2 Addressing	Structure of Router	Infrared	PPP	BGP
S 11-12	SLO-1 Lab 3: LAN Configuration using straight through and cross over cables	Lab 6: Static and Default Routing	Lab 9: EIGRP Configuration, Bandwidth, and Adjacencies	Lab 12: Multi-Area OSPF with Stub Areas and Authentication	Lab 15: Configuring Static and Default Routes

Learning Resources	1. Behrouz A. Forouzan, "Data Communications and Networking" 5th ed., 2010	3. William Stallings, Data and Computer Communications, 9 th ed., 2010
	2. Bhushan Trivedi, "Data Communication and Networks" 2016	4. Todd Lammle, CCNA Study Guide, 7 th ed. 2011

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
Total	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Viswanadhan, Teken BIM Technologies, viswanathan_alladi@yahoo.com	1. Dr. J. Dhaliya Sweetlin, Anna University, jdsweetlin@mitindia.edu	1. Mrs. T. Manoranjitham, SRMIST
2. Dr. Devi Jayaraman, Virtusa, devij@virtusa.com	2. Dr. B. Latha, Sairam Engineering College, hod.cse@sairam.edu.in	2. Mr. J. Godwin Ponsam, SRMIST Dr. J.S. Femilda Josephin, SRMIST

Course Code	18CSC201J	Course Name	DATA STRUCTURES AND ALGORITHMS	Course Category	C	Professional Core			
						L	T	P	C
						3	0	2	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	18CSC204J
Course Offering Department	Computer Science and Engineering			Data Book / Codes/Standards	Nil

Course Learning Rationale (CLR):		The purpose of learning this course is to:		
CLR-1 :	Utilize the different data types; Utilize searching and sorting algorithms for data search			
CLR-2 :	Utilize linked list in developing applications			
CLR-3 :	Utilize stack and queues in processing data for real-time applications			
CLR-4 :	Utilize tree data storage structure for real-time applications			
CLR-5 :	Utilize algorithms to find shortest data search in graphs for real-time application development			
CLR-6 :	Utilize the different types of data structures and its operations for real-time programming applications			

Course Learning Outcomes (CLO):		At the end of this course, learners will be able to:		
CLO-1 :	Identify linear and non-linear data structures. Create algorithms for searching and sorting			
CLO-2 :	Create the different types of linked lists and evaluate its operations			
CLO-3 :	Construct stack and queue data structures and evaluate its operations			
CLO-4 :	Create tree data structures and evaluate its types and operations			
CLO-5 :	Create graph data structure, evaluate its operations, implement algorithms to identify shortest path			
CLO-6 :	Construct the different data structures and evaluate their types and operations			

Learning		
1	2	3
Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
3	80	70
3	85	75
3	75	70
3	85	80
3	85	75
3	80	70

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
L	H	-	H	L	-	-	-	L	L	-	H	-	-	-
M	H	L	M	L	-	-	-	M	L	-	H	-	-	-
M	H	M	H	L	-	-	-	M	L	-	H	-	-	-
M	H	M	H	L	-	-	-	M	L	-	H	-	-	-
H	H	M	H	L	-	-	-	M	L	-	H	-	-	-
L	H	-	H	L	-	-	-	L	L	-	H	-	-	-

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Introduction-Basic Terminology	Array	Stack ADT	General Trees	Graph Terminology
	SLO-2	Data Structures	Operations on Arrays – Insertion and Deletion	Stack Array Implementation	Tree Terminologies	Graph Traversal
S-2	SLO-1	Data Structure Operations	Applications on Arrays	Stack Linked List Implementation	Tree Representation	Topological sorting
	SLO-2	ADT	Multidimensional Arrays- Sparse Matrix	Applications of Stack- Infix to Postfix Conversion	Tree Traversal	Minimum spanning tree – Prims Algorithm
S-3	SLO-1	Algorithms – Searching techniques	Linked List Implementation - Insertion	Applications of Stack- Postfix Evaluation	Binary Tree Representation	Minimum Spanning Tree - Kruskal's Algorithm
	SLO-2	Complexity – Time , Space Trade off	Linked List- Deletion and Search	Applications of Stack- Balancing symbols	Expression Trees	Network flow problem
S-4-5	SLO-1	Lab 1: Implementation of Searching - Linear and Binary Search Techniques	Lab 4 :Implementation of Array – Insertion, Deletion.	Lab 7 :Implementation of stack using array and Linked List	Lab 10: Implementation of Tree using array	Lab 13: Implementation of Graph using Array
	SLO-2					
S-6	SLO-1	Algorithms - Sorting	Applications of Linked List	Applications of Stack- Nested Function Calls	Binary Tree Traversal	Shortest Path Algorithm- Introduction
	SLO-2	Complexity – Time , Space Trade off	Polynomial Arithmetic	Recursion concept using stack	Threaded Binary Tree	Shortest Path Algorithm: Dijkstra's Algorithm
S-7	SLO-1	Mathematical notations	Cursor Based Implementation – Methodology	Applications of Recursion:Tower of Hanoi	Binary Search Tree :Construction, Searching	Hashing: Hash functions - Introduction
	SLO-2	Asymptotic notations-Big O, Omega	Cursor Based Implementation	Queue ADT	Binary Search Tree : Insertion and Deletion	Hashing: Hash functions
S-8	SLO-1	Asymptotic notations - Theta	Circular Linked List	Queue Implementation using array	AVL Trees: Rotations	Hashing : Collision avoidance
	SLO-2	Mathematical functions	Circular Linked List - Implementation	Queue Implementation using Linked List	AVL Tree: Insertions	Hashing : Separate chaining
S-9-10	SLO-1	Lab 2: Implementation of sorting Techniques – Insertion sort and Bubble Sort Techniques	Lab 5: Implementation of Linked List - Cursor Based Implementation	Lab 8: Implementation of Queue using Array and linked list	Lab 11: Implementation of BST using linked list	Lab 14 :Implementation of Shortest path Algorithm
	SLO-2					

S-11	SLO-1	Data Structures and its Types	Applications of Circular List -Joseph Problem	Circular Queue	B-Trees Constructions	Open Addressing
	SLO-2	Linear and Non-Linear Data Structures	Doubly Linked List	Implementation of Circular Queue	B-Trees Search	Linear Probing
S-12	SLO-1	1D, 2D Array Initialization using Pointers	Doubly Linked List Insertion	Applications of Queue	B-Trees Deletions	Quadratic probing
	SLO-2	1D, 2D Array Accessing using Pointers	Doubly Linked List Insertion variations	Double ended queue	Splay Trees	Double Hashing
S-13	SLO-1	Declaring Structure and accessing	Doubly Linked List Deletion	Priority Queue	Red Black Trees	Rehashing
	SLO-2	Declaring Arrays of Structures and accessing	Doubly Linked List Search	Priority Queue - Applications	Red Black Trees Insertion	Extensible Hashing
S-14-15	SLO-1	Lab 3: Implement Structures using Pointers	Lab 6: Implementation of Doubly linked List	Lab 9: Applications of Stack, Queue	Lab 12: Implementation of B-Trees	Lab 15 :Implementation of Minimal Spanning Tree
	SLO-2					

Learning Resources	1. Seymour Lipschutz, Data Structures with C, McGraw Hill, 2014 2. R.F.Gilberg, B.A.Forouzan, Data Structures, 2 nd ed., Thomson India, 2005 3. A.V.Aho, J.E Hopcroft, J.D.Ullman, Data structures and Algorithms, Pearson Education, 2003 4. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2 nd ed., Pearson Education, 2015	5. Reema Thareja, Data Structures Using C, 1 st ed., Oxford Higher Education, 2011 6. Thomas H Cormen, Charles E Leiserson, Ronald L Revest, Clifford Stein, Introduction to Algorithms 3 rd ed., The MIT Press Cambridge, 2014

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
Total		100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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	3. Dr. Noor Mahammad, IIITDM, Kancheepuram, noor@iiitdm.ac.in	3. Ms. Ferni Ukrit, SRMIST

Course Code	18CSC202J	Course Name	OBJECT ORIENTED DESIGN AND PROGRAMMING	Course Category	C	Professional Core			
						L	T	P	C
						3	0	2	4

Pre-requisite Courses	18CSS101J	Co-requisite Courses	Nil	Progressive Courses	18CSC207J
Course Offering Department	Computer Science and Engineering			Data Book / Codes/Standards	Nil

Course Learning Rationale (CLR):		The purpose of learning this course is to:			Learning			Program Learning Outcomes (PLO)														
					1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1 :	Utilize class and build domain model for real-time programs				Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLR-2 :	Utilize method overloading and operator overloading for real-time application development programs																					
CLR-3 :	Utilize inline, friend and virtual functions and create application development programs																					
CLR-4 :	Utilize exceptional handling and collections for real-time object oriented programming applications																					
CLR-5 :	Construct UML component diagram and deployment diagram for design of applications																					
CLR-6 :	Create programs using object oriented approach and design methodologies for real-time application development																					
Course Learning Outcomes (CLO):		At the end of this course, learners will be able to:																				
CLO-1 :	Identify the class and build domain model				3	80	70	H	H	M	-	-	-	-	-	H	H	-	-	M	H	H
CLO-2 :	Construct programs using method overloading and operator overloading				3	85	75	H	H	H	H	H	-	M	-	H	H	-	-	M	H	H
CLO-3 :	Create programs using inline, friend and virtual functions, construct programs using standard templates				3	75	70	H	H	M	H	H	-	M	-	H	H	-	-	M	H	H
CLO-4 :	Construct programs using exceptional handling and collections				3	85	80	H	H	H	-	-	-	-	-	H	M	-	-	M	H	H
CLO-5 :	Create UML component diagram and deployment diagram				3	85	75	H	M	M	M	M	M	M	-	H	H	-	M	M	H	H
CLO-6 :	Create programs using object oriented approach and design methodologies				3	80	70	H	H	M	-	-	-	-	-	H	H	-	-	M	H	H

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Comparison of Procedural and Object Oriented Programming	Types of constructor (Default, Parameter)	Feature Inheritance: Single and Multiple	Generic - Templates : Introduction	STL: Containers: Sequence and Associative Container
	SLO-2	OOPS and its features	Static constructor and copy constructor	Inheritance: Multilevel	Function templates	
S-2	SLO-1	I/O Operations, Data Types, Variables, static	Feature Polymorphism: Constructor overloading	Inheritance: Hierarchical	Example programs Function templates	Sequence Container: Vector, List
	SLO-2	Constants, Pointers, Type Conversions	Method Overloading	Inheritance: Hybrid	Class Templates	Sequence Container: Deque, Array
S-3	SLO-1	Features: Class and Objects	Example for method overloading	Inheritance: Example Programs	Class Templates	STL : Stack
	SLO-2	UML Diagrams Introduction	Method Overloading: Different parameter with different return values		Example programs for Class and Function templates	
S 4-5	SLO-1	Lab 1: I/O operations	Lab 4: Constructor and Method overloading	Lab 7: Inheritance and its types	Lab 10: Templates	Lab 13: STL Containers
	SLO-2					
S-6	SLO-1	Feature :Class and Objects	Operator Overloading and types	Advanced Functions: Inline, Friend	Exceptional Handling: try and catch	Associative Containers: Map, Multimap
	SLO-2	Examples of Class and Objects	Overloading Assignment Operator	Advanced Functions: Virtual, Overriding	Exceptional Handling: Multilevel exceptional	
S-7	SLO-1	UML Class Diagram and its components	Overloading Unary Operators	Advanced Function: Pure Virtual function	Exceptional Handling: throw and throws	Iterator and Specialized Iterator
	SLO-2	Class Diagram relations and Multiplicity	Example for Unary Operator overloading	Example for Virtual and pure virtual function	Exceptional Handling: finally	Functions of Iterator
S-8	SLO-1	Feature Abstraction and Encapsulation	Overloading Binary Operators	Abstract class and Interface	Exceptional Handling: User defined exceptional	Algorithms: find(), count(), sort()
	SLO-2	Application of Abstraction and Encapsulation	Example for Binary Operator overloading	Example Program	Example Programs using C++	Algorithms: search(), merge()
S 9-10	SLO-1	Lab 2: Classes and Objects, Class Diagram	Lab 5: Polymorphism : Operators Overloading	Lab 8: Virtual Function and Abstract class	Lab 11: Exceptional Handling	Lab 15: STL Associative containers and algorithms
	SLO-2					
S-11	SLO-1	Access specifiers – public, private	UML Interaction Diagrams	UML State Chart Diagram	Dynamic Modeling: Package Diagram	Function Object : for_each(), transform()

	SLO-2	Access specifiers - protected, friend, inline	Sequence Diagram	UML State Chart Diagram	UML Component Diagram	Example for Algorithms
S-12	SLO-1	UML use case Diagram, use case, Scenario	Collaboration Diagram	Example State Chart Diagram	UML Component Diagram	Streams and Files: Introduction
	SLO-2	Use case Diagram objects and relations	Example Diagram	UML Activity Diagram	UML Deployment Diagram	Classes and Errors
S-13	SLO-1	Method, Constructor and Destructor	Feature: Inheritance	UML Activity Diagram	UML Deployment Diagram	Disk File Handling Reading Data and Writing Data
	SLO-2	Example program for constructor	Inheritance and its types	Example Activity Diagram	Example Package, Deployment, Package	
S 14-15	SLO-1 SLO-2	Lab 3: Methods and Constructor, Usecase	Lab 6: UML Interaction Diagram	Lab 9: State Chart and Activity Diagram	Lab12 : UML Component, Deployment, Package diagram	Lab15: Streams and File Handling

Learning Resources	1. Grady Booch, Robert A. Maksimchuk, Michael W. Engle, <i>Object-Oriented Analysis and Design with Applications</i> , 3 rd ed., Addison-Wesley, May 2007	4. Robert Lafore, <i>Object-Oriented Programming in C++</i> , 4 th ed., SAMS Publishing, 2008 5. Ali Bahrami, <i>Object Oriented Systems Development</i> , McGraw Hill, 2004 6. Craig Larmen, <i>Applying UML and Patterns</i> , 3 rd ed., Prentice Hall, 2004
	2. Reema Thareja, <i>Object Oriented Programming with C++</i> , 1 st ed., Oxford University Press, 2015 3. Sourav Sahay, <i>Object Oriented Programming with C++</i> , 2 nd ed., Oxford University Press, 2017	

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
Total		100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc

For the laboratory component the students are advised to take an application and apply the concepts

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. Girish Raghavan, Senior DMTS Member, Wipro Ltd.	1. Dr. Srinivasa Rao Bakshi, IITM Chennai, sbakshi@iitm.ac.in	1. Ms. C.G.Anupama, SRMIST
Ms. Thamichelvi, Solutions Architect, Wipro Ltd	2. Dr. Ramesh Babu, N, IITM Chennai, nrbabu@iitm.ac.in	2. Mr. C.Arun, SRMIST
		3. Mr. Geogen George, SRMIST
		4. Mr. Muthukumaran, SRMIST

Course Code	18CSC203J	Course Name	COMPUTER ORGANIZATION AND ARCHITECTURE	Course Category	C	Professional Core			
						L	T	P	C
						3	0	2	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	18CSC207J
Course Offering Department	Computer Science and Engineering			Data Book / Codes/Standards	Nil

Course Learning Rationale (CLR):		<i>The purpose of learning this course is to:</i>		Learning			Program Learning Outcomes (PLO)														
CLR-1 :		<i>Utilize the functional units of a computer</i>		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2 :		<i>Analyze the functions of arithmetic Units like adders, multipliers etc.</i>		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLR-3 :		<i>Understand the concepts of Pipelining and basic processing units</i>																			
CLR-4 :		<i>Study about parallel processing and performance considerations.</i>																			
CLR-5 :		<i>Have a detailed study on Input-Output organization and Memory Systems.</i>																			
CLR-6 :		<i>Simulate simple fundamental units like half adder, full adder etc</i>																			
Course Learning Outcomes (CLO):		<i>At the end of this course, learners will be able to:</i>																			
CLO-1 :		<i>Identify the computer hardware and how software interacts with computer hardware</i>		2	80	70	H	H	-	-	-	-	-	-	M	L	-	M	-	-	-
CLO-2 :		<i>Apply Boolean algebra as related to designing computer logic, through simple combinational and sequential logic circuits</i>		3	85	75	H	H	H	-	H	-	-	-	M	L	-	M	-	-	-
CLO-3 :		<i>Analyze the detailed operation of Basic Processing units and the performance of Pipelining</i>		2	75	70	H	H	H	H	-	-	-	-	M	L	-	M	-	-	-
CLO-4 :		<i>Analyze concepts of parallelism and multi-core processors.</i>		3	85	80	H	-	-	H	-	-	-	-	M	L	-	M	-	-	-
CLO-5 :		<i>Identify the memory technologies, input-output systems and evaluate the performance of memory system</i>		3	85	75	H	-	H	H	-	-	-	-	M	L	-	M	-	-	-
CLO-6 :		<i>Identify the computer hardware, software and its interactions</i>		3	85	75	H	H	H	H	H	-	-	-	M	L	-	M	-	-	-

Duration (hour)	15	15	15	15	15
S-1	SLO-1	Functional Units of a computer	Addition and subtraction of Signed numbers	Fundamental concepts of basic processing unit	Parallelism
	SLO-2	Operational concepts	Problem solving	Performing ALU operation	Need, types of Parallelism
S-2	SLO-1	Bus structures	Design of fast adders	Execution of complete instruction, Branch instruction	applications of Parallelism
	SLO-2	Memory locations and addresses	Ripple carry adder and Carry look ahead adder	Multiple bus organization	Parallelism in Software
S-3	SLO-1	Memory operations	Multiplication of positive numbers	Hardwired control	Instruction level parallelism
	SLO-2	Memory operations	Problem Solving	Generation of control signals	Data level parallelism
S-4-5	SLO-1	Lab 1: To recognize various components of PC-Input Output systems	Lab4:Study of TASM	Lab-7: Design of Half Adder	Lab-10: Study of Array Multiplier
	SLO-2	Processing and Memory units	Addition and Subtraction of 8-bit number	Design of Full Adder	Design of Array Multiplier
S-6	SLO-1	Instructions, Instruction sequencing	Signed operand multiplication	Micro-programmed control-	Challenges in parallel processing
	SLO-2	Addressing modes	Problem solving	Microinstruction	Architectures of Parallel Systems - Flynn's classification
S-7	SLO-1	Problem solving	Fast multiplication- Bit pair recoding of Multipliers	Micro-program Sequencing	SISD,SIMD
	SLO-2	Introduction to Microprocessor	Problem Solving	Micro instruction with Next address field	MIMD, MISD
S-8	SLO-1	Introduction to Assembly language	Carry Save Addition of summands	Basic concepts of pipelining	Hardware multithreading
	SLO-2	Writing of assembly language programming	Problem Solving	Pipeline Performance	Coarse Grain parallelism, Fine Grain parallelism

S 9-10	SLO-1	Lab-2: To understand how different components of PC are connected to work properly	Lab 5: Addition of 16-bit number Subtraction of 16-bit number	Lab-8: Study of Ripple Carry Adder Design of Ripple Carry Adder	Lab-11: Study of Booth Algorithm	Lab-14: Understanding Processing unit Design of primitive processing unit
	SLO-2	Assembling of System Components				
S-11	SLO-1	ARM Processor: The thumb instruction set	Integer division – Restoring Division	Pipeline Hazards-Data hazards	Uni-processor and Multiprocessors	Input Output Organization
	SLO-2	Processor and CPU cores	Solving Problems	Methods to overcome Data hazards	Multi-core processors	Need for Input output devices
S-12	SLO-1	Instruction Encoding format	Non Restoring Division	Instruction Hazards	Multi-core processors	Memory mapped IO
	SLO-2	Memory load and Store instruction in ARM	Solving Problems	Hazards on conditional and Unconditional Branching	Memory in Multiprocessor Systems	Program controlled IO
S-13	SLO-1	Basics of IO operations.	Floating point numbers and operations	Control hazards	Cache Coherency in Multiprocessor Systems	Interrupts-Hardware, Enabling and Disabling Interrupts
	SLO-2	Basics of IO operations.	Solving Problems	Influence of hazards on instruction sets	MESI protocol for Multiprocessor Systems	Handling multiple Devices
S 14-15	SLO-1	Lab -3 To understand how different components of PC are connected to work properly	Lab-6: Multiplication of 8-bit number Factorial of a given number	Lab-9: Study of Carry Look-ahead Adder Design of Carry Look-ahead Adder	Lab-12: Program to carry out Booth Algorithm	Lab-15: Understanding Pipeline concepts Design of basic pipeline.
	SLO-2	Disassembling of System Components				

Learning Resources	1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer Organization, 5 th ed., McGraw-Hill, 2015 2. Kai Hwang, Faye A. Briggs, Computer Architecture and Parallel Processing, 3 rd ed., McGraw Hill, 2016 3. Ghosh T. K., Computer Organization and Architecture, 3 rd ed., Tata McGraw-Hill, 2011 4. P. Hayes, Computer Architecture and Organization, 3 rd ed., McGraw Hill, 2015.	5. William Stallings, Computer Organization and Architecture – Designing for Performance, 10 th ed., Pearson Education, 2015 6. David A. Patterson and John L. Hennessy Computer Organization and Design - A Hardware software interface, 5 th ed., Morgan Kaufmann, 2014
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Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
	Total	100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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		2. Dr. C. Malathy, SRMIST
		3. Mrs M.S. Abirami, SRMIST

Course Code	18CSC204J	Course Name	DESIGN AND ANALYSIS OF ALGORITHMS	Course Category	C	Professional Core			
						L	T	P	C
						3	0	2	4

Pre-requisite Courses	18CSC201J, 18CSC202J	Co-requisite Courses	18CSC207J	Progressive Courses	Nil
Course Offering Department	Computer Science and Engineering			Data Book / Codes/Standards	Nil

Course Learning Rationale (CLR):		The purpose of learning this course is to:		
CLR-1 :	Design efficient algorithms in solving complex real time problems			
CLR-2 :	Analyze various algorithm design techniques to solve real time problems in polynomial time			
CLR-3 :	Utilize various approaches to solve greedy and dynamic algorithms			
CLR-4 :	Utilize back tracking and branch and bound paradigms to solve exponential time problems			
CLR-5 :	Analyze the need of approximation and randomization algorithms, utilize the importance Non polynomial algorithms			
CLR-6 :	Construct algorithms that are efficient in space and time complexities			
Course Learning Outcomes (CLO):		At the end of this course, learners will be able to:		
CLO-1 :	Apply efficient algorithms to reduce space and time complexity of both recurrent and non-recurrent relations			
CLO-2 :	Solve problems using divide and conquer approaches			
CLO-3 :	Apply greedy and dynamic programming types techniques to solve polynomial time problems.			
CLO-4 :	Create exponential problems using backtracking and branch and bound approaches.			
CLO-5 :	Interpret various approximation algorithms and interpret solutions to evaluate P type, NP Type, NPC, NP Hard problems			
CLO-6 :	Create algorithms that are efficient in space and time complexities by using divide conquer, greedy, backtracking technique			

Learning			
Level of Thinking (Bloom)	1	2	3
Expected Proficiency (%)			
Expected Attainment (%)			

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Engineering Knowledge														
Problem Analysis														
Design & Development														
Analysis, Design, Research														
Modern Tool Usage														
Society & Culture														
Environment & Sustainability														
Ethics														
Individual & Team Work														
Communication														
Project Mgt. & Finance														
Life Long Learning														
PSO - 1														
PSO - 2														
PSO - 3														

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Introduction-Algorithm Design	Introduction-Divide and Conquer	Introduction-Greedy and Dynamic Programming	Introduction to backtracking - branch and bound	Introduction to randomization and approximation algorithm
	SLO-2	Fundamentals of Algorithms	Maximum Subarray Problem	Examples of problems that can be solved by using greedy and dynamic approach	N queen's problem - backtracking	Randomized hiring problem
S-2	SLO-1	Correctness of algorithm	Binary Search	Huffman coding using greedy approach	Sum of subsets using backtracking	Randomized quick sort
	SLO-2	Time complexity analysis	Complexity of binary search	Comparison of brute force and Huffman method of encoding	Complexity calculation of sum of subsets	Complexity analysis
S-3	SLO-1	Insertion sort-Line count, Operation count	Merge sort	Knapsack problem using greedy approach	Graph introduction	String matching algorithm
	SLO-2	Algorithm Design paradigms	Time complexity analysis	Complexity derivation of knapsack using greedy	Hamiltonian circuit - backtracking	Examples
S-4-5	SLO-1	Lab 1: Simple Algorithm-Insertion sort	Lab 4: Quicksort, Binary search	Lab 7: Huffman coding, knapsack and using greedy	Lab 10: N queen's problem	Lab 13: Randomized quick sort
	SLO-2					
S-6	SLO-1	Designing an algorithm	Quick sort and its Time complexity analysis	Tree traversals	Branch and bound - Knapsack problem	Rabin Karp algorithm for string matching
	SLO-2	And its analysis-Best, Worst and Average case	Best case, Worst case, Average case analysis	Minimum spanning tree - greedy Kruskal's algorithm - greedy	Example and complexity calculation. Differentiate with dynamic and greedy	Example discussion
S-7	SLO-1	Asymptotic notations Based on growth functions.	Strassen's Matrix multiplication and its recurrence relation	Minimum spanning tree - Prims algorithm	Travelling salesman problem using branch and bound	Approximation algorithm
	SLO-2	$O, O(\Theta), \omega, \Omega$	Time complexity analysis of Merge sort	Introduction to dynamic programming	Travelling salesman problem using branch and bound example	Vertex covering
S-8	SLO-1	Mathematical analysis	Largest sub-array sum	0/1 knapsack problem	Travelling salesman problem using branch and bound example	Introduction Complexity classes
	SLO-2	Induction, Recurrence relations	Time complexity analysis of Largest sub-array sum	Complexity calculation of knapsack problem	Time complexity calculation with an example	P type problems
S-9-10	SLO-1	Lab 2: Bubble Sort	Lab 5: Strassen Matrix multiplication	Lab 8: Various tree traversals, Krukshall's MST	Lab 11: Travelling salesman problem	Lab 14: String matching algorithms
	SLO-2					

S-11	SLO-1	Solution of recurrence relations	Master Theorem Proof	Matrix chain multiplication using dynamic programming	Graph algorithms	Introduction to NP type problems
	SLO-2	Substitution method	Master theorem examples	Complexity of matrix chain multiplication	Depth first search and Breadth first search	Hamiltonian cycle problem
S-12	SLO-1	Solution of recurrence relations	Finding Maximum and Minimum in an array	Longest common subsequence using dynamic programming	Shortest path introduction	NP complete problem introduction
	SLO-2	Recursion tree	Time complexity analysis-Examples	Explanation of LCS with an example	Floyd-Warshall Introduction	Satisfiability problem
S-13	SLO-1	Solution of recurrence relations	Algorithm for finding closest pair problem	Optimal binary search tree (OBST) using dynamic programming	Floyd-Warshall with sample graph	NP hard problems
	SLO-2	Examples	Convex Hull problem	Explanation of OBST with an example.	Floyd-Warshall complexity	Examples
S-14-15	SLO-1	Lab 3: Recurrence Type-Merge sort, Linear search	Lab 6: Finding Maximum and Minimum in an array, Convex Hull problem	Lab 9: Longest common subsequence	Lab 12: BFS and DFS implementation with array	Lab 15: Discussion over analyzing a real time problem
	SLO-2					

Learning Resources	1. Thomas H Cormen, Charles E Leiserson, Ronald L. Rivest, Clifford Stein, Introduction to Algorithms, 3 rd ed., The MIT Press Cambridge, 2014	3. Ellis Horowitz, Sartaj Sahni, Sanguthevar, Rajesekaran, Fundamentals of Computer Algorithms, Galgotia Publication, 2010
	2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2 nd ed., Pearson Education, 2006	4. S. Sridhar, Design and Analysis of Algorithms, Oxford University Press, 2015

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
	Total	100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. G. Venkateswaran, Wipro Technologies, gvenki@pilani.bits-pilani.ac.in	1. Mitesh Khapra, IITM Chennai, miteshk@cse.iitm.ac.in	1. Mr.K.Senthil Kumar, SRMIST
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		3. Mr. V. Sivakumar, SRMIST
		4. Ms. R. Vidhya, SRMIST

Course Code	18CSC205J	Course Name	OPERATING SYSTEMS	Course Category	C	Professional Core				L	T	P	C
										3	0	2	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computer Science and Engineering		Data Book / Codes/Standards	Nil	

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning			Program Learning Outcomes (PLO)														
CLR-1:	Introduce the key role of an Operating system	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2:	Insist the Process Management functions of an Operating system	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLR-3:	Emphasize the importance of Memory Management concepts of an Operating system																		
CLR-4:	Realize the significance of Device Management part of an Operating system																		
CLR-5:	Comprehend the need of File Management functions of an Operating system																		
CLR-6:	Explore the services offered by the Operating system practically																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1:	Identify the need of an Operating system	1	80	70	H	H	H	H	H	M	L	M	H	M	M	H	H	H	M
CLO-2:	Know the Process management functions of an Operating system	1	85	75	H	H	H	H	H	M	L	M	H	M	M	H	H	H	M
CLO-3:	Understand the need of Memory Management functions of an Operating system	1	75	70	H	H	H	H	H	M	L	M	H	M	M	H	H	H	M
CLO-4:	Find the significance of Device management role of an Operating system	2	85	80	H	H	H	H	H	M	L	M	H	M	M	H	H	H	M
CLO-5:	Recognize the essentials of File Management part of an Operating system	2	85	75	H	H	H	H	H	M	L	M	H	M	M	H	H	H	M
CLO-6:	Gain an insight of Importance of an Operating system through practical	3	80	70	H	H	H	H	H	M	L	M	H	M	M	H	H	H	M

Duration (hour)	15	15	15	15	15
S-1	SLO-1	Operating System Objectives and functions	PROCESS SYNCHRONIZATION : Peterson's solution, Synchronization Hardware	MEMORY MANAGEMENT: Memory Management: Logical Vs Physical address space, Swapping	VIRTUAL MEMORY- Background
	SLO-2	Gaining the role of Operating systems	Understanding the two-process solution and the benefits of the synchronization hardware	Understanding the basics of Memory management	Understanding the need of demand paging
S-2	SLO-1	The evolution of operating system, Major achievements	Process synchronization: Semaphores, usage, implementation	Contiguous Memory allocation – Fixed and Dynamic partition	VIRTUAL MEMORY – Basic concepts – page fault handling
	SLO-2	Understanding the evolution of Operating systems from early batch processing systems to modern complex systems	Gaining the knowledge of the usage of the semaphores for the Mutual exclusion mechanisms	Getting to know about Partition memory management and issues: Internal fragmentation and external fragmentation problems	Understanding , how an OS handles the page faults
S-3	SLO-1	OS Design considerations for Multiprocessor and Multicore	Classical Problems of synchronization – Readers writers problem, Bounded Buffer problem	Strategies for selecting free holes in Dynamic partition	Performance of Demand paging
	SLO-2	Understanding the key design issues of Multiprocessor Operating systems and Multicore Operating systems	Good understanding of synchronization mechanisms	Understanding the allocation strategies with examples	Understanding the relationship of effective access time and the page fault rate
S 4-5	SLO-1	LAB 1 : Understanding the booting process of Linux	LAB4 : System admin commands – Basics	LAB7: Shell Programs – Basic level	LAB10 : Overlay concept
S-6	SLO-1	PROCESS CONCEPT- Processes, PCB	Classical Problems of synchronization – Dining Philosophers problem (Monitor)	Paged memory management	Copy-on write
	SLO-2	Understanding the Process concept and Maintenance of PCB by OS	Understanding the synchronization of limited resources among multiple processes	Understanding the Paging technique.PMT hardware mechanism	Understanding the need for Copy-on write
S-7	SLO-1	Threads – Overview and its Benefits	CPU SCHEDULING : FCFS,SJF,Priority	Structure of Page Map Table	Page replacement Mechanisms: FIFO, Optimal, LRU and LRU approximation Techniques
	SLO-2	Understanding the importance of threads	Understanding the scheduling techniques	Understanding the components of PMT	Understanding the Pros and cons of the

					page replacement techniques	
S-8	SLO-1	Process Scheduling : Scheduling Queues, Schedulers, Context switch	CPU Scheduling: Round robin, Multilevel queue Scheduling, Multilevel feedback Scheduling	Example : Intel 32 bit and 64 –bit Architectures	Counting based page replacement and Page Buffering Algorithms	Directory Implementation
	SLO-2	Understanding basics of Process scheduling	Understanding the scheduling techniques	Understanding the Paging in the Intel architectures	To know on additional Techniques available for page replacement strategies	Understanding the various levels of directory structure
S 9-10	SLO-1	LAB2 : Understanding the Linux file system	LAB5: System admin commands – Simple task automations	LAB 8:Process Creation	LAB11: IPC using Pipes	LAB14 : Study of OS161
	SLO-2					
S-11	SLO-1	Operations on Process – Process creation, Process termination	Real Time scheduling: Rate Monotonic Scheduling and Deadline Scheduling	Example : ARM Architectures	Allocation of Frames - Global Vs Local Allocation	FILE SYSTEM IMPLEMENTATION :Allocation methods
	SLO-2	Understanding the system calls – fork(),wait(),exit()	Understanding the real time scheduling	Understanding the Paging with respect to ARM	Understanding the root cause of the Thrashing	Understanding the pros and Cons of various disk allocation methods
S-12	SLO-1	Inter Process communication : Shared Memory, Message Passing ,Pipe()	DEADLOCKS: Necessary conditions, Resource allocation graph, Deadlock prevention methods	Segmented memory management	Thrashing, Causes of Thrashing	FILE SYSTEM IMPLEMENTATION :Free space Management
	SLO-2	Understanding the need for IPC	Understanding the deadlock scenario	Understanding the users view of memory with respect to the primary memory	Understanding the Thrashing	Understanding the methods available for maintaining the free spaces in the disk
S-13	SLO-1	PROCESS SYNCHRONIZATION: Background, Critical section Problem	Deadlocks :Deadlock Avoidance, Detection and Recovery	Paged segmentation Technique	Working set Model	Swap space Management
	SLO-2	Understanding the race conditions and the need for the Process synchronization	Understanding the deadlock avoidance, detection and recovery mechanisms	Understanding the combined scheme for efficient management	Understanding the working set model for controlling the Working set Model	Understanding the Low-level task of the OS
S 14-15	SLO-1	LAB3: Understanding the various Phases of Compilation of a 'C' Program	LAB6 : Linux commands	LAB9: Overlay concept	LAB12: IPC using shared memory and Message queues	LAB15 : Understanding the OS161 filesystem and working with test programs
	SLO-2					

Learning Resources	1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating systems, 9 th ed., John Wiley & Sons, 2013	3. Andrew S.Tanenbaum, Herbert Bos, Modern Operating systems, 4 th ed., Pearson, 2015
	2. William Stallings, Operating Systems-Internals and Design Principles, 7 th ed., Prentice Hall, 2012	4. Bryant O'Hallaxn, Computer systems- A Programmer's Perspective,Pearson, 2015

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
Total		100 %		100 %		100 %		100 %		-	

Course Designers			
Experts from Industry		Experts from Higher Technical Institutions	
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		Internal Experts	
		1. Dr.G.Maragatham, SRMIST	3. Ms. Aruna S, SRMIST
		2. Mr. Eliazar M, SRMIST	

Course Code	18CSC206J	Course Name	SOFTWARE ENGINEERING AND PROJECT MANAGEMENT	Course Category	C	Professional Core				L	T	P	C
										3	0	2	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computer Science and Engineering			Data Book / Codes/Standards	Nil

Course Learning Rationale (CLR):		The purpose of learning this course is to:			Learning			Program Learning Outcomes (PLO)														
CLR-1 :		Familiarize the software life cycle models and software development process			1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2 :		Understand the various techniques for requirements, planning and managing a technology project			Level of Thinking (Bloom) Expected Proficiency (%) Expected Attainment (%)			Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLR-3 :		Examine basic methodologies for software design, development, testing, closure and implementation																				
CLR-4 :		Understand manage users expectations and the software development team																				
CLR-5 :		Acquire the latest industry knowledge, tools and comply to the latest global standards for project management																				
Course Learning Outcomes (CLO):		At the end of this course, learners will be able to:																				
CLO-1 :		Identify the process of project life cycle model and process			1	85	80	H	H	L	-	-	-	L	-	H	H	M	M	-	-	-
CLO-2 :		Analyze and specify software requirements through a productive working Relationship with project stakeholders			2	80	75	H	H	H	H	-	M	-	H	H	M	H	M	-	-	-
CLO-3 :		Design the system based on Functional Oriented and Object Oriented Approach for Software Design.			3	85	85	H	H	M	H	H	M	M	L	H	H	M	-	-	-	-
CLO-4 :		Develop the correct and robust code for the software products			3	85	85	H	H	H	-	H	-	-	M	H	M	H	-	-	-	-
CLO-5 :		Perform by applying the test plan and various testing techniques			2	85	75	H	M	M	M	M	M	M	-	H	H	-	M	-	-	-

Duration (hour)	15		15	15	15	15
S-1	SLO-1	Introduction to Software Engineering	Software Design - Software Design Fundamentals	Software Construction	Introduction to testing	Product Release
	SLO-2	Software Project Management - life cycle activities	Design Standards - Design Type	Coding Standards	Verification	Product Release
S-2	SLO-1	Traditional – Waterfall, V Model	Design model – Architectural design, Software architecture	Coding Framework	Validation	Product Release Management
	SLO-2	Prototype, Spiral, RAD	Software Design Methods	Reviews - Desk checks (Peer Reviews)	Test Strategy	Product Release Management
S-3	SLO-1	Conventional – Agile,	Top Down , Bottom Up	Walkthroughs	Planning	Implementation
	SLO-2	XP, Scrum	Module Division (Refactoring)	Code Reviews, Inspections	Example: Test Strategy and Planning	Implementation
S 4-5	SLO-1	Lab1:Identify the Software Project, Create Business Case, Arrive at a Problem Statement	Lab 4:Prepare Project Plan based on scope, Find Job roles and responsibilities, Calculate Project effort based on resources	Lab 7:State and Sequence Diagram, Deployment Diagram, Sample Frontend Design (UI/UX)	Lab 10: Module Implementation (Phase 2), Scrum Master to Induce New Issues in Agile Development	Lab 13:Manual Testing
	SLO-2					
S-6	SLO-1	Introduction to Requirement Engineering	Module Coupling	Coding Methods	Test Project Monitoring and Control	User Training
	SLO-2	Requirements Elicitation	Component level design	Structured Programming	Test Project Monitoring and Control	Maintenance Introduction
S-7	SLO-1	Software Project Effort and cost estimation	User Interface Design	Object-Oriented Programming	Test Project Monitoring and Control	Maintenance Types - Corrective
	SLO-2	Cost estimation	Pattern oriented design	Automatic Code Generation	Test Project Monitoring and Control	Adaptive
S-8	SLO-1	Cocoma 1 and 2	Web application design	Automatic Code Generation	Test Project Monitoring and Control	Perfective
	SLO-2	Cocoma 1 and 2	Web application design	Automatic Code Generation	Test Project Monitoring and Control	Preventive
S 9-10	SLO-1	Lab 2:Stakeholder and User Description, Identify the appropriate Process Model, Comparative study with Agile Model	Lab 5:Prepare the Work, Breakdown Structure based on timelines, Risk Identification and Plan	Lab 8:Module Description, Module Implementation (phase 1) Using Agile	Lab 11:Module Implementation (Phase 3) Scrum Master to Induce New requirements in Agile Development, Scrum Master to Induce New Issues in Agile Development, Code Documentation	Lab 14:User Manual, Analysis of Costing, Effort and Resources
	SLO-2					
S-11	SLO-1	Risk Management	Design Reuse	Software Code Reuse	Design –Master test plan, types	Maintenance Cost
	SLO-2	Risk Management	Design Reuse	Software Code Reuse	Design –Master test plan, types	Maintenance Process
S-12	SLO-1	Configuration management	Concurrent Engineering in Software Design	Pair Programming	Test Case Management	life cycle
	SLO-2	Configuration management	Concurrent Engineering in Software Design	Test-Driven Development	Test Case Management	Software Release

S-13	SLO-1	Project Planning – WBC, planning,	Design Life-Cycle Management	Configuration Management	Test Case Reporting	Software Maintenance
	SLO-2	scope, risk	Design Life-Cycle Management	Software Construction Artifacts	Test Case Reporting	Software Release, Software Maintenance
S 14-15	SLO-1	Lab 3: Identify the Requirements, System Requirements, Functional Requirements, Non-Functional Requirements	Lab 6: Design a System Architecture, Use Case Diagram, ER Diagram (Database), DFD Diagram (process) (Upto Level 1), Class Diagram (Applied For OOPS based Project), Collaboration Diagram (Applied For OOPS based Project) (Software – Rational Rose)	Lab 9: Module Implementation, Scrum Master to Induce New requirements in Agile Development	Lab 12: Master Test Plan, Test Case Design (Phase 1)	Lab 15: Project Demo and Report Submission with the team
	SLO-2					

Learning Resources	1. Roger S. Pressman, Software Engineering – A Practitioner Approach, 6 th ed., McGraw Hill, 2005	5. Ashfaque Ahmed, Software Project Management: a process-driven approach, Boca Raton, Fla: CRC Press, 2012
	2. Ian Sommerville, Software Engineering, 8 th ed., Pearson Education, 2010	
	3. Rajib Mall, Fundamentals of Software Engineering, 4 th ed., PHI Learning Private Limited, 2014	
	4. Ramesh, Gopalaswamy, Managing Global Projects, Tata McGraw Hill, 2005	
	6. Walker Royce, Software Project Management, Pearson Education, 1999	7. Jim Smith Agile Project Management: Creating Innovative Products, Pearson 2008
	7. Jim Smith Agile Project Management: Creating Innovative Products, Pearson 2008	

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
Total		100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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2. Dr. Mariappan Valthilingam, Amazon, Bangalore	2. V. Masilamani. IIITDM, masila@iiitdm.ac.in	2. Dr. T.S. Shiny Angel, SRMIST
		3. Mr. N. Arivazhagan, SRMIST
		4. Mrs. K.R. Jansi, SRMIST

Course Code	18CSC207J	Course Name	ADVANCED PROGRAMMING PRACTICE	Course Category	C	Professional Core			
						L	T	P	C
						3	0	2	4

Pre-requisite Courses	18CSC202J	Co-requisite Courses	18CSC204J	Progressive Courses	Nil
Course Offering Department	Computer Science and Engineering		Data Book / Codes/Standards	Nil	

Course Learning Rationale (CLR):		The purpose of learning this course is to:			Learning			Program Learning Outcomes (PLO)																
CLR-1 :	Create Real-time Application Programs using structured, procedural and object oriented programming paradigms	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
CLR-2 :	Create Real-time Application Programs using event driven, declarative and imperative programming paradigms																							
CLR-3 :	Create Real-time Application Programs using parallel, concurrent and functional programming paradigms																							
CLR-4 :	Create Real-time Application Programs using logic, dependent type and network programming paradigms																							
CLR-5 :	Create Real-time Application Programs using symbolic, automata based and graphical user interface program paradigm																							
CLR-6 :	Create Real-time Application Programs using different programming paradigms using python language																							
Course Learning Outcomes (CLO):		At the end of this course, learners will be able to:																						
CLO-1 :	Create Programs using structured, procedural and object oriented programming paradigms				3	85	80	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3		
CLO-2 :	Create Programs using event driven, declarative and imperative programming paradigms				3	85	80	H	H	H	H	H	-	-	L	M	M	L	M	-	M	-		
CLO-3 :	Create Programs using parallel, concurrent and functional programming paradigms				3	85	80	H	H	H	H	H	-	-	L	M	M	L	M	-	-	-		
CLO-4 :	Create Programs using logic, dependent type and network programming paradigms				3	85	80	H	H	H	H	H	-	-	L	M	M	L	M	-	-	-		
CLO-5 :	Create Programs using symbolic, automata based and graphical user interface programming paradigms				3	85	80	H	H	H	H	H	-	-	L	M	M	L	M	-	-	-		
CLO-6 :	Create Programs using different programming paradigms using python language				3	85	80	H	H	H	H	H	-	-	L	M	M	L	M	-	-	-		

Duration (hour)	15	15	15	15	15
S-1	SLO-1 Structured Programming Paradigm	Event Driven Programming Paradigm	Parallel Programming Paradigm	Logic Programming Paradigm	Symbolic Programming Paradigm
	SLO-2 Programming Language Theory	Event Object, handler, bind	Multi-threading, Multi-Processing	First-class function, Higher-order function, Pure functions, Recursion	Symbolic Maths, algebraic manipulations, limits, differentiation, integration, series
S-2	SLO-1 Bohm-Jacopini structured program theorem	Keypress events, Mouse events	Serial Processing, Parallel Processing	Packages: Kanren, SymPy	SymPy usage for symbolic maths
	SLO-2 Sequence, selection, decision, iteration, recursion	Automatic events from a timer	Multiprocessing module in Python	PySWIP, PyDatalog	Equation Solving, Matrices
S-3	SLO-1 Other languages: C, C++, Java, C#, Ruby	Other languages: Algol, Javascript, Elm	Process class, Pool class	Other languages: Prolog, ROOP, Janus	Other languages: Aurora, LISP, Wolfram
	SLO-2 Demo: Structured Programming in Python	Demo: Event Driven Programming in Python	Demo: Parallel Programming in Python	Demo: Logic Programming in Python	Demo: Symbolic Programming in Python
S 4-5	SLO-1 Lab 1: Structured Programming	Lab 4: Event Driven Programming	Lab 7: Parallel Programming	Lab 10: Logic Programming	Lab 13: Symbolic Programming
	SLO-2				
S-6	SLO-1 Procedural Programming Paradigm	Declarative Programming Paradigm	Concurrent Programming Paradigm	Dependent Type Programming Paradigm	Automata Based Programming Paradigm
	SLO-2 Routines, Subroutines, functions	Sets of declarative statements	Parallel Vs Concurrent Programming	Logic Quantifier: for all, there exists	Finite State Machine, deterministic finite automaton (dfa), nfa
S-7	SLO-1 Using Functions in Python	Object attribute, Binding behavior	threading, multiprocessing	Dependent functions, dependent pairs	State transitions using python-automaton
	SLO-2 logical view, control flow of procedural programming in various aspects	Creating Events without describing flow	concurrent.futures, gevent, greenlets, celery	Relation between data and its computation	Initial state, destination state, event (transition)
S-8	SLO-1 Other languages: Bliss, ChuckK, Matlab	Other languages: Prolog, Z3, LINQ, SQL	Other languages: ANI, Plaid	Other Languages: Idris, Agda, Coq	Other languages: Forth, Ragel, SCXML
	SLO-2 Demo: creating routines and subroutines using functions in Python	Demo: Declarative Programming in Python	Demo: Concurrent Programming in Python	Demo: Dependent Type Programming in Python	Demo: Automata Based Programming in Python
S 9-10	SLO-1 Lab 2: Procedural Programming	Lab 5: Declarative Programming	Lab 8: Concurrent Programming	Lab 11: Dependent Type Programming	Lab 14: Automata Programming
	SLO-2				
S-11	SLO-1 Object Oriented Programming Paradigm	Imperative Programming Paradigm	Functional Programming Paradigm	Network Programming Paradigm	GUI Programming Paradigm
	SLO-2 Class, Objects, Instances, Methods	Program State, Instructions to change the program state	Sequence of Commands	Socket Programming: TCP & UDP Connection oriented, connectionless	Graphical User Interface (GUI)

S-12	SLO-1	Encapsulation, Data Abstraction	Combining Algorithms and Data Structures	map(), reduce(), filter(), lambda	Sock_Stream, Sock_Dgram, socket(), bind(), recvfrom(), sendto(), listen()	Tkinter, WxPython, JPython
	SLO-2	Polymorphism, Inheritance	Imperative Vs Declarative Programming	partial, functools	Server-Client: send(), recv(), connect(), accept(), read(), write(), close()	WxWidgets, PyQt5
S-13	SLO-1	Constructor, Destructor	Other languages: PHP, Ruby, Perl, Swift	Other languages: F#, Clojure, Haskell	Other languages: PowerShell, Bash, TCL	Other languages: GTK, java-gnome
	SLO-2	Example Languages: BETA, Cecil, Lava Demo: OOP in Python	Demo: Imperative Programming in Python	Demo: Functional Programming in Python	Demo: Socket Programming in Python	Demo: GUI Programming in Python
S-14-15	SLO-1 SLO-2	Lab 3: Object Oriented Programming	Lab 6: Imperative Programming	Lab 9: Functional Programming	Lab 12: Network Programming	Lab 15: GUI Programming

Learning Resources	1. Elad Shalom, A Review of Programming Paradigms throughout the History: With a suggestion Toward a Future Approach, Kindle Edition, 2018	4. Amit Saha, Doing Math with Python: Use Programming to Explore Algebra, Statistics, Calculus and More, Kindle Edition, 2015
	2. John Goerzen, Brandon Rhodes, Foundations of Python Network Programming: The comprehensive guide to building network applications with Python, 2 nd ed., Kindle Edition, 2010	5. Alan D Moore, Python GUI Programming with Tkinter: Develop responsive and powerful GUI applications with Tkinter, Kindle Edition, 2018
	3. Elliot Forbes, Learning Concurrency in Python: Build highly efficient, robust and concurrent applications, Kindle Edition, 2017	6. https://www.scipy-lectures.org/

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
Level 1	Remember	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
	Understand	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
Total		100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry		Experts from Higher Technical Institutions
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2. Mr. Janmajay Singh, Fuji Xerox R&D, Japan, janmajaysingh14@gmail.com		2. Prof. R. Golda Brunet, GCE, goldabrunet@gcessalem.edu.in
		3. Ms. K. Sornalakshmi, SRMIST
		4. Mr. C. Arun, SRMIST

Course Code	18CSC301T	Course Name	FORMAL LANGUAGE AND AUTOMATA	Course Category	C	Professional Core	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computer Science and Engineering			Data Book / Codes/Standards	Nil
Course Learning Rationale (CLR):	The purpose of learning this course is to:			Learning	Program Learning Outcomes (PLO)
CLR-1 :	Utilize the mathematics and engineering principles for the basics of Formal Language			1 2 3	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
CLR-2 :	Acquire knowledge of Automata and minimize with Regular language's			Level of Thinking (Bloom) Expected Proficiency (%) Expected Attainment (%)	Engineering Knowledge Problem Analysis Design & Development Analysis, Design, Research Modern Tool Usage Society & Culture Environment & Sustainability Ethics Individual & Team Work Communication Project Mgt. & Finance Life Long Learning PSO - 1 PSO - 2 PSO - 3
CLR-3 :	Acquire knowledge of Context free Grammar and simplify using normal forms				
CLR-4 :	Gain knowledge to push down automata and apply it with CFL				
CLR-5 :	Analyze the methods of turning machine				
CLR-6 :	Analyze and Design the methods of computational complexity				
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:				
CLO-1 :	Acquire the knowledge of mathematics and engineering principles for the basics of Formal Language				M H - H L - - - L L - - H - - -
CLO-2 :	Acquire the ability to identify specification of a Regular language's with Automata				M H L M L - - - M L - H - - -
CLO-3 :	Acquire knowledge of Context free Grammar and simplify using normal forms				M H M H L - - - M L - H - - -
CLO-4 :	Understand the concepts of push down automata and CFL .				M H M H L - - - M L - H - - -
CLO-5 :	Apply the knowledge to turning machine and its methods				H H M H L - - - M L - H - - -
CLO-6 :	Design the computational and acceptor machines using FA, PDA and Turing machines				L H - H L - - - L L - H - - -

Duration (hour)	11	9	9	9	7
S-1	SLO-1	Introduction to Automaton	Grammars: Introduction: Types of Grammar	Pushdown Automata: Definitions Moves	Turing Machines: Introduction
	SLO-2	Mathematical concepts	Context Free Grammars and Languages	Instantaneous descriptions	Formal definition of Turing machines, Instantaneous descriptions
S-2	SLO-1	Formal Languages: Strings, Languages, Properties	Derivations	Deterministic pushdown automata	Turing Machine as Acceptors
	SLO-2	Finite Representation : Regular Expressions	Ambiguity	Problems related to DPDA	Problems related to turning machine as Acceptors
S-3	SLO-1	Problems related to regular expressions	Relationship between derivation and derivation trees	Non - Deterministic pushdown automata	Problems related to turning machine as Acceptors
	SLO-2	Finite Automata :Deterministic Finite Automata	Problems related to Context free Grammar	Problems related to NDPDA	Problems related to turning machine as Acceptors
S-4	SLO-1	Nondeterministic Finite Automata	Simplification of CFG : Elimination of Useless Symbols	Problems related to DPDA and NDPDA	Turing Machine as a Computing Device
	SLO-2	Finite Automaton with ϵ - moves			Problems related to turning Turing Machine as a Computing Device
S-5	SLO-1	Problems related to Deterministic and Nondeterministic Finite Automata	Simplification of CFG : Unit productions	Pushdown automata to CFL Equivalence	Problems related to turning Turing Machine as a Computing Device
	SLO-2	Problems related to Finite Automaton with ϵ - moves	Simplification of CFG : Null productions	Problems related to Equivalence of PDA to CFG	Problems related to turning Turing Machine as a Computing Device
S-6	SLO-1	Equivalence of NFA and DFA	Problems related to Simplification of CFG	Problems related to Equivalence of PDA to CFG	Techniques for Turing Machine Construction
	SLO-2	Heuristics to Convert NFA to DFA			
S-7	SLO-1	Equivalence of NDFA's with and without ϵ - moves	Chomsky normal form	CFL to Pushdown automata Equivalence	Considering the state as a tuple Considering the tape symbol as a tuple
	SLO-2	Problems related Equivalence of NDFA's with and without ϵ -moves	Problems related to CNF	Problems related to Equivalence of CFG to PDA	Checking off symbols
S-8	SLO-1	Minimization of DFA	Greiback Normal form	Pumping lemma for CFL	Modifications of Turing Machine
	SLO-2	Problems related to Minimization of DFA			Multi-tape Turing Machine

S-9	SLO-1	Regular Languages : Equivalence of Finite Automata and Regular Languages	Problems related to GNF	Problems based on pumping Lemma	Non-Deterministic Turing Machine	
	SLO-2	Equivalence of Finite Automata and Regular Grammars			Semi-Infinite Tape Turing Machine	
S-10	SLO-1	Problems related to Equivalence of Finite Automata and Regular Languages and Regular Grammars				
	SLO-2	Variants of Finite Automata :Two-way Finite Automaton Mealy Machines				
S-11	SLO-1	Properties of Regular Languages: Closure Properties				
	SLO-2	Set Theoretic Properties & Other Properties				
	SLO-3	Pumping Lemma				

Learning Resources	1.Hopcroft J.E., Motwani R. and Ullman J.D, "Introduction to Automata Theory, Languages and Computations", Second Edition, Pearson Education, 2008. 2. Michael Sipser, "Introduction to the Theory of Computation" Cengage Learning, 2012.	4..John.C.Martin, "Introduction to Languages and the Theory of Computation" McGraw-Hill Education, 01- May-2010. 5. Kamala Krithivasan, Rama.R," Introduction to Formal Languages, Automata Theory and Computation", Pearson Education India, 01-Sep-2009. 6. Peter Linz , "An introduction to formal languages and automata", Jones & Bartlett Learning, 2001.

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40 %	-	30 %	-	30 %	-	30 %	-	30%	-
Level 2	Understand	40 %	-	40 %	-	40 %	-	40 %	-	40%	-
	Apply	40 %	-	40 %	-	40 %	-	40 %	-	40%	-
Level 3	Analyze	40 %	-	40 %	-	40 %	-	40 %	-	40%	-
	Evaluate	20 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Create	20 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
		Dr.R.AnnieUthra
		Dr.Jeyasudha

Course Code	18CSC302J	Course Name	COMPUTER NETWORKS	Course Category	C	Professional Core	L	T	P	C
							3	0	2	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department		Computer Science and Engineering	Data Book / Codes/Standards	Nil	

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Understand the evolution of computer networks using the layered network architecture
CLR-2 :	Understand the addressing concepts and learn networks devices
CLR-3 :	Design computer networks using subnetting and routing concepts
CLR-4 :	Understand the error types , framing, flow control
CLR-5 :	Understand the various Medium Access Control techniques and also the characteristics of physical layer functionalities
CLR-6 :	Understand basic network administration

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:
CLO-1 :	Acquire the basics of computer network and its architecture
CLO-2 :	Acquire the knowledge of various networks devices and addressing methods
CLO-3 :	Ability to design the network routing methods
CLO-4 :	Acquire the various error codes and framing concepts
CLO-5 :	Ability to understand the physical layer functions and components
CLO-6 :	Ability to design a computer network using a switch and router

Learning		
1	2	3
Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
3	80	70
3	85	75
3	75	70
3	85	80
3	85	75
3	80	70

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
L	H	-	H	L	-	-	-	L	L	-	H	-	-	-
M	H	L	M	L	-	-	-	M	L	-	H	-	-	-
M	H	M	H	L	-	-	-	M	L	-	H	-	-	-
M	H	M	H	L	-	-	-	M	L	-	H	-	-	-
H	H	M	H	L	-	-	-	M	L	-	H	-	-	-
L	H	-	H	L	-	-	-	L	L	-	H	-	-	-

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Evolution of Computer Networks	Addressing types	Network layer functionalities	Introduction- error types	Physical layer overview
	SLO-2	The Internet today	Physical, logical, port, specific addresses	Delivery vs Forwarding	Detection vs Correction	Functionalities
S-2	SLO-1	Data communications	IPv4 addresses	Unicast routing protocols	Error detection	Analog and digital
	SLO-2	Components	Notations	Intra , inter domain routing	Parity	Data, signals
S-3	SLO-1	Networks	Classful addressing	Multicast routing protocols	CRC	Transmission impairment
	SLO-2	Physical structures	Categories	Applications	Checksum	Attenuation, Distortion, Noise
S-4.5	SLO-1	Lab 1: Introduction to Packet tracer	Lab 4 :IP Addressing and subnetting (VLSM).	Lab 7 : Implementation of Static Routing	Lab 10: Implementation of EIGRP Configuration	Lab 13: Implementation of Single-Area OSPF Link Costs and Interface
	SLO-2					
S-6	SLO-1	Network models	Classless addressing	Distance vector routing	Error correction	Performance metrics
	SLO-2	Categories of network	Prefix usage	Node instability issues	Hamming code	Bandwidth, delay, throughput, jitter
S-7	SLO-1	Protocols and standards	Network Address Translation(NAT)	RIPv1	Framing	Wireless 802.11
	SLO-2	Standards organizations	Translation table	RIPv2	Flow control	Addressing mechanism

S-8	SLO-1	Layered tasks	IPv6 addresses	Link state routing	Error control	Transmission Media
	SLO-2	Hierarchy	Types, Notation	Dijkstra's Algorithm	ARO types	Twisted pair, Coaxial, Fibre
S 9-10	SLO-1	Lab 2: Implementation of various Topology creation	Lab 5: Configuring Interfaces	Lab 8: Implementation of Default Routing	Lab 11: Implementation of EIGRP Bandwidth and Adjacencies	Lab 14 :Implementation of Multi-Area OSPF with Stub Areas and Authentication
	SLO-2					
S-11	SLO-1	OSI model	VLSM	OSPF	Random access	IEEE 802.15
	SLO-2	Layered approach, Peer-peer approach	Masking	EIGRP	ALOHA	Architecture
S-12	SLO-1	Layers in the OSI model	CIDR	Path vector routing	CSMA/CD	IEEE 802.15.4
	SLO-2	Comparison of layers	Address aggregation	Stabilized routing table creation for AS	CSMA/CA	Architecture
S-13	SLO-1	TCP/IP protocol suite	Networking devices	BGP	Controlled access	IEEE 802.16
	SLO-2	Comparison with OSI model	Router, Switch, hub, Bridges	BGP Sessions	Channelization	Architecture
S 14-15	SLO-1	Lab 3: Implement the categories of network(LAN,MAN,WAN)	Lab 6: Basic Router Configuration, Creating Passwords	Lab 9: Implementation of RIPv1, v2	Lab 12:Implementation of EIGRP Authentication and Timers	Lab 15 : Redistribution Between EIGRP and OSPF
	SLO-2					

Learning Resources	1. Behrouz A. Forouzan, "Data Communications and Networking" 5 th edition, July 1, 2010, ISBN: 9780073376226. 2. Todd Lammle, "CCNA Study Guide", Edition 7, 2011, ISBN: 13: 9780470901076. 3. William Stallings, "Data and Computer Communications", Edition 9, 2010.	
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Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
Total		100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1.. Dr. Sricharan, Wipro Technologies, Chennai	1. Dr. Noor Mohammad, IIITDM, Kancheepuram, noor@iiitdm.ac.in	1. Mr. K. Venkatesh, SRMIST
2.	2.	2. Ms. D. Anitha, SRMIST
	3.	3. Ms. Ferni Ukrit, SRMIST

Course Code	18CSC303J	Course Name	DATABASE MANAGEMENT SYSTEMS	Course Category	C	Professional Core			
						L	T	P	C
						3	0	2	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computer Science and Engineering			Data Book / Codes/Standards	Nil

Course Learning Rationale (CLR):		The purpose of learning this course is to:			Learning		
CLR-1 :	Understand the fundamentals of Database Management Systems, Architecture and Languages				1	2	3
CLR-2 :	Conceive the database design process through ER Model and Relational Model				Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-3 :	Design Logical Database Schema and mapping it to implementation level schema through Database Language Features						
CLR-4 :	Familiarize queries using Structure Query Language (SQL) and PL/SQL						
CLR-5 :	Familiarize the Improvement of the database design using normalization criteria and optimize queries						
CLR-6 :	Understand the practical problems of concurrency control and gain knowledge about failures and recovery						
Course Learning Outcomes (CLO):		At the end of this course, learners will be able to:					
CLO-1 :	Acquire the knowledge on DBMS Architecture and Languages				3	80	70
CLO-2 :	Apply the fundamentals of data models to model an application's data requirements using conceptual modeling tools like ER diagrams				3	85	75
CLO-3 :	Apply the method to convert the ER model to a database schemas based on the conceptual relational model				3	75	70
CLO-4 :	Apply the knowledge to create, store and retrieve data using Structure Query Language (SQL) and PL/SQL				3	85	80
CLO-5 :	Apply the knowledge to improve database design using various normalization criteria and optimize queries				3	85	75
CLO-6 :	Appreciate the fundamental concepts of transaction processing- concurrency control techniques and recovery procedures.				3	85	75

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt & Finance	Lifelong Learning	PSO-1	PSO-2	PSO-3
H	M	L	L	L	-	-	-	L	H	H	H	-	-	-
H	H	H	H	H	-	-	-	H	H	H	H	-	-	-
H	H	H	H	H	-	-	-	H	H	H	H	-	-	-
H	H	L	M	L	-	-	-	M	M	M	L	-	-	-
H	L	L	L	L	-	-	-	H	L	L	L			

Duration (hour)		15	15	15	15	15
S-1	SLO-1	What is Database Management System	Database Design	Basics of SQL-DDL,DML,DCL,TCL	Relational Algebra – Fundamental Operators and syntax, relational algebra queries, Tuple relational calculus	Transaction concepts, properties of transactions,
	SLO-2	Advantage of DBMS over File Processing System	Design process	Structure Creation, alternation		
S-2	SLO-1	Introduction and applications of DBMS	Entity Relation Model	Defining Constraints-Primary Key, Foreign Key, Unique, not null, check, IN operator		serializability of transactions,
	SLO-2	Purpose of database system				testing for serializability, System recovery,
S-3	SLO-1	Views of data	ER diagram	Functions-aggregation functions	Pitfalls in Relational database, Decomposing bad schema	Concurrency Control
	SLO-2			Built-in Functions-numeric, date, string functions, string functions, Set operations,		
S-4-5	SLO-1	Lab 1: SQL Data Definition Language Commands on sample exercise	Lab4 : Inbuilt functions in SQL on sample exercise.	Lab 7 : Join Queries on sample exercise.	Lab10: PL/SQL Procedures on sample exercise.	Lab 13: PL/SQL Exception Handling
	SLO-2	* The abstract of the project to construct database must be framed		* Frame and execute the appropriate DDL,DML,DCL,TCL for the project		
S-6	SLO-1	Database system Architecture	Keys , Attributes and Constraints	Sub Queries, correlated sub queries	closure of FD set , closure of attributes	Two- Phase Commit protocol, Recovery and Atomicity
	SLO-2				irreducible set of FD	
S-7	SLO-1	Data Independence	Mapping Cardinality	Nested Queries, Views and its Types	Normalization – 1NF, 2NF, 3NF,	Log-based recovery
	SLO-2					
S-8	SLO-1	The evolution of Data Models	Extended ER - Generalization,	Transaction Control Commands	Decomposition using FD- dependency	concurrent executions of transactions and

	SLO-2		Specialization and Aggregation	Commit, Rollback, Savepoint	preservation,	related problems
S 9-10	SLO-1	Lab 2: SQL Data Manipulation Language Commands	Lab 5: Construct a ER Model for the application to be constructed to a Database	Lab 8: Set Operators & Views. * Frame and execute the appropriate In-Built functions for the project	Lab 11: PL/SQL Functions * Frame and execute the appropriate Set Operators & Views for the project	Lab 14: PL/SQL Trigger * Frame and execute the appropriate PL/SQL Cursors and Exceptional Handling for the project
	SLO-2	* Identification of project Modules and functionality				
S-11	SLO-1	Degrees of Data Abstraction	ER Diagram Issues	PL/SQL Concepts- Cursors	BCNF	Locking mechanism, solution to concurrency related problems
	SLO-2		Weak Entity			
S-12	SLO-1	Database Users and DBA	Relational Model	Stored Procedure, Functions Triggers and Exceptional Handling	Multi- valued dependency,	Deadlock
	SLO-2				4NF	
S-13	SLO-1	Database Languages	Conversion of ER to Relational Table	Query Processing	Join dependency and 5NF	two-phase locking protocol, Isolation, Intent locking
	SLO-2					
S 14-15	SLO-1	Lab 3: SQL Data Control Language Commands and Transaction control commands to the sample exercises	Lab 6: Nested Queries on sample exercise	Lab9: PL/SQL Conditional and Iterative Statements	Lab 12: PL/SQL Cursors * Frame and execute the appropriate PL/SQL Conditional and Iterative Statements for the project	Lab 15 : * Frame and execute the appropriate PL/SQL Cursors and Exceptional Handling for the project * Demo of the project
	SLO-2	* Identify the issues that can arise in a business perspective for the application	* Construction of Relational Table from the ER Diagram	* Frame and execute the appropriate Nested Queries for the project		

Learning Resources	1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, Database System ConceptsII, Sixth Edition, Tata McGraw Hill,2011.	4. Martin Gruber, Understanding SQL, Sybex,1990 5. SharadMaheshwari,IntroductiontoSQLandPL/SQL,2 ^d ed.,LaxmiPublications,2016. 6. RaghuramaKrishnan,JohannesGehrke,DatabaseManagementSystems,3rdEdition,McGrawHill Education,2003.
	2. Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database SystemsII, Sixth Edition, Pearson Education,2011. 3. CJ Date,A Kannan,S Swamynathan, An Introduction to Database Systems, Eight Edition, Pearson Education,2006. 4. Rajesh Narang, Database Management Systems, 2 nd ed., PHI Learning Private Limited,2011.	

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
Level 2	Apply Analyze	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 3	Evaluate Create	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Total	100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr.Mariappan Vaithilingam, Engineering Leader Amazon, dr.v.m@ieee.org		1. Ms. Sasi Rekha Sankar SRMIST
2. Mr. Badinath, SDET, Amzon, sbadhrinath@gmail.com		2. Mr.Elizer, SRMIST
		3. Mrs. Hemavathy, SRMIST

Course Code	18CSC304J	Course Name	COMPILER DESIGN	Course Category	C	Professional Core				L	T	P	C
										3	0	2	4

Pre-requisite Courses	18CSC301T	Co-requisite Courses	Nil	Progressive Courses	
Course Offering Department	Computer Science and Engineering			Data Book / Codes/Standards	Nil

Course Learning Rationale (CLR):		The purpose of learning this course is to:	
CLR-1 :	Utilize the mathematics and engineering principles for the Design of Compilers		
CLR-2 :	Acquire knowledge of Lexical Analyzer from a specification of a language's lexical rules		
CLR-3 :	Acquire knowledge of Syntax Analyzer for parsing the sentences in a compiler grammar		
CLR-4 :	Gain knowledge to translate a system into various intermediate codes		
CLR-5 :	Analyze the methods of implementing a Code Generator for compilers		
CLR-6 :	Analyze and Design the methods of developing a Code Optimizer		
Course Learning Outcomes (CLO):		At the end of this course, learners will be able to:	
CLO-1 :	Acquire the knowledge of mathematics and engineering principles for the Design of Compilers		
CLO-2 :	Acquire the ability to identify specification of a language's lexical rules of Lexical Analyzer		
CLO-3 :	Apply the knowledge of Syntax Analyzer for parsing the sentences in a compiler grammar		
CLO-4 :	Understand the concepts of translation of various intermediate codes .		
CLO-5 :	Apply the knowledge to implement Code Generator for compilers		
CLO-6 :	Analyze and Design the methods of developing a Code Optimizer		

Learning		
1	2	3
Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
Engineering Knowledge	Problem Analysis	Design & Development
		Analysis, Design, Research
		Modern Tool Usage
		Society & Culture
		Environment & Sustainability
		Ethics
		Individual & Team Work
		Communication
		Project Mgt. & Finance
		Life Long Learning
		PSO-1
		PSO-2
		PSO- 3

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
H	H	H	H	M	L	L	L	M	M	L	H	H	H	H
H	H	H	H	M	L	L	L	M	M	L	H	H	H	H
H	H	H	H	M	L	L	L	M	M	L	H	H	H	H
H	H	H	H	M	L	L	L	M	M	L	H	H	H	H
H	H	H	H	M	L	L	L	M	M	L	H	H	H	H
H	H	H	H	M	L	L	L	M	M	L	H	H	H	H

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Compilers – Analysis of the source program	Syntax Analysis Definition - Role of parser	Bottom Up Parsing	Intermediate Code Generation	Code optimization
	SLO-2	Phases of a compiler – Cousins of the Compiler	Lexical versus Syntactic Analysis	Reductions	Intermediate Languages - prefix - postfix	Introduction– Principal Sources of Optimization
S-2	SLO-1	Grouping of Phases – Compiler construction tools	Representative Grammars	Handle Pruning	Quadruple - triple - indirect triples Representation	Function Preserving Transformation
	SLO-2	Lexical Analysis – Role of Lexical Analyzer	Syntax Error Handling	Shift Reduce Parsing	Syntax tree- Evaluation of expression - three-address code	Loop Optimization
S-3	SLO-1	Input Buffering	Elimination of Ambiguity, Left Recursion	Problems related to Shift Reduce Parsing	Synthesized attributes – Inherited attributes	Optimization of basic Blocks
	SLO-2	Specification of Tokens	Left Factoring	Conflicts During Shift Reduce Parsing	Intermediate languages – Declarations	Building Expression of DAG
S 4-5	SLO-1	Lab 1 - Implementation of Lexical Analyzer	Lab 4 Elimination of Ambiguity, Left Recursion and Left Factoring	Lab 7 - Shift Reduce Parsing	Lab 10-Intermediate code generation – Postfix, Prefix	Lab 13 Implementation of DAG
	SLO-2					
S-6	SLO-1	Finite automation - deterministic	Top down parsing	LR Parsers- Why LR Parsers	Assignment Statements	Peephole Optimization
	SLO-2	Finite automation - non deterministic	Recursive Descent Parsing, back tracking	Items and LR(0) Automaton, Closure of Item Sets,	Boolean Expressions, Case Statements	Basic Blocks, Flow Graphs
S-7	SLO-1	Transition Tables	Computation of FIRST	LR Parsing Algorithm	Back patching – Procedure calls	Next -Use Information

	SLO-2	Acceptance of Input Strings by Automata	Problems related to FIRST	Operator Precedence Parser Computation of LEADING	Code Generation	Introduction to Global Data Flow Analysis
S-8	SLO-1	State Diagrams and Regular Expressions	Computation of FOLLOW	Computation of TRAILING	Issues in the design of code generator	Computation of gen and kill
	SLO-2	Conversion of regular expression to NFA – Thompson's	Problems related to FOLLOW	Problems related to LEADING AND TRAILING	The target machine – Runtime Storage management	Computation of in and out
S 9-10	SLO-1 SLO-2	Lab 2 conversion from Regular Expression to NFA	Lab 5 -FIRST AND FOLLOW computation	Lab 8- Computation of LEADING AND TRAILING	Lab 11 Intermediate code generation – Quadruple, Triple, Indirect triple	Lab 14 : Implementation of Global Data Flow Analysis
S-11	SLO-1	Conversion of NFA to DFA	Construction of a predictive parsing table	SLR Grammars	A simple Code generator	Parameter Passing.
	SLO-2	Simulation of an NFA	Predictive Parsers LL(1) Grammars	SLR Parsing Tables	Code Generation Algorithm	Runtime Environments
S-12	SLO-1	Converting Regular expression directly to DFA	Transition Diagrams for Predictive Parsers	Problems related to SLR	Register and Address Descriptors	Source Language issues
	SLO-2	Minimization of DFA	Error Recovery in Predictive Parsing	Construction of Canonical LR(1) and LALR	Generating Code of Assignment Statements	Storage Organization
S-13	SLO-1	Minimization of NFA	Predictive Parsing Algorithm	Construction of LALR	Cross Compiler – T diagrams	Activation Records
	SLO-2	Design of lexical analysis (LEX)	Non Recursive Predictive Parser	Problems related to Canonical LR(1) and LALR Parsing Table	Issues in Cross compilers	Storage Allocation strategies
S 14-15	SLO-1 SLO-2	Lab 3 Conversion from NFA to DFA	Lab 6 Predictive Parsing Table	Lab9 Computation of LR(0) items	Lab 12 : A simple code Generator	Lab 15: Implement any one storage allocation strategies(heap, stack, static)

Learning Resources	1. Alfred V.Aho, Jeffery D.Ullman, Ravi Sethi, "Compilers, Principle techniques and tools", Pearson Education 2011 2. S. Godfrey Winster, S. Aruna Devi, R. Sujatha, "Compiler Design", Yesdee Publishing Pvt. Ltd, 2016 3. William M. Waite and Gerhard Goos. Compiler Construction. Springer-Verlag, New York, 2013.	4. K. Muneeswaran, "Compiler Design", Oxford Higher Education, Fourth edition 2015 5. David Galles, "Modern Compiler Design", Pearson Education, Reprint 2012. 6. Raghavan V., "Principles of Compiler Design", Tata McGraw Hill Education Pvt. Ltd., 2010
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Learning Assessment

		Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
	Total	100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
		1. Ms. R. Jeya
		2. Mrs. J. Jeyasudha

Course Code	18CSC305J	Course Name	ARTIFICIAL INTELLIGENCE	Course Category	C	Professional Core			
						L	T	P	C
						3	0	2	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computer Science and Engineering			Data Book / Codes/Standards	Nil

Course Learning Rationale (CLR):		The purpose of learning this course is to:		
CLR-1:	Provide a broad understanding of the basic techniques for building intelligent computer systems and an understanding of how AI is applied to problems.			
CLR-2:	Gain knowledge in problem formulation and building intelligent agents			
CLR-3:	Understand the search technique procedures applied to real world problems			
CLR-4:	Understand the types of logic and knowledge representation schemes			
CLR-5:	Acquire knowledge in planning and learning algorithms			
CLR-6:	Gain knowledge in AI Applications and advances in Artificial Intelligence			

Course Learning Outcomes (CLO):		At the end of this course, learners will be able to:		
CLO-1:	Formulate a problem and build intelligent agents			
CLO-2:	Apply appropriate searching techniques to solve a real world problem			
CLO-3:	Analyze the problem and infer new knowledge using suitable knowledge representation schemes			
CLO-4:	Develop planning and apply learning algorithms on real world problems			
CLO-5:	Design an expert system and implement natural language processing techniques			
CLO-6:	Implement advance techniques in Artificial Intelligence			

Learning		
1	2	3
Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
1	80	70
2	85	75
2	75	70
2	85	80
3	85	75
3	80	70

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
M	M	M	M	H	-	-	-	M	L	-	H	L	L	L
M	H	H	H	H	-	-	-	M	L	-	H	M	L	M
M	H	H	M	H	-	-	-	M	L	-	H	M	L	M
M	H	M	H	H	-	-	-	M	L	-	H	M	M	M
M	H	H	H	H	-	-	-	M	L	-	H	H	M	H
L	H	M	M	H	-	-	-	H	L	-	H	H	M	H

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Introduction to AI-AI techniques	Searching techniques- Uniformed search- General search Algorithm	Knowledge and reasoning- Approaches and issues of knowledge reasoning	Planning- Planning problems, Simple planning agent	Expert system- Architecture
	SLO-2	Problem solving with AI	Uniformed search Methods- Breadth first search	Knowledge base agents- Logic Basics	Planning languages	Pros and Cons of expert system
S-2	SLO-1	AI Models, Data acquisition and learning aspects in AI	Uniformed search Methods- Depth first search	Logic- Propositional logic- syntax, semantics and inferences	Blocks world, Goal stack planning	Rule based systems
	SLO-2	Problem solving- Problem solving process, Formulating problems	Uniformed search Methods- Depth limited search	Propositional logic- Reasoning patterns	Mean Ends Analysis	Frame based expert system
S-3	SLO-1	Problem types and characteristics	Uniformed search Methods- Iterative Deepening search	Predicate logic – Syntax and semantics, instance and is relationship	Non-linear Planning	Case study
	SLO-2	Problem space and search	Bi-directional search	Unification and Resolution	Conditional planning, Reactive planning	Case study
S-4-5	SLO-1	Lab 1: Implementation of toy problems	Lab4: Implementation and Analysis of DFS and BFS for an application	Lab 7: Implementation of unification and resolution for real world problems.	Lab 10 :Implementation of block world problem	Natural language processing- Levels of NLP
	SLO-2					
S-6	SLO-1	Intelligent agent	Informed search- Generate and test, Best First search	Knowledge representation using rules	Learning- Machine learning	Syntactic and Semantic Analysis
	SLO-2	Rationality and Rational agent with performance measures	Informed search- A* Algorithm	Knowledge representation using semantic nets	Goals and Challenges of machine learning	Information retrieval
S-7	SLO-1	Flexibility and Intelligent agents	AO* research	Knowledge representation using frames	Learning concepts, models	Information Extraction

	SLO-2	Task environment and its properties	Local search Algorithms-Hill Climbing, Simulated Annealing	Inferences	Artificial neural network based learning-Back propagation	Machine translation
S-8	SLO-1	Types of agents	Local Beam Search	Uncertain Knowledge and reasoning-Methods	Support vector machines	NLP Applications
	SLO-2	Other aspects of agents	Genetic Algorithms	Bayesian probability and belief network	Reinforcement learning	NLP Applications
S-9-10	SLO-1	Lab 2: Developing agent programs for real world problems	Lab 5: Developing Best first search and A* Algorithm for real world problems	Lab 8: Implementation of knowledge representation schemes - use cases	Lab 11: Implementation of learning algorithms for an application	Lab 14: Implementation of NLP programs
	SLO-2	Constraint satisfaction problems(CSP)	Adversarial search Methods-Game playing-Important concepts	Probabilistic reasoning	Adaptive learning	Advance topics in Artificial Intelligence-Cloud Computing and intelligent agent
S-11	SLO-1					
	SLO-2	Crypto arithmetic puzzles	Game playing and knowledge structure	Probabilistic reasoning over time	Multi_agent based learning	Business intelligence and analytics
S-12	SLO-1	CSP as a search problem-constraints and representation	Game as a search problem-Minimax approach	Forward and backward reasoning	Ensemble learning	Sentiment Analysis
	SLO-2	CSP-Backtracking, Role of heuristic	Minimax Algorithm	Other uncertain techniques-Data mining	Learning for decision making	Deep learning Algorithms
S-13	SLO-1	CSP-Forward checking and constraint propagation	Alpha beta pruning	Fuzzy logic	Distributed learning	Deep learning Algorithms
	SLO-2	CSP-Intelligent backtracking	Game theory problems	Dempster -shafer theory	Speedup learning	Planning and logic in intelligent agents
S-14-15	SLO-1	Lab 3: Implementation of constraint satisfaction problems	Lab 6: Implementation of minimax algorithm for an application	Lab 9: Implementation of uncertain methods for an application	Lab12: Development of ensemble model for an application	Lab 15: Applying deep learning methods to solve an application.
	SLO-2					

Learning Resources	1. Parag Kulkarni, Prachi Joshi, Artificial Intelligence –Building Intelligent Systems, 1 st ed., PHI learning, 2015	4. Prateek Joshi, Artificial Intelligence with Python, 1 st ed., Packt Publishing, 2017 5. Denis Rothman, Artificial Intelligence by Example, Packt, 2018
	2. Deepak Keshani, First course in Artificial Intelligence, McGraw Hill Pvt Ltd, 2013 3. Stuart J. Russell, Peter Norvig, Artificial Intelligence –A Modern approach, 3 rd Pearson Education, 2016	

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	10%	10%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	20%	20%	15%	15%	15%	15%	15%	15%
	Create										
	Total	100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry		Experts from Higher Technical Institutions
1. Mr. Jagatheeswaran, Lead, Auxo labs jagatheeswarans.iot@auxolabs.in		1. Dr. Chitrakala, Anna University, au.chitras@gmail.com
2.		2.
		3.
		Internal Experts
		1. Dr.M.Pushpalatha, SRMIST
		2. Dr.G..Vadivu, SRMIST
		3. Dr.C.Lakshmi, SRMIST

Course Code	18CSE387T	Course Name	GENETIC ALGORITHM AND ITS APPLICATIONS	Course Category	E	Professional Elective	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computer Science and Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)
CLR-1:	Evolutionary Computation and Genetic Algorithms	1 2 3	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
CLR-2:	Terminologies and operators of GA and	Level of Thinking (Bloom) Expected Proficiency (%) Expected Attainment (%)	Engineering Knowledge Problem Analysis Design & Development Analysis, Design, Research Modern Tool Usage Society & Culture Environment & Sustainability Ethics Individual & Team Work Communication Project Mgt. & Finance Life Long Learning PSO - 1 PSO - 2 PSO - 3
CLR-3:	Advanced Operators and Techniques in GA and Classification of Genetic Algorithms		
CLR-4:	Genetic Programming and Genetic Algorithm Optimization problems		
CLR-5:	Applications of Genetic Algorithms		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:		
CLO-1:	Provides a introduction to genetic algorithm including fundamentals of genetic concepts	3 80 75	L H - H L - - - L L - H - - -
CLO-2:	To have a clear view of genetic operators	3 85 75	M H L H L - - - M L - H - - -
CLO-3:	To explore Genetic Algorithm optimization problems	3 80 75	M H M H L - - - M L - H - - -
CLO-4:	Discuss applications of Genetic Algorithms for various optimization problems.	3 85 80	M H M H L - - - M L - H - - -

Duration (hour)	9	9	9	9	9
S-1	SLO-1 The Historical Development of Evolutionary Computing. Genetic Algorithms and Genetic Programming	Terminologies and operators of GA. Key elements, Individuals,	Diploidy, Dominance etc. Inversion and Reordering. Order Crossover and Cycle crossover.	Genetic programming (GP). Comparison of GP and other algorithms. Genetic operators. Tree based GP, Representation of GP.	Specific Applications of Genetic Algorithms. GA in network synthesis, Control systems engineering and Fuzzy based speed control of Brushless DC motor.
	SLO-2	Genes, Fitness, Populations. Data Structures.			
S-2	SLO-1 Features of Evolutionary Computation	Breeding, Selection, Crossover, Mutation and Replacement.	Micro operators: Segregation and translocation, Duplications and Deletion, Sexual determination.	Attributes in GP. Steps of GP, Characteristics of GP. What are Human Competitive, High-Return, Routine, and Machine Intelligence?	Feature selection in machine learning using GA. Designing texture filters with GA.
	SLO-2 Advantages of Evolutionary computation.				
S-3	SLO-1 Genetic algorithms-Biological background. Cell, Chromosomes, Genetics, Reproduction and Natural selection.	Search Termination or Convergence criteria.	Non-binary representation, Multi-objective optimization, combined optimization and Knowledge based techniques.	Applications of Genetic Programming	GA based knowledge acquisition in Image Processing. Object localization in image using GA.
	SLO-2				
S-4	SLO-1 Search space, GA world, Evolution and optimization	Best individual, Worst individual, Sum of fitness and Medium fitness.	Classification of GAs. Simple Genetic algorithms (SGA). Parallel and distributed GAs.	GA Optimization problems: Fuzzy optimization problems, Multi objective Reliability Design Problem. Network and bicriteria reliability problems.	Data mining applications such as feature selection in data mining, GA in intrusion detection, etc.
	SLO-2				
S-5	SLO-1 Evolution and genetic algorithms. Conventional optimization and search techniques.	Why do genetic algorithms work? Building block hypothesis	Master-slave, Fine-grained parallel GAs. Multiple-Deme Parallel GAs.	Combinatorial Optimization problems. Linear integer model	Applications in wireless networks for topology planning. GA application in ATM network.
	SLO-2				
S-6	SLO-1 Gradient based, Random search, Stochastic Hill climbing	A Macro mutation hypothesis. An adaptive mutation hypothesis.	Hierarchical Parallel algorithms. Hierarchical Genetic Algorithms: Crossover, Initialization heuristics. Remove sharp algorithms.	Applications of combinatorial optimization methods.	VLSI design applications Genetic layout optimization using GA.
	SLO-2				
S-7	SLO-1 Simulated Annealing, Symbolic AI. A simple Genetic Algorithm.	The schema theorem	Adaptive GA., Initialization, Evaluation function, Selection operators, Crossover	Network design and Routing problems	Introduction to Particle Swam Optimization [PSO] and Ant Colony Optimization [ACO].

	SLO-2		Optimal allocation of Trials. Implicit Parallelism	operators, and mutation operators.		
S 8	SLO-1	Comparison of GA with other optimization techniques.	Advanced operators and techniques in GA,	Independent sampling GA and Breeding Phase.	Planning of passive optical networks, Packet switched networks,	Examples on PSO and ACO.
S-9		Limitations of GA.	Convergence problems in GA	Niched pareto genetic algorithm	Optimal topological design of all terminal networks.	Comparison of GA with PSO and ACO

Learning Resources	<ol style="list-style-type: none"> 1. S.N. Sivanandam and S.N. Deepa , "Introduction to Genetic Algorithms", Springer, 2nd edition (2008) 2. Mitsuo Gen and Runwei Cheng, "Genetic Algorithms and Engineering Optimization", John Wiley, Fourth edition (2010) 3. Michael Negnevitsky, "Artificial Intelligence, A Guide to Intelligent Systems", Second edition ((2005))
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Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Understand										
Level 2	Apply	40 %	-	40 %	-	40 %	-	40 %	-	40%	-
	Analyze										
Level 3	Evaluate	20 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Create										
Total	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. K. Selvaraj, Caterpillar, Bangalore	Dr. A.P. Shanthi, CSE, Anna University, Chennai	1.Dr. V. Ganapathy SRMIST
	Dr. A. Kannan, CSE, VIT, Vellore.	2.Dr. D. Rajeswari SRMIST
		3.S. Saranya SRMIST

Course Code	18CSE388T	Course Name	ARTIFICIAL NEURAL NETWORKS	Course Category	E	Professional Elective	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computer Science and Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):		The purpose of learning this course is to:		
CLR-1 :	Connect Biology with Computers			
CLR-2 :	Understand components of artificial neural networks			
CLR-3 :	Understand supervised learning networkparadigms			
CLR-4 :	Understand unsupervised learning networkparadigms			

Course Learning Outcomes (CLO):		At the end of this course, learners will be able to:		
CLO-1 :	Know the purpose of Artificial Neural Networks			
CLO-2 :	Apply the concepts of activation, propogation functions			
CLO-3 :	Work with supervised learning network paradigm			
CLO-4 :	Work with unsupervised learning network paradigm			

Learning		
1	2	3
Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
H	L	-	-	H	-	-	-	-	-	-	H	L	L	-
H	H	-	-	H	-	-	-	-	-	-	H	H	H	H
H	H	H	-	H	-	-	-	-	-	-	H	H	H	H
H	H	-	-	H	-	-	-	-	-	-	H	H	H	H

Duration (hour)	9	9	9	9	9
S-1	SLO-1 Why neural network?	Components of artificial neural networks	Learning and training samples	Radial basis functions	Unsupervised learning network paradigms
	SLO-2 Basics of Artificial Neural Networks	The concept of time in neural networks	Paradigms of Learning	Information processing of an RBF network	Structure of a self-organizing map(SOM)
S-2	SLO-1 A brief history of neural networks	Connections	Using training samples	Training of RBF networks	Functionality
	SLO-2 Biological neural networks	Propagation function	Gradient Optimization Procedure	Growing of RBF networks	Training
S-3	SLO-1 Biological neural networks	Activation	Hebbian learning rule	Compare multilayer perceptrons and RBF	Topology function
	SLO-2 The vertebrate nervous system	Threshold value, Activation function	Supervised learning network paradigms	Recurrent perceptron-like networks	Decreasing Learning Rate
S-4	SLO-1 peripheral nervous system	Common activation functions	The perceptron, back propagation and its variants	Jordan networks	Variations of SOMs
	SLO-2 Cerebrum, cerebellum, diencephalon, brainstem	Output function, Learning strategies	Singlelayer perceptron	Elman networks	Neural gas
S-5	SLO-1 The Neuron	Network topologies	Linear Separability	Training recurrent networks	Multi-SOM
	SLO-2 Components	Feedforward networks	Multilayer perceptron	Unfolding in time	Multi-neural gas
S-6	SLO-1 Electrochemical processes	Recurrent networks	Backpropagation of error	Teacher forcing	Growing neural gas
	SLO-2 Receptor cells- Various types	Completely linked networks	Selecting learning rate	Recurrent backpropagation	Adaptive resonance theory(ART)
S-7	SLO-1 Information processing within nervous system	Bias neuron	Resilient Backpropagation		Task and structure of an ART network
	SLO-2 Light Sensing organs	Representing Neurons	Adaption of Weights		Resonance
S-8	SLO-1 Neurons in living organisms	Orders of Activation	Variations in Backpropagation		
	SLO-2 Transition to technical neurons	Synchronous activation			
S-9	SLO-1 input and output of data	Asynchronous activation	Multilayer perceptron	Evolutionary algorithms	Learning process of an ART network
	SLO-2	input and output of data			

Learning Resources	1. David Kriesel, <i>A Brief Introduction to Neural Networks</i> , dkriesel.com, 2005	3. Raul Rojas, <i>Neural Networks: A Systematic Introduction</i> , 1996.
	2. Gunjan Goswami, <i>Introduction to Artificial Neural Networks</i> , S.K. Kataria & Sons, 2012	4. S. Sivanandam, <i>Introduction to Artificial Neural Networks</i> , 2003

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Understand										
Level 2	Apply	40 %	-	40 %	-	40 %	-	40 %	-	40%	-
	Analyze										
Level 3	Evaluate	20 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. 1. Dr. Harisekharan, CTO, Sri Seshaa Technologies Pvt. Ltd., Chennai	1. Dr. J. Suresh, SSN College of Engineering	Dr. G. Vadivu
	2. Dr. Sharmila Shankar, Crescent Institute of Science and Technology	Dr. D. Rajeswari
		Dr. M. S. Abirami

Course Code	18CSE389T	Course Name	FUZZY LOGIC AND ITS APPLICATIONS	Course Category	E	Professional Elective	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computer Science & Engg	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)
CLR-1 :	Understand the Fuzzy Logic Basics	1 2 3	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
CLR-2 :	Gain knowledge on the Machine learning concepts	Level of Thinking (Bloom)	Engineering Knowledge
CLR-3 :	Gain knowledge on Fuzzy based clustering concepts	Expected Proficiency (%)	Problem Analysis
CLR-4 :	Acquire knowledge on Fuzzy Integrated classification	Expected Attainment (%)	Design & Development
CLR-5 :	Understanding Neuro-Fuzzy Modeling concepts		Analysis, Design, Research
CLR-5 :	Acquiring better understanding on Fuzzy logic usage		Modern Tool Usage
CLR-6 :	Understanding the fuzzylogics in Machine learning		Society & Culture
			Environment & Sustainability
			Ethics
			Individual & Team Work
			Communication
			Project Mgt & Finance
			Life Long Learning
			PSO - 1
			PSO - 2
			PSO - 3
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:		
CLO-1 :	Acquire the knowledge on Basics of Fuzzy Logic	2 80 85	H M - H - - - - -
CLO-2 :	Understand the basic concepts in Machine learning	2 75 80	H H - H - - - - -
CLO-3 :	Apply the knowledge of Clustering in Fuzzy logics	2 85 80	H - - H - - - - -
CLO-4 :	Apply the concept of Classification in Fuzzy Logics	2 80 75	H H - H - - - - -
CLO-5 :	Acquire the knowledge on Neuro-Fuzzy reasoning	2 75 85	H - - H - - - - -
CLO-6 :	Acquire the insight of Neuro-Fuzzy Modeling	2 75 85	H - H H H - - - -

Duration (hour)	9	9	9	9	9
S-1	SLO-1 Fuzzy Logic Introduction : Comparison of traditional logic and fuzzy logic	Machine learning : Importance of ML	Fuzzy Clustering Basics: Cluster analysis ,Objective function-based cluster analysis, Fuzzy analysis of data	Fuzzy Integral Classification: Introduction and Notation ,Reduction vs. Ordering	Neuro Fuzzy Modeling : ANFIS – Adaptive Neuro Fuzzy Inference system
	SLO-2 Basic History of Fuzzy Logic	Types of Machine Learning : Supervised Learning-Unsupervised Learning, reinforcement Learning	Special objective functions, A principal clustering algorithm	The Borda Count	ANFIS - architecture
S-2	SLO-1 The case of Imprecision, A Historical perspective	The Curse of dimensionality	Classical Fuzzy Clustering Algorithms : The fuzzy c-means algorithm	The Average Rule , The Median Alternative	Hybrid learning algorithm
	SLO-2 The Utility of Fuzzy systems, Limitations of Fuzzy systems	Overfitting and linear regression	The Gustafson-Kessel algorithm	The Product Rule, The MaxMax and MaxMin Rules	Coactive Neuro fuzzy modeling : Towards generalized ANFIS
S-3	SLO-1 Fuzzy sets and membership	Bias and Variance Learning Curve		The Intersection Method , The Union Rule	Framework
	SLO-2 Chance Vs Fuzziness		The Gath-Geva algorithm	Logistic Regression : The Logit Transform and Maximum Likelihood Estimation	Neuron functions for adaptive networks
S-4	SLO-1 Classical sets and Fuzzy sets : Operations on classical sets, properties of classical sets	Classification	Computational effort	Separate Weight Sets	Fuzzy membership functions Vs Receptive field units
	SLO-2 Operations on fuzzy sets, properties of fuzzy sets	Error and noise	Linear and Ellipsoidal Prototypes : The fuzzy c-varieties algorithm	Model Selection by Local Accuracy	Non-linear rule
S-5	SLO-1 Classical relations : Cartesian product, crisp relations	Measuring(dis)similarity-Evaluating the output of clustering method	The adaptive fuzzy clustering algorithm	Maximizing the Fuzzy Integral : What Does This Have to Do with Classifier Combination?	Neuro-fuzzy spectrum
	SLO-2 Fuzzy relations: cardinality of fuzzy relations, operations on fuzzy relations	Hierarchical clustering, Agglomerative clustering - Divisive clustering	Algorithms by Gustafson/Kessel and Gath/Geva	Pairwise Coupling - Pairwise Threshold Optimization	Analysis of Adaptive learning capability : Convergence based on the steepest descend method alone

S-6	SLO-1	Properties of fuzzy relations	K-Means clustering		Comparing the Combination Methods : Small Training Set, Three Models	Interpretability spectrum
	SLO-2	Tolerance and Equivalence relations: crisp tolerance		Cluster Estimation Models : AO membership functions	Large Training Set, Three Models	Evolution of antecedents
S-7	SLO-1	Fuzzy Tolerance	Perceptrons	ACE membership functions	Small Training Set, Three Good Models , One Worthless	Evolution of consequence
	SLO-2	Properties of Membership functions, Fuzzification and defuzzification – Features of the memberfunction	Feedforward networks.	Hyperconic clustering (dancing cones)	Large Training Set, Three Good Models, One Worthless	Evolving partitions
S-8	SLO-1	Various forms	Multilayer Networks and BackPropagation Algorithms	Cluster Validity : Global validity measures	Small Training Set, Worthless and Noisy Models Included	Neuro Fuzzy Control : Feedback control systems and Neuro fuzzy control
	SLO-2	Defuzzification of crisp sets	Linear Models – Linear regression, Logistic regression	Solid clustering validity measures, Shell clustering validity measures	Large Training Set, Worthless and Noisy Models Included	Expert control
S-9	SLO-1	Lambda cuts of fuzzy relations, Defuzzification to scalars	Tree learning : Decision trees	Local validity measures : The compatible cluster merging algorithm, The unsupervised FCSS algorithm	Fuzzy Association rules	Inverse learning, specialized learning
	SLO-2	Conclusion : Benefits of Fuzzy in comparison with crisp	Conclusion : Summary of ML concepts	Conclusion : Fuzzy based clustering merits	Conclusion : Fuzzy based classifier benefits	Conclusion : Summary / benefits of Neuro-fuzzy systems

Learning Resources	1. Vojislav Kecman, Learning and soft computing: Support vector Machines, Neural networks and Fuzzy logic models, A Bradford Book, The MIT Press., 2001, ISBN : 0-262-11255-8	4. Timothy Masters, Assessing and Improving Prediction and Classification Theory and Algorithms in C++, ISBN-13 (pbk): 978-1-4842-3335-1 ISBN-13 (electronic): 978-1-4842-3336-8 ,https://doi.org/10.1007/978-1-4842-3336-8, 2018.
	2. Timothy J. Ross, University of New Mexico, USA., Fuzzy Logic with Engineering Applications, 3rd Edition, Wiley, 2010. ISBN 978-0-470-74376-8 3. Frank Höppner, Frank Klawonn, Rudolf Kruse and Thomas Runkler: Fuzzy Cluster Analysis, Wiley (1999) ISBN 0-471-98864-2	5. Jyh-Shing, Roger Jang, Chuen-Tsai sun, Eiji Mizutani., Neuro fuzzy and soft computing – A computational approach to learning and machine intelligence, Prentice Hall (1997) , ISBN : 0-13-2610663 6. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012 7. Ethem Alpaydin, "Introduction to Machine Learning", Prentice Hall of India, 2005 8. Tom Mitchell, "Machine Learning", McGraw-Hill, 1997.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Understand										
Level 2	Apply	40 %	-	40 %	-	40 %	-	40 %	-	40%	-
	Analyze										
Level 3	Evaluate	20 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr.R.Gokulakrishnan, Additional Director(EXIM), Software Technology Parks of India , r.gokul@stpi.in 2. Dr.Prabhu, Coherent , US., prabu.balu@coherent.com	Dr.Subrat Kumar Nayak, Associate professor, Institute of Technical education and Research, subratnayak@soa.ac.in	Dr.G.Maragatham , Dr. Manas Ranjan Ms.A.Saranya

Course Code	18CSE390T	Course Name	COMPUTER VISION	Course Category	E	Professional Elective	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computer Science and Engineering		Data Book / Codes/Standards	Nil	

Course Learning Rationale (CLR):		The purpose of learning this course is to:		
CLR-1 :	Recognize and describe both the theoretical and practical aspects of computing with images. Connect issues from Computer Vision to Human Vision			
CLR-2 :	Describe the foundation of image formation and image analysis. Understand the basics of 2D and 3D Computer Vision.			
CLR-3 :	Become familiar with the major technical approaches involved in computer vision. Describe various methods used for registration, alignment, and matching in images.			
CLR-4 :	Get an exposure to advanced concepts leading to object and scene categorization from images.			
CLR-5 :	Build computer vision applications.			
Course Learning Outcomes (CLO):		At the end of this course, learners will be able to:		
CLO-1 :	Provide an introduction to computer vision including fundamentals of image formation	3	80	75
CLO-2 :	Provide a clear view of image formation	3	85	75
CLO-3 :	Provide a clear view of image processing	3	80	75
CLO-4 :	Provide knowledge about Computational photography	3	85	80
CLO-5 :	Provide knowledge about Image rendering	3	80	75

Duration (hour)		9	9	9	9	9
S-1	SLO-1	Introduction to Computer Vision	Points and patches-An Introduction	Active contours	Triangulation	Motion models
	SLO-2	Image formation	Feature detectors	Snakes	Two-frame structure from motion	Planar perspective motion
S-2	SLO-1	Geometric primitives	Feature descriptors	Dynamic snakes and CONDENSATION	Projective reconstruction	Rotational panoramas
	SLO-2	2D,3D Transformations			Self-calibration	
S-3	SLO-1	3D to 2D Projection	Feature matching	Scissors	Perspective and projective factorization	Gap closing
	SLO-2	Lighting,Reflectance and shading		Level Sets	Bundle adjustment	
S-4	SLO-1	Sampling and aliasing	Feature tracking	Split and merge	Exploiting sparsity	Cylindrical and spherical coordinates
	SLO-2	Image processing Point operators				
S-5	SLO-1	Pixel transforms	Edge detection	Mean shift and mode finding	Constrained structure and motion	Bundle adjustment
	SLO-2	Color transforms				
S-6	SLO-1	Histogram equalization	Edge linking	Normalized cuts	Hierarchical motion estimation	Parallax removal
	SLO-2					
S-7	SLO-1	Linear filtering	Successive approximation	Graph cuts and energy-based methods	Fourier-based alignment	Recognizing panoramas

	SLO-2	Non Linear filtering	Hough transforms			
S-8	SLO-1	Fourier transforms	Hough transforms	2D and 3D feature-based alignment	Incremental refinement	Compositing
S-9	SLO-1	Two-dimensional Fourier transforms , Wiener filtering	Vanishing points	Pose estimation	Case Study	Case Study

Learning Resources	1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer, 2010. 2. Forsyth/Ponce, "Computer Vision: A Modern Approach", Pearson Education India, 2nd edition (2015) 3. S. Nagabhushana, "Computer Vision and Image Processing", New Age International Pvt Ltd, First edition (2005)			4. Rafael C. Gonzalez "Digital Image Processing", Pearson Education; Fourth edition (2018)		
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Learning Assessment						
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)				Final Examination (50% weightage)
		CLA – 1 (10%)	CLA – 2 (15%)	CLA – 3 (15%)	CLA – 4 (10%)#	
Level 1	Remember	40%	30%	30 %	30%	30%
	Understand					
Level 2	Apply	40%	40%	40 %	40%	40%
	Analyze					
Level 3	Evaluate	10%	30%	30%	30%	30%
	Create					
	Total	100 %	100 %	100 %	100 %	-

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
	Dr. A.P. Shanthi , CEG Campus Anna University	1. Dr. V. Ganapathy, SRMIST
		2. T. Senthil Kumar, SRMIST

Course Code	18CSE353T	Course Name	DIGITAL IMAGE PROCESSING	Course Category	E	Professional Elective	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computer Science and Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):		The purpose of learning this course is to:		Learning			Program Learning Outcomes (PLO)															
CLR-1 :		To provide deep understanding of basic concepts of digital image acquisition		Level of Thinking (Bloom) Expected Proficiency (%) Expected Attainment (%)	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2 :		To provide deep Understanding of various digital image enhancement techniques			Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3			
CLR-3 :		Understand image restoration and segmentation methods			H	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
CLR-4 :		To provide understanding and implementation of image compression techniques			H	H	H	-	H	-	-	-	-	-	-	-	-	-	-	-		
CLR-5 :		Provide understanding and knowledge of image recognition methods			H	H	M	-	H	-	-	-	-	-	-	-	-	-	-	-		
Course Learning Outcomes (CLO):		At the end of this course, learners will be able to:																				
CLO-1 :	Understand basics of digital images and tools for image processing		2	80	85																	
CLO-2 :	Learn and implement image Enhancement techniques		2	75	80																	
CLO-3 :	Understand and Learn image Restoration and Segmentation Methods		2	85	80																	
CLO-4 :	Understand and implement Image Compression techniques		2	80	75																	
CLO-5 :	Learn and Implement Image Recognition methods		2	75	85																	

Duration (hour)	9	9	9	9	9
S-1	SLO-1	Introduction	Introduction to Spatial Domain	Noise models – Mean Filters – Order Statistics	Wavelets – Subband coding – Multiresolution expansions
S-2	SLO-1	Origin- Steps in Digital Image Processing	Gray level transformations	Adaptive filters – Band reject Filters – Band pass Filters	Fundamentals of Compression – Image Compression methods - Error Free Compression
S-3	SLO-1	Components	Histogram processing	Inverse Filtering – Wiener filtering Segmentation	Variable Length Coding – Bit-Plane Coding – Lossless Predictive Coding
S-4	SLO-1	Elements of Visual Perception	Basics of Spatial Filtering	Point, Line, and Edge Detection	Lossy Compression – Lossy Predictive Coding
S-5	SLO-1	Image Sensing and Acquisition	Smoothing and Sharpening Spatial Filtering	Marr-Hildreth & Canny edge detector	Compression Standards-Huffman, Arithmetic coding, LZW coding, Run Length Encoding
S-6	SLO-1	Image Sampling and Quantization	Frequency Domain: Basics of filtering	Edge Linking and Boundary detection	Compression StandardsHuffman, Arithmetic coding, LZW coding, Run Length Encoding
S-7	SLO-1	Relationships between pixels	Smoothing and Sharpening frequency domain filters	Local & Regional processing-Region based segmentation	Block Transform coding, Wavelet coding, JPEG standard
S-8	SLO-1	Introduction to Image processing toolbox in MATLAB	Smoothing and Sharpening frequency domain filters	Morphological processing- Watershed segmentation algorithm	MATLAB code for image compression: Huffam coding, Arithmetic coding, wavelet coding
S-9	SLO-1	Tool box practice	MATLAB code for histogram equalization	MATLAB code for restoring an image after degradation using adaptive and wiener filter	MATLAB code for image compression: Huffam coding,
	SLO-2	Exploring functions	MATLAB code for spatial and frequency domain filter.	Edge detection operators	Arithmetic coding, wavelet coding

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Understand										
Level 2	Apply	40 %	-	40 %	-	40 %	-	40 %	-	40%	-
	Analyze										
Level 3	Evaluate	20 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Madhan Thandayithapani kutiyappan, Assistant consultant, TCS - siruseri	Dr. S. Sridhar, Anna University	Dr. G.Niranjana. Associate Professor/CSE
	Dr. Senthil kumar, Annauniversity	Mr. Rajasekar Assistant Professor/IT Mr. James Joseph Assistant Professor/SWE

Course Code	18CSE359T	Course Name	NATURAL LANGUAGE PROCESSING	Course Category	E	Professional Elective	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	CSE	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)
CLR-1:	Teach students the leading trends and systems in natural language processing.	1 2 3	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
CLR-2:	Make them understand the concepts of morphology, syntax, semantics and pragmatics of the language and that they are able to give the appropriate examples that will illustrate the above mentioned concepts.	Level of Thinking (Bloom)	Engineering Knowledge
CLR-3:	Teach them to recognize the significance of pragmatics for natural language understanding.	Expected Proficiency (%)	Problem Analysis
CLR-4:	Enable students to be capable to describe the application based on natural language processing and to show the points of syntactic, semantic and pragmatic processing.	Expected Attainment (%)	Design & Development
CLR-5:	To conceive basics of knowledge representation, inference, and relations to the artificial intelligence.		Analysis, Design, Research
CLR-6:	To understand natural language processing and to learn how to apply basic algorithms in this field		Modern Tool Usage
			Society & Culture
			Environment & Sustainability
			Ethics
			Individual & Team Work
			Communication
			Project Mgt. & Finance
			Life Long Learning
			PSO-1
			PSO-2
			PSO-3

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
CLO-1:	Understand approaches to syntax and semantics in NLP.	2	80	85	H	H	H	H	H	-	-	-	H	M	M	H	H	H	H
CLO-2:	Understand approaches to discourse, generation, dialogue and summarization within NLP.	2	75	80	H	H	H	H	H	-	-	-	H	M	M	H	H	H	H
CLO-3:	Understand current methods for statistical approaches to machine translation.	2	85	80	H	L	M	H	H	-	-	-	H	M	M	H	H	H	H
CLO-4:	Understand machine learning techniques used in NLP, including the probabilistic context-free grammars and unsupervised methods, as applied within NLP	2	80	75	H	H	H	H	H	-	-	-	H	M	M	H	H	H	H
CLO-5:	Understand the knowledge of various levels of analysis involved in NLP	2	75	85	H	H	H	H	H	-	-	-	H	M	M	H	H	H	H
CLO-6:	Gain knowledge in automated Natural Language Generation and Machine Translation	2	80	85	H	L	L	H	H	-	-	-	H	M	M	H	H	H	H

Duration (hour)	9	9	9	9	9
S-1	SLO-1 Introduction to Natural Language Processing	Syntax Parsing	Semantic Relations	Information Extraction and its approaches	Introduction to Probabilistic Approaches
	SLO-2 Steps - Morphology - Syntax - Semantics	Dependency Parsing	Semantic Role Labeling		Statistical Approaches to NLP Tasks
S-2	SLO-1 Morphological Analysis (Morphological Parsing)	Semantics	Semantic Frames	Information Retrieval	Sequence Labeling
	SLO-2 Stemming - Lemmatization	Semantic Parsing	Ontology and Semantics		
S-3	SLO-1 Parts of Speech Tagging	Word Sense Disambiguation	Semantic Network and Knowledge Graph	Semantic Search	Problems - Similarity Measures
	SLO-2				
S-4	SLO-1 Approaches on NLP Tasks (Rule-based, Statistical, Machine Learning)	Lexical Disambiguation	Intent Detection and Classification	Summarization	Word Embeddings
	SLO-2			Extractive Vs Abstractive Summarization	
S-5	SLO-1 N-grams	Structural Disambiguation	Paraphrase Extraction	Information Fusion	CBOW
	SLO-2				
S-6	SLO-1 Multiword Expressions	Word, Context and Sentence-level Semantics	Discourse	Single and Multi-document	Skip-gram
	SLO-2		Coreference Resolution	Summarization - Question Answering	
S-7	SLO-1 Collocations (Association Measures, Coefficients and Context Measures)	Pronoun Resolution	Text Coherence	Introduction to Chatbot Applications	Sentence Embeddings
	SLO-2			Retrieval based- Conversation based	

S-8	SLO-1	Vector Representation of Words	Semantic Representation of text	Discourse Structure	NLU and NLG	Recurrent Neural Networks (RNN)
	SLO-2			Coherence		
S-9	SLO-1	Language Modeling	Introduction to Semantic Relations	Discourse Planning	Machine Translation	Long Short-Term Memory (LSTM)
	SLO-2				Interlingua	

Learning Resources	1. Danie Jurafsky and James H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", Prentice Hall, 2nd Edition, 2018.	3. James Allen, Benjamin Cummings, "Natural Language Understanding", 2nd edition, 1995
	2. C. Manning and H. Schütze, "Foundations of Statistical Natural Language Processing", MIT Press. Cambridge, MA, 1999	4. Yoav Goldberg, "Neural Network Methods for Natural Language Processing". 5. http://mccormickml.com/2106/04/19/word2vec-tutorial-the-skip-gram-model/ 6. https://nlp.stanford.edu/pubs/glove.pdf

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40 %	-	30 %	-	30 %	-	30 %	-	30%	-
Level 2	Understand	40 %	-	40 %	-	40 %	-	40 %	-	40%	-
	Apply										
Level 3	Analyze	40 %	-	40 %	-	40 %	-	40 %	-	40%	-
	Evaluate	20 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. J. Balaji, Associate Manager, Allstate Solutions Pvt Ltd, jagank.balaji@gmail.com	1. Dr. G. Nagappan, Professor, nagappan@saveetha.ac.in (sent for review)	1. Dr. M. Ferni Ukrit, SRMIST
		2. Dr. A. Pandian, SRMIST
		3. Ms. K. Meenakshi, SRMIST

Course Code	18CSE479T	Course Name	STATISTICAL MACHINE LEARNING	Course Category	E	Professional Elective	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	CSE	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):		The purpose of learning this course is to:			Learning			Program Learning Outcomes (PLO)														
CLR-1 :	Understand the statistical machine learning techniques.				1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2 :	Gain knowledge on linear regression models ,Random Forests				Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
CLR-3 :	KNN classifier Gain knowledge on the basics of probabilistic approaches like Naive Bayes, Bayes Theorem																					
CLR-4 :	Acquire knowledge on Support Vector machines																					
CLR-5 :	Introduce the working principle of Artificial Neural networks																					
CLR-6 :	Understand the K-means clustering techniques, PCA and SVD							H	-	-	-	-	-	-	-	-	-	-	H	H	-	-
Course Learning Outcomes (CLO):		At the end of this course, learners will be able to:						H	H	-	-	-	-	-	-	-	-	-	H	H	-	-
CLO-1 :	Acquire the knowledge on statistical machine learning techniques.				1	80	85	H	H	-	-	-	-	-	-	-	-	-	H	H	-	-
CLO-2 :	Acquire the ability to build model based on logistic regression and random forest techniques				1	75	80	H	-	-	-	-	-	-	-	-	-	-	H	H	-	-
CLO-3 :	Understand the basic ideas of probability and work on probabilistic approaches like Naive Bayes, Bayes Theorem				1	85	80	H	H	H	H	-	-	-	-	-	-	-	H	H	M	H
CLO-4 :	Apply the knowledge of Kernel functions in practical applications				3	80	75	H	H	H	H	-	-	-	-	-	-	-	H	H	M	H
CLO-5 :	Apply the knowledge of K-means clustering on real world examples				3	75	85	H	-	H	H	-	-	-	-	-	-	-	H	H	M	H
CLO-6 :	Acquire the knowledge on using PCA and SVD with Scikit-learn				2	80	85	H	-	H	H	-	-	-	-	-	-	-	H	H	M	H

Duration (hour)	9	9	9	9	9
S-1	SLO-1 Statistical terminology for model building and validation-Machine Learning, Major differences between statistical modeling and machine learning	Comparison between regression and machine learning models Compensating factors in machine learning models	K-nearest neighbors-KNN voter example Curse of dimensionality-Curse of dimensionality with 1D, 2D, and 3D example	Support Vector Machines and Neural Networks-Support vector machines working principles-Maximum margin classifier	K-means clustering-K-means working methodology from first principles
S-2	SLO-1 Steps in machine learning model development and deployment	Assumptions of linear regression Steps applied in linear regression modeling	Curse of dimensionality with 3D example	Support vector classifier	Optimal number of clusters and cluster evaluation
S-3	SLO-1 Statistical fundamentals and terminology for model building and validation	Example of simple linear regression from first principles	KNN classifier with breast cancer Wisconsin data example	Support vector machines	The elbow method
S-4	SLO-1 Bias versus variance trade-off, Train and test data	Machine learning models - ridge and lasso regression-Example of ridge regression machine learning, Example of lasso regression machine learning model	Naive Bayes	Kernel functions	K-means clustering with the iris data example
S-5	SLO-1 Linear regression versus gradient descent	Logistic Regression Versus Random Forest-Maximum likelihood estimation	Probability fundamentals-Joint probability	Artificial neural networks - ANN	Principal component analysis - PCA-PCA working methodology from first principles
S-6	SLO-1 When to stop tuning machine learning models	Terminology involved in logistic regression Applying steps in logistic regression modeling	Understanding Bayes theorem with conditional probability	Forward propagation and backpropagation	PCA applied on handwritten digits using scikit-learn
S-7	SLO-1 Train, validation, and test data Cross-validation	Random forest-Example of random forest using German credit data Grid search on random forest	Naive Bayes classification	Optimization of neural networks-Stochastic gradient descent - SGD	Singular value decomposition - SVD

S-8	SLO-1 SLO-2	Grid Search	Variable importance plot	Laplace estimator	Introduction to deep learning-Solving methodology	SVD applied on handwritten digits using scikit-learn
S-9	SLO-1 SLO-2	Machine learning model overview	Comparison of logistic regression with random forest	Naive Bayes SMS spam classification example	Deep learning software	SVD applied on handwritten digits using scikit-learn

Learning Resources	1. Prata Dange, "Statistics for Machine Learning", Packt Publishing Ltd., 2017. 2. Masashi Sugiyama, "Introduction to Statistical Machine Learning", Elsevier, 2016	3. Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani, An Introduction to Statistical Learning with Applications in R, Springer, 2015 4. Hastie Trevor, The Elements of Statistical Learning: Data Mining, Inference, and Prediction, Springer-Verlag New York Inc, February 2009
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Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Understand										
Level 2	Apply	40 %	-	40 %	-	40 %	-	40 %	-	40%	-
	Analyze										
Level 3	Evaluate	20 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Harisekharan, CTO, Sri Seshaa Technologies Pvt. Ltd., Chennai	1. Dr. Bagavandas, Centre for Statistics, SRMIST	1. Dr. G. Vadivu
2. Mr. S. Sudarsun – Chief Scientist, Co-Founder, Buddhealth	2. Dr. Sampath, Professor, Department of Statistics, Madras University	2. Dr. C. Lakshmi
		3. Dr. G. Manju

Course Code	18CSE480T	Course Name	NATURE INSPIRED COMPUTING TECHNIQUES	Course Category	E	Professional Elective	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computer Science and Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):		The purpose of learning this course is to:			Learning		
CLR-1 :	To Understand the basics of Natural systems				1	2	3
CLR-2 :	To appreciate the concepts of Natural systems and its applications				Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment(%)
CLR-3 :	To understand newBasic Natural systems functions(operations)						
CLR-4 :	To understand the fundamentals of nature inspired techniques which influence computing						
CLR-5 :	To understand an Integration of Hardware and software in Natural applications.						
CLR-6 :	To Understand practical implementation of Natural design considerations.						
Course Learning Outcomes (CLO):		At the end of this course, learners will be able to:					
CLO-1 :	Illustrate the basic concepts of Swarm Intelligenceprocesses				3	80	70
CLO-2 :	Examine the principle of Immuno computing techniques				3	85	75
CLO-3 :	Skills for planning, estimating, and resourcing for Natural design considerations				3	75	70
CLO-4 :	Manage the scope changes of nature inspired techniques which influence computing				3	85	80
CLO-5 :	Ability to identify optimization Techniques as a means to provide functionality and value to apply context in specific case studies				3	85	75
CLO-6 :	Ability to understand the needs and familiarize the DNA Computing				3	80	70

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
L	H	L	H	L	L	M	L	L	L	M	L	L	L	L
L	H	L	H	L	L	M	L	L	L	M	L	L	L	L
L	H	L	H	L	L	M	L	L	L	M	L	L	L	L
L	H	L	H	L	L	M	L	L	L	M	L	L	L	L
L	H	L	H	L	L	M	L	L	L	M	L	L	L	L
L	H	L	H	L	L	M	L	L	L	M	L	L	L	L

Duration (hour)	9	9	9	9	9
S-1	SLO-1 Introduction	Evolutionary Computing	Swarm Intelligence	Introduction to Immune System	DNA Computing
	SLO-2 Overview of Philosophy		Introduction		
S-2	SLO-1 Nature to Nature Computing	Hill Climbing	Ant Colony Optimization	Physiology and main components	DNA Molecule
	SLO-2		Ant Foraging Behavior		
S-3	SLO-1 A Brief Overview of Three Branches	Simulated Annealing	Ant Colony Optimization	Pattern Recognition and Binding	Adleman's experiment
	SLO-2 Individuals, Entities and agents		SACO algorithm		
S-4	SLO-1 Parallelism and Distributivity Interactivity	Simulated Annealing	Ant Colony Algorithm (ACA)	Immune Network Theory	PAM Model
	SLO-2			Danger Theory	
S-5	SLO-1 Adaptation- Feedback	Genetics Principles	scope of ACO algorithms	Immune Algorithms	Splicing Systems
	SLO-2				
S-6	SLO-1 Self-Organization	Standard Evolutionary Algorithm	Swarm Robotics	Genetic algorithms	From Classical to DNA Computing
	SLO-2 Complexity, Emergence	Genetic Algorithms			
S-7	SLO-1 Bottom-up Vs Top-Down Approach	Reproduction	Social Adaptation of Knowledge	Bone Marrow Models	Universal DNA Computers
	SLO-2	Crossover Mutation			
S-8	SLO-1 Determination	Evolutionary Programming	Particle Swarm Optimization	Forest's Algorithm	Scope of DNA Computing
	SLO-2				
S-9	SLO-1 Chaos and Fractals	Genetic Programming	Particle Swarm Optimization	Artificial Immune Networks	Lipton's Solution to SAT Problem
	SLO-2				

Learning Resources	1. <i>Leandro Nunes de Castro, "Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", Chapman & Hall/CRC, Taylor and Francis Group, 2007.</i>	3. <i>Albert Y. Zomaya, "Handbook of Nature-Inspired and Innovative Computing", Springer, 2006</i> 4. <i>Marco Dorigo, Thomas Stutzle, "Ant Colony Optimization", PHI, 2005</i>
	2. <i>Floreano D. and Mattiussi C., "Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies", MIT Press, Cambridge, MA, 2008.</i>	

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#		Theory	Practice
Level 1	Remember	40 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Understand										
Level 2	Apply	40 %	-	40 %	-	40 %	-	40 %	-	40%	-
	Analyze										
Level 3	Evaluate	20 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. Lokesh Peta, Head Developer, OE Connection, Newbury-UK; Mail: peta.lokesh@gmail.com	Prof. A. Amuthan, Professor, Pondicherry Engineering College, amuthan@pec.edu	Dr. G. Maragatham / Mr. C. Santhana Krishnan Dr. C. Lakshmi

Course Code	18CSE481T	Course Name	APPLIED MACHINE LEARNING	Course Category	E	Professional Elective	L	T	P	C
							3	0	0	3

Pre-requisite Courses	18CSE392T	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	CSE	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):		Learning		
The purpose of learning this course is to:		1	2	3
CLR-1 :	Analyze the text data using Machine Learning	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-2 :	Analyze the audio data using Machine Learning			
CLR-3 :	Analyze Time series and Sequential data using Machine Learning			
CLR-4 :	Analyze the Image Content using Machine Learning			
CLR-5 :	Visualize the data			

Course Learning Outcomes (CLO):		At the end of this course, learners will be able to:		
CLO-1 :	Identifying patterns in text using topic modeling	3	75	80
CLO-2 :	Building a speech recognizer	3	75	80
CLO-3 :	Extracting statistics from time series data, Building Conditional Random Fields for sequential text data	3	75	80
CLO-4 :	Building an object recognizer	3	75	80

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
H	M	H	-	H	-	-	-	-	-	-	H	H	H	H
H	M	H	-	H	-	-	-	-	-	-	H	H	H	H
H	M	H	-	H	-	-	-	-	-	-	H	H	H	H
H	M	H	-	H	-	-	-	-	-	-	H	H	H	H

Duration (hour)		9	9	9	9	9
S-1	SLO-1	Text Feature Engineering Introduction	Speech Recognition Introduction	Dissecting Time Series and Sequential Data	Image Content Analysis	Biometric Face Recognition
	SLO-2	Cleaning text data	Reading audio data	Introduction	Computer Vision	Face detection from the image and video
S-2	SLO-1	Preprocessing data using tokenization	Plotting audio data	Transforming data into the time series format Pandas and Numpy to convert Time Series data	Operating on images using OpenCV-Python	Capturing and processing video from a webcam Resizing and Scaling
	SLO-2	Tagging and categorising words	Transforming audio signals into the frequency domain	Plotting time series data	Learn to extract and load the image	Building a face detector using Haar cascades
S-3	SLO-1	Sequential tagging, Backoff tagging	Apply Fourier transform signal and plot	Slicing time series data Operating on time series data	Detecting edges Histogram equalization	determine the location of a face in the video frames captured from the webcam
	SLO-2	Creating features from text data- Stemming,	Generating audio signals with custom parameters	Plotting sliced time series data	Sobel filter, Laplacian edge detector, Canny edge detector	Face detector on the grayscale image
S-4	SLO-1	Lemmatizing	Generate the time axis	Operating on time series data	Histogram equalization	Building eye and nose detectors
	SLO-2	Bagging using random forests	Synthesizing music	Extracting statistics from time series data	Visualize gray scale image	Face cascade classifier

S-5	SLO-1	Implementing bag of words	Construct the audio sample -amplitude and frequency	Correlation coefficients	Detecting corners	Visualize eye and nose detector
	SLO-2	Testing prepared data	synthesizer function	Plotting and understanding correlations	Understand the output corner detection image	Performing Principal Components Analysis
S-6	SLO-1	Analyze the results	Extracting frequency domain features	Building Hidden Markov Models for sequential data	Detecting SIFT feature points	PCA in face recognition systems
	SLO-2	Building a text classifier	MFCC and filter bank features	Prepare the Time Series data	SIFT feature detection	Convert the dataset from a five-dimensional set to a two-dimensional set
S-7	SLO-1	Analyzing the sentiment of a sentence	Building Hidden Markov Models	Train Gaussian HMM	Visualize the feature detected image	Kernel Principal Components Analysis
	SLO-2	Implement the sentiment analysis of a sentence	HMM training and prediction	Visualizing the model	Building a Star feature detector	Perform Kernel PCA
S-8	SLO-1	Identifying patterns in text using topic modeling	Building a speech recognizer	Building Conditional Random Fields for sequential text data	Detect features using the Star feature detector	Plot the PCA-transformed data
	SLO-2	Implement identifying patterns in text using topic modeling	MFCC features	CRF Model	Visualize keypoints on the input image	Plot Kernel PCA-transformed data
S-9	SLO-1	Case study- Twitter Data	Case study	Analyzing stock market data using Hidden Markov Models	Creating features using visual codebook and vector quantization	Performing blind source separation
	SLO-2	Case study- Twitter Data	Case study	Train the HMM and visualize	Method to quantize the data points	Independent Components Analysis

Learning Resources	1. Prateek Joshi and co, Python: Real World Machine Learning, Packt Publishing, 2016	3. Richert Coelho, Building Machine Learning Systems with Python, Packt Publishing, 2016
	2. Sebastian Raschka, Python Machine Learning, Packt Publishing, 2013.	4. Michael Bowles, Machine Learning in Python, Wiley & Sons, 2015

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Understand										
Level 2	Apply	40 %	-	40 %	-	40 %	-	40 %	-	40%	-
	Analyze										
Level 3	Evaluate	20 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry		Experts from Higher Technical Institutions
Dr. Harisekharan, CTO, Sri Seshaa Technologies Pvt. Ltd., Chennai		Dr. J. Suresh, SSN College of Engineering
Mr. S. Sudarsun – Chief Scientist, Co-Founder, Buddhealth		Dr. Sharmila Shankar, Crescent Institute of Science and Technology
		Internal Experts
		1. Dr. G. Vadiyu
		2. Mr. Karthik Nanmaran
		3. Dr. Renukadevi

Course Code	18CSE482T	Course Name	COMPUTATIONAL NEUROSCIENCE	Course Category	E	Professional Elective			
						L	T	P	C
						3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computer Science & Engg	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning			Program Learning Outcomes (PLO)														
CLR-1 :	Understand to knowWhat happens in your brain when you make a decision	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2 :	Gain knowledge mathematical and computational models that are used in the field of theoretical neuroscience																		
CLR-3 :	Basics of adaptively and learning,																		
CLR-4 :	Acquire knowledge on Basic models of cognitive processing.																		
CLR-5 :	Acquire knowledge on implementation model for neuro models																		
CLR-6 :	Acquire knowledge on various computational algorithm																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Lifelong Learning	PSO-1	PSO-2	PSO-3
CLO-1 :	To Design Models of single neurons , and small networks	3	80	70	L	H	L	H	H	-	-	-	L	L	-	H	L	H	H
CLO-2 :	Implementation of all simple as well as more complex numerical computations with few neurons.	3	85	75	H	H	L	M	L	-	-	-	M	L	-	H	L	H	H
CLO-3 :	Analyse connected networks in the mean-field limit	3	75	70	H	H	M	H	L	-	-	-	M	L	-	H	L	H	H
CLO-4 :	Formalize biological facts into mathematical models	3	85	80	M	H	M	H	L	-	-	-	M	L	-	H	L	H	H
CLO-5 :	Understand a simple mathematical model of memory formation in the brain	3	85	75	H	H	M	H	L	-	-	-	M	L	-	H	L	H	H
CLO-6 :	Understand a simple mathematical model of decision processes	3	80	70	L	H	-	H	L	-	-	-	L	L	-	H	L	H	H

Duration (hour)		9	9	9	9	9
S-1	SLO-1	History of Computational Neuroscience	Four components of Neural Signaling	From artificial neural network to realistic neural networks - Introduction	Memory Classification Scheme – Declarative, Non-declarative	Hebbian Learning-Hebbian versus Perceptron Learning-
	SLO-2	Models in Computational Neuroscience	Four components of Neural Signaling	Modelling the ventral stream	Auto-associative network and hippo campus - Learning and retrieval phase	Learning by Error Minimization
S-2	SLO-1	Computational Theory of the Brain	Neurotransmission	Modelling the dorsa and auditory stream	Point-attractor neural networks - Network dynamics and training	Gradient Descent Learning
	SLO-2	Biological Background	Population dynamics	Mechanical behavior of ceramics-flexural strength -The Perceptron .	Signal-to-noise analysis - Noisy weights and diluted attractor networks	Stabilizing Hebbian Learning
S-3	SLO-1	Basic synaptic mechanisms and dendritic processing	Modeling the average behavior of neurons	Mapping function	Sparse attractor neural networks and correlated patterns-Sparse patterns and expansion recoding	Principal Component Analysis (PCA)- Eigenvectors-Eigenvalues-Covariance matrix
	SLO-2	The generation of action potentials	Hodgkin	Multi-layer Perceptron	Control of sparseness in attractor networks	Singular Value Decomposition
S-4	SLO-1	Stimulation and rising phase	Modeling the average behavior of neurons	Back-propagation – Initution , Derivation	Chaotic networks-Attractors	Limits and Extensions of PCA
	SLO-2	Peak and falling phase	Huxley Model	Back-propagation –Loss Function	Lyapunov functions - The Cohen-Grossberg theorem	Variations of Hebbian Learning
S-5	SLO-1	After hyperpolarization and Refractory Period	Spiking neuron models - Single	Back-propagation – Limitation	Asymmetrical networks	Nonlinear Hebbian learning
	SLO-2	Hodgkin and Huxley equations - Intro	Spiking neuron models - Detailed	Support Vector Machines - Introduction	Non-monotonic networks	Linsker's Model of the Visual System
S-6	SLO-1	Neuron - axons,dendritesetc, thefour components ofNeural Signaling	Spiking neuron models – 2D Model	Support Vector Machines - Classification	Complementary memory systems	Application of Lateral Inhibition
	SLO-2	Neurotransmission:neurotrasmitter,receptor, ionchannel, channelgating	Integrate and firing model -Leaky integrate-and-fire model	Support Vector Machines - Regression	Distributed model of working memory-Limited capacity of working memory	Lateral Geniculate Nucleus

Course Code	18CSE483T	Course Name	INTELLIGENT MACHINING	Course Category	E	Professional Elective			
						L	T	P	C
						3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	CSE	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning			Program Learning Outcomes (PLO)														
CLR-1 :	Understand the fundamentals of Artificial Intelligence	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2 :	Learn basics of Intelligent machining, sensors and machining process																		
CLR-3 :	Understand the design of Intelligent Systems - RTOS																		
CLR-4 :	Understand the computational methods, optimization and reasoning about physical system																		
CLR-5 :	Understand implications of Artificial Intelligence in various real time applications																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLO-1 :	Acquire the knowledge on the fundamentals of Artificial intelligence and its problem solving approaches	2	80	85															
CLO-2 :	Acquire the knowledge on fundamentals of Intelligent Machining and machining process	2	75	80	H	H	H	H	H	H	-	-	-	-	-	H	-	-	-
CLO-3 :	Acquire knowledge on the design of Intelligent Systems and RTOS	2	85	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-4 :	Acquire knowledge on computational methods and optimization	2	80	75	-	H	-	-	H	-	-	-	-	-	-	-	-	-	-
CLO-5 :	Apply the knowledge on Real time applications	2	75	85	-	H	-	-	H	-	-	-	-	-	-	-	-	-	-

Duration (hour)	9	9	9	9	9
S-1	SLO-1 Introduction to Artificial Intelligence and its techniques	Introduction Intelligent Machining, Basics	Representation of Intelligent systems	Computational methods and optimization	Case Study - Autonomous Vehicle (Driver Less Car)
	SLO-2 Problem Solving with Artificial Intelligence	Open Architecture Machine Control	Control for the Evolution of VLSI Designs		
S-2	SLO-1 AI Models, Data acquisition and learning aspects of AI	Manufacturing Automation Protocol	An Object-Oriented Approach	Neural Network Modelling	Case Study - Defect Prediction , Wear and Tear Prediction in Mechanical devices
	SLO-2 Problem Solving - Problem Solving Process, Formulating Problems	The Evolution of Intelligent Machining			
S-3	SLO-1 Problem types and Characteristics	MOSAIC - NGC	Tools and Techniques for Conceptual Design	Fuzzy set theory	Case Study - Flying Drones
	SLO-2 Problem Space and Search	OSACA - SERCOS	Design Compilers		
S-4	SLO-1 Intelligent Agent	Components of Intelligent Machining	Labelled Interval Calculus	Machining Optimization	Case Study - Cogito
	SLO-2 Rationality and Rational agent with performance measures	Introduction sensors - Machining Process	Knowledge Representations for Design Improvisation		
S-5	SLO-1 Flexibility and Intelligent Agents	Sensing and Monitoring	A knowledge-based Framework for Design	Objective Functions and Constraints	Case Study - Alexa , SIRI
	SLO-2 Task Environment and its Properties	Signal Processing		Optimization Techniques	
S-6	SLO-1 Types of Agents	Transforming Data into Information - Examples	Introduction to RTOS - Hardware Components	Reasoning about physical system	Case Study - Smarter Home robots
	SLO-2 Other aspects of agents	Machining Process Control			
S-7	SLO-1 Constraint satisfaction problem (CSP)	Practical Uses of Machine Learning	Design Principles of RTOS - Interrupt Processing - task Management	Temporal Qualitative Analysis	Case Study -Application of AI in CAD/CAM
	SLO-2 Crypto Arithmetic puzzles	Machine Learning Process Control Strategies			
S-8	SLO-1 CSP as a search problem-constraints and representation	Programmable Logic Controllers (PLC)	Task Scheduling -Synchronization tools	Reasoning about Geometry	Case Study - Streamlining Drug Discovery

	SLO-2	CSP- backtracking and Role of heuristic	Closed Loop Process Control Systems	Task Communication - Memory Management		
S-9	SLO-1	CSP - Froward Checking and constraint propogation	Introduction to Adaptive Control	File System	Study of Heuristic knowledge for automatic configuration Generation and Innovation	Case Study - Betterment (Financial Advisor)
	SLO-2	CSP-Intelligent backtracking	Commercially Available Software	Tracing and Debugging		

Learning Resources	1.Farid Meziane, Sunil Vadera, Khiary Kobbacy and Nathan Proudlove, "Intelligent Systems in Manufacturing: Current Developments and Future Prospects", (unit 1)	5. K.C.Wang, " Embedded and Real-Time Operating Systems (Chapter 10.6- Unit 3) 6. Sam Siewert, John Pratt, " Real-Time Embedded Components and Systems with Linux and RTOS", David Pallai Publisher, 2016. (Chapter 8- Unit 3) 7. <i>Machining: Fundamentals and Recent Advances</i> , J. Paulo Davim, Springer. (Chapter 12-unit 4) 8. <i>Artificial Intelligent in Engineering Design: Volume 2</i> , Gerard Meurant, Springer (Chapter 10-14 - unit 5)
	2. <i>How Netflix Uses Analytics To Select Movies, Create Content, and Make Multimillion Dollar Decisions</i> Author: Zach Bulogo(unit 1) 3. <i>Digital Signal Processing: A Practical Guide for Engineers and Scientists</i> , Steven Smith (unti 2) 4. <i>Artificial Intelligent in Engineering Design: Volume 1</i> , Gerard Meurant, Springer (Chapter 2,3,5,6,9 -unit3)	

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Understand										
Level 2	Apply	40 %	-	40 %	-	40 %	-	40 %	-	40%	-
	Analyze										
Level 3	Evaluate	20 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Dr, Mariappan, Engineering Leader, Amazon, India	Khanna Nehemiah H, Professor, Ramanujam Computing Center, Anna University	1.Dr.C.Lakshmi, SRMIST
		2. Dr.S Prabakaran, SRMIST
		3. Dr. M. Thenmozhi, SRMIST

Course Code	18CSE484T	Course Name	DEEP LEARNING	Course Category	E	Professional Elective	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computer Science and Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)
CLR-1 :	Understand the concepts of Neural Networks and Deep Learning	1 2 3	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
CLR-2 :	Understand Deep neural network and layered learning approach		
CLR-3 :	Study and understand CNN and RNN for deep learning		
CLR-4 :	Learn and understand Auto Encoders and its applications		
CLR-5 :	Understand concept of transfer learning and its applications with keras		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom) Expected Proficiency (%) Expected Attainment (%)	Engineering Knowledge Problem Analysis Design & Development Analysis Design Research Modern Tool Usage Society & Culture Environment & Sustainability Ethics Individual & Team Work Communication Project Mgt. & Finance Life Long Learning PSO-1 PSO-2 PSO-3
CLO-1 :	Apply basic mathematical concepts in Deep Learning	2 80 85	H L - - H - - - - - H H - -
CLO-2 :	Work with powerful framework for supervised learning	3 75 80	H H - - H - - - - - H H H M
CLO-3 :	Deal with Convolution Neural Networks	2 85 80	H H H - H - - - - - H H H H
CLO-4 :	Analyze various types efficient data encoders	2 80 75	H H - - H - - - - - H H H H
CLO-5 :	Apply various network models in deep learning	3 75 85	H H H H H - - - - - H H H H

Duration (hour)	9	9	9	9	9
S-1	SLO-1 Historical trends in deep learning – Machine Learning basics	Introduction to Simple DNN	Convolution Neural Networks Introduction	Encoder	Deep Architectures in Vision
	SLO-2 Learning algorithms – Supervised and Unsupervised Training	Platform for Deep Learning	Convolution Operation	Decoder	AlexNet to ResNet
S-2	SLO-1 Linear Algebra for machine learning	Deep Learning Software Libraries	Motivation	Auto Encoders Introduction	Transfer Learning
	SLO-2 Testing - Cross Validation	Deep Feed Forward Networks Introduction	Pooling	Auto Encoders	
S-3	SLO-1 Dimensionality Reduction	Learning XOR	Normalization	Under Complete Auto Encoder	Siamese Networks
	SLO-2 Over fitting /Under Fitting	Gradient-Based Learning	Applications in Computer Vision - ImageNet	Regularized Auto Encoder	
S-4	SLO-1 Hyper parameters and validation sets	Various Activation Functions, ReLU, Sigmoid – Error Functions	Sequence Modelling –VGGNet, LeNet	Stochastic Auto Encoder	Metric Learning
	SLO-2 Estimators – Bias - Variance	Architecture Design	Recurrent Neural Networks	Denosing Auto Encoder	Ranking / Triplet Loss
S-5	SLO-1 Loss Function-- Regularization	Differentiation Algorithms	RNN topologies- Difficulty in Training RNN	Contractive Auto Encoder	RCNNs with keras
	SLO-2 Biological Neuron – Idea of Computational units	Regularization methods for Deep Learning		Auto Encoder Applications	
S-6	SLO-1 McCulloch-Pitts units and Thresholding logic	Early Stopping	Long Short Term Memory	Dimensionality Reduction and Classification using Auto encoders	CNN-RNN
	SLO-2 Linear Perceptron	Drop Out		Recommendation	
S-7	SLO-1 Perceptron Learning Algorithm	Difficulty of training deep neural networks	Bidirectional LSTMs	Optimization for Deep Learning-Optimizers –RMS prop for RNNs	Applications in captioning and Video tasks
	SLO-2 Convergence theorem for Perceptron Learning Algorithm				
S-8	SLO-1 Linear Separability	Greedy layer wise training	Bidirectional RNNs	SGD for CNNs	3D CNNs
	SLO-2 Multilayer perceptron –The first example of network with Keras code				
S-9	SLO-1 Backpropagation	Optimization methods for Neural Networks-Adagrad, Adam	Application case study -Handwritten digits recognition using deep learning, LSTM with Keras – sentiment Analysis	Application case study – Image dimensionality reduction using encoders LSTM with Keras – sentiment Analysis	Application case study – Image recognition using RCNN and transfer learning
	SLO-2				

Learning Resources	1. <i>Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.</i>	3. <i>Neural Networks: A Systematic Introduction, Raul Rojas, 1996.</i>
	2. <i>Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.</i>	4. <i>Christopher and M. Bishop, "Pattern Recognition and Machine Learning", Springer Science Business Media, 2006.</i>
		5. <i>Jason Brownlee, "Deep Learning with Python", ebook, 2016.</i>

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	40 %	-	30 %	-	30 %	-	30 %	-	30%	-
Level 2	Apply Analyze	40 %	-	40 %	-	40 %	-	40 %	-	40%	-
Level 3	Evaluate Create	20 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1.	1.	1. <i>Dr.E.Poovammal</i>
2.	2.	2. <i>Dr.G.Vadivu</i>
		3. <i>Mr. Joseph James</i>

Course Code	18CSE485T	Course Name	ROBOTICS: COMPUTATIONAL MOTION PLANNING				Course Category	E	Professional Elective				L	T	P	C	
Pre-requisite Courses	Nil		Co-requisite Courses	Nil			Progressive Courses	Nil					3	0	0	3	
Course Offering Department		Computer Science and Engineering				Data Book / Codes/Standards				Nil							

Course Learning Rationale (CLR):		<i>The purpose of learning this course is to:</i>			Learning			Program Learning Outcomes (PLO)																
CLR-1 :	<i>Acquire knowledge of Bug algorithms and configuration Space</i>				1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
CLR-2 :	<i>Acquire knowledge of Potential functions and Navigations</i>				Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life long learning	PSO-1	PSO-2	PSO-3		
CLR-3 :	<i>Acquire knowledge of Sampling Algorithms</i>																							
CLR-4 :	<i>Gain knowledge of filtering techniques</i>																							
CLR-5 :	<i>Gain knowledge about Trajectory and Motion Planning</i>																							
CLR-6 :	<i>Design motion plan for Robot in the path specified</i>																							
Course Learning Outcomes (CLO):		<i>At the end of this course, learners will be able to:</i>																						
CLO-1 :	<i>Apply knowledge of Bug algorithms and configuration Space</i>																							
CLO-2 :	<i>Apply knowledge of Potential functions and Navigations</i>																							
CLO-3 :	<i>Apply knowledge of Sampling Algorithms</i>																							
CLO-4 :	<i>Gain knowledge of filtering techniques</i>																							
CLO-5 :	<i>Gain knowledge about Trajectory and Motion Planning</i>																							

Duration (hour)	9	9	9	9	9
S-1	SLO-1	Over view of Motion Planning	Potential Function: Addictive Attractive/Repulsive Potential	Sampling - Based Algorithms- Probabilistic Road Maps: Basic PRM	Linear Kalman Filtering
	SLO-2	Bug1 And Bug 2	Gradient Descent	Implementation of basic PRM	
S-2	SLO-1	Tangent Bug	Computing Distance From Implementation In The Plane	PRM sampling Strategies	Kalman Filter : Example
	SLO-2	Implementation: The Tangent Line		PRM connection Strategies	
S-3	SLO-1	Distance On Gradient	Local Minima Problem	Single-Query Sampling Based Planners: Expensive Spaces Trees	Bayesian Methods : Localization
	SLO-2	Continuation Method	Wave-Front Planner	Rapidly Exploring Random Trees	Basic Idea Probabilistic Localization
S-4	SLO-1	Robot Configuration Specification	Navigation Potential Function: Sphere-Space	Connection Strategies and SBL Planner	Probabilistic Localization As Recursive Bayesian Filtering
	SLO-2		Star-Space		
S-5	SLO-1	Circular Mobile Robot	Potential Functions for Rigid-Body Robots	Integration Of Planners Sampling Based Roadmap	Derivation Of Probabilistic Localization
	SLO-2	Two joint planer arm	Path Planning for Articulated Bodies		
S-6	SLO-1	Dimension Of The Configuration Space	Visibility Graph	Analysis Of PRM	Representation Of Posterior
	SLO-2				
					Controllability

S-7	SLO-1	Topology of configuration space: Homeomorphisms and Diffeomorphisms	Deformation Retracts : Generalized Voronoi Diagram	Control based Planning	Sensor Model	Motion Planning: Optimal Control
	SLO-2			Multiple Robots		
S-8	SLO-1	Differentiable Manifolds	Retract -Like Structure: Generalized Voronoi Graph	Manipulation Planning	Mapping:: Mapping with known locations	Steering Chained -Form Systems Using Sinusoids
	SLO-2					
S-9	SLO-1	Examples	Piecewise Retracts: The Rod Hierarchical Generalized Voronoi Graph Silhouette Methods	Assembly Planning	Bayesian Simultaneous Localization and Mapping	Nonlinear Optimization
	SLO-2					

Learning Resources	1. HowieM.Choset,SethHutchinson,KevinM.Lynch,GeorgeKantor,WolframBurgard,LydiaE. Kavraki,SebastianThrun,"PrinciplesofRobotMotion:Theory,Algorithms,andImplementation"	3. http://robotics.stanford.edu/~latombe/cs326/2009/schedule.htm
	2. Jean-ClaudeLatombe,"RobotMotionPlanning",SpringerScience&BusinessMedia,2012	

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Understand										
Level 2	Apply	40 %	-	40 %	-	40 %	-	40 %	-	40%	-
	Analyze										
Level 3	Evaluate Create	20 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry		Internal Experts
		Dr.R.Annie Uthra
		Dr.P. Supraja

Course Code	18CSE486T	Course Name	ADVANCED ALGORITHMS	Course Category	E	Professional Elective	L	T	P	C
							3	0	0	3

Pre-requisite Courses	18CS201J	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computer Science and Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):		<i>The purpose of learning this course is to:</i>			Learning			Program Learning Outcomes (PLO)														
CLR-1 :	<i>Understand different asymptotic notations to analyze an algorithms</i>				1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2 :	<i>Utilize various data structures in developing applications</i>				Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
CLR-3 :	<i>Utilize stack and queues in processing data for real-time applications</i>																					
CLR-4 :	<i>Understand various data structures to handle graph theory related real-time applications</i>																					
CLR-5 :	<i>Understand various probabilistic algorithms and randomized algorithms for real-time programming applications</i>																					
CLR-6 :	<i>Understand various Complexity classes like P-Type, NP-Type, NP-Complete, NP-Hard problems</i>																					
Course Learning Outcomes (CLO):		<i>At the end of this course, learners will be able to:</i>																				
CLO-1 :	<i>Understand complexity of various algorithms</i>				3	80	70	L	H	-	H	L	-	-	-	L	L	-	H	-	-	-
CLO-2 :	<i>How efficiently a problem can be solved with respect to time and space</i>				3	85	75	M	H	L	M	L	-	-	-	M	L	-	H	-	-	-
CLO-3 :	<i>To find the appropriateness of Data structure for real time applications</i>				3	75	70	M	H	M	H	L	-	-	-	M	L	-	H	-	-	-
CLO-4 :	<i>Representation and Solving Graph algorithms</i>				3	85	80	M	H	M	H	L	-	-	-	M	L	-	H	-	-	-
CLO-5 :	<i>Understand approximation methods to solve very difficult problems</i>				3	85	75	H	H	M	H	L	-	-	-	M	L	-	H	-	-	-
CLO-6 :	<i>Understand various complexity classes of problems in computer science</i>				3	80	70	L	H	-	H	L	-	-	-	L	L	-	H	-	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	Introduction-Basic Terminology	Elementary data structures-Array	Graph algorithms-Representation of graphs	Approximation algorithms	Complexity classes-Introduction
	SLO-2	Complexity of algorithms- Space and time complexity issues-Growth of functions	Operations on Arrays – Insertion and Deletion	BFS-DFS	The vertex-cover problem	Various definitions
S-2	SLO-1	Introduction of various asymptotic notations like $\Theta, \omega, O, \Omega$	Stack-Variou ADT operations- Uses of stack-Variou examples	Strongly connected components	The traveling-salesman problem	NP-Completeness and the classes of P and NP
	SLO-2	Designing algorithm-Analysis of Insertion sort-Best case, worst case, average case analysis	Queue ADT- Insertion-deletion and various operations on Queue	Minimum Spanning tree-Introduction Prim's algorithm	Example	Continued
S-3	SLO-1	Various Problem solving techniques	Linked List- Deletion and Search-Doubly linked list-Variou operations on linked list	Kruskal algorithm	The set-covering problem –With an example	A Formal language framework-Polynomial time verification
	SLO-2	Divide and Conquer paradigm	Polynomial Arithmetic	Single source Shortest path problem	The subset-sum problem	Continued
S-4-5	SLO-1	Recurrence relations-Construction of recurrence relation for various examples-	Hashing-Hash functions Open addressing- Perfect Hashing	The Bellman-Ford algorithm - Single-source shortest paths in directed acyclic graphs -Dijkstra's algorithm	String Matching-	p-type and NP-type problems NP-Completeness-Variou examples
	SLO-2	Towers of Hanoi Problem, Fibannacci series			The naive string-matching algorithm	
S-6	SLO-1	Solution by Substitution method	Various hashing methods	Shortest paths and matrix multiplication	Example	NP-Completeness-reducibility
	SLO-2	Recursion Tree Method	Collision in hashing-Avoiding Collision – Variou methods	The Floyd-Warshall algorithm	The Rabin-Karp algorithm	Continued
S-7	SLO-1	Mater Theorem-Proof	Binary search tree	An example	Continued	NP-Completeness-reducibility
	SLO-2	Simple examples	Insertion-Deletion-Finding max,min	Johnson's algorithm for sparse graphs	The Knuth-Morris-Pratt algorithm	Continued

S-8	SLO-1	Probabilistic analysis of an algorithm	Red Black tree	Example	An example	NP-completeness proofs Continued- Satisfiability of boolean formulas is NP-complete.
	SLO-2	Hiring assistant problem	Insertion-Deletion	Flow network-example	Computational Geometry- Finding Convex hull- Finding the closest pair of points	3-CNF satisfiability problem-NP Complete
S-9	SLO-1	Probabilistic analysis Quick sort with illustration	Properties of RBT	Continued	Continued	NP-Hard problem-Definition and various examples-continued
	SLO-2					

Learning Resources	<ol style="list-style-type: none"> 1. Cormen,ThomasH.;Leiserson,CharlesE.;Rivest,RonaldL.;Stein,Clifford(2009) <i>Introduction to Algorithms</i> (3rd ed.). MIT Press and McGraw-Hill 2. Ananyeviton,IntroductiontotheDesignandAnalysisofAlgorithms,Kindleedition2017. 3. Harowitz,SahaniandSangudevarRajasekaran,Fundamentalsofcomputeralgorithm, Universities Press; Second edition2008 	4.Mark Allen Weiz, <i>Data structures and algorithm analysis</i> , Pearson Education India 2012

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Understand										
Level 2	Apply	40 %	-	40 %	-	40 %	-	40 %	-	40%	-
	Analyze										
Level 3	Evaluate	20 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Create										
Total		100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
	1. Dr.Masila Mani.V IIITDM, Kancheepuram,noor@iiitdm.ac.in	1. K..Senthil Kumar, SRMIST
		2. Dr.Thenmozhi , SRMIST

Course Code	18CSO101T	Course Name	IT INFRASTRUCTURE MANAGEMENT	Course Category	O	Open Elective	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computer Science& Engg.			Data Book / Codes/Standards	Nil

Course Learning Rationale (CLR):		The purpose of learning this course is to:			Learning			Program Learning Outcomes (PLO)														
CLR-1 :		Understand the design factors and challenges in IT Infrastructure Management			1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2 :		Understand service delivery and associated processes			Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
CLR-3 :		Understand storage and security management related to IT Infrastructure																				
CLR-4 :		Understand performance and tuning processes and associated case studies																				
CLR-5 :		Understand the suitability for combinations in information technology, business administration and electronic commerce.																				
Course Learning Outcomes (CLO):		At the end of this course, learners will be able to:																				
CLO-1 :	Be able to describe the business value and processes of ICT services in an organization and apply that knowledge and skill with initiative to a workplace scenario			2	80	85	L	-	L	H	L	-	-	-	H	H	M	L	-	-	-	
CLO-2 :	Be able to investigate, critically analyze and evaluate the impact of new and current ICT services to an organization			2	75	80	M	-	-	H	H	-	-	-	L	L	L	H	-	-	-	
CLO-3 :	Be able to describe how effective IT Infrastructure Management requires strategic planning with alignment from both the IT and business perspectives in an organization			2	85	80	M	L	M	H	L	-	-	-	M	H	H	H	-	-	-	
CLO-4 :	Be able to demonstrate the technical and communications skills that contribute to the operation of ICT services in an organization			2	80	75	M	L	L	L	-	-	-	-	H	H	M	L	-	-	-	
CLO-5 :	Be able to reflect critically on the role of an enterprise architect in an organization			2	75	85	L	-	L	L	-	-	-	-	L	L	H	L	-	-	-	
CLO-6 :	Be able to synthesize the theoretical, technical and management issues that deliver ICT services to an organization			2	80	85	H	-	L	L	L	-	-	-	L	L	H	L	-	-	-	

Duration (hour)		9	9	9	9	9
S-1	SLO-1	Introduction – IT Infrastructure	Service Delivery And Support Process - Intro	Storage And Security Management - Intro	Performance And Tuning Process	Case Studies
	SLO-2	Challenges in IT Infrastructure Management		Backup and Storage, Archive & Retrieve		
S-2	SLO-1	Design Factors for IT Organizations	Service Level Management	Space Management	Introduction on tuning process	Asset Network Corporation case
	SLO-2	Design Factors for IT Infrastructures				
S-3	SLO-1	Determining customer's Requirements, Identifying System Components to manage	Financial Management	Hierarchical space management	Difference between Performance and Tuning processes and other Infrastructure processes	Radio Shack case
	SLO-2					
S-4	SLO-1	Identifying System Components to manage	IT Service Continuity Management	Database & Application protection	Definitions	Business Process Outsourcing (BPO) Infrastructure Planning and Management
	SLO-2					
S-5	SLO-1	Exist Processes, Data, applications,	Capacity Management	Disaster Recovery Bare Machine Recovery (BMR)	Preferred characteristics	e-Commerce Business Infrastructure Planning and Management
	SLO-2					
S-6	SLO-1	Tools and their integration	Configuration Management	Data Retention	Performance and tuning applied to major resource environments	Enron case
	SLO-2					
S-7	SLO-1	IT Systems and Service Management Process	Service desk, Incident management	Computer Security Identity Management	Assessing an Infrastructure's performance and tuning process	Tycocase
	SLO-2					

S-8	SLO-1	Information systems Design Process	Availability management,	Access control system	Measuring and streamlining the P and T process	Worldcom case
	SLO-2					
S-9	SLO-1 SLO-2	IT Infrastructure Library	Release Management	Intrusion Detection	Performance tuning recommendations for data and event management	Analyze an information infrastructure – case study

Learning Resources	1. Rich Schiesser, "IT Systems Management", 2nd edition, 2010, Pearson Education, ISBN: 978-0137025060	4. Leonard Jessup, Joseph Valacich, "Information System Today: Managing Digital World", 3rd Edition, 2007, Prentice Hall, ISBN: 0-13-233506-9.
	2. P. Gupta, "IT Infrastructure and Its Management" 2nd Reprint, 2010, Tata McGraw Hill, ISBN: 978-0070699793	5. Hausman, Cook, "IT Architecture for Dummies", 2011, Wiley Publishing, Hoboken, NJ www.wiley.com ISBN: 978-0-470-55423-4
	3. Sjaak Laan, "IT Infrastructure Architecture: Infrastructure Building Blocks and Concepts", 2011, Lulu Press Inc, ISBN 978-1-4478-8128-5.	6. Richard J. Reese, "IT Architecture in Action", 2008, Xlibris Publishing, ISBN: 978-1-4363-0505-1

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Understand										
Level 2	Apply	40 %	-	40 %	-	40 %	-	40 %	-	40%	-
	Analyze										
Level 3	Evaluate	20 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry		Experts from Higher Technical Institutions Internal Experts
1. Mr. Mohamed Yaseen MS, Technical Business Analyst, CBA - Sydney, Australia, yasucseu@gmail.com		1. Dr. J. Baskar Babujee, Associate Professor, Madras Institute of Technology, Chennai. baskarjee@annauniv.edu
2. Mr. P. Ananda Natarajan, Senior Associate Consultant, Infosys, Chennai., anand_adnan@yahoo.com		2. Dr. MB. Mukesh Krishnan, SRMIST

Course Code	18CSO102T	Course Name	MOBILE APPLICATION DEVELOPMENT	Course Category	O	Open Elective	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computer Science & Engg	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):		The purpose of learning this course is to:		
CLR-1 :	Understand the basics of Android devices and Platform.			
CLR-2 :	Acquire knowledge on basic building blocks of Android programming required for App development.			
CLR-3 :	Understand persistence Data storage mechanism in Android			
CLR-4 :	Understand advanced application concepts like networking, Animations and Google Maps services etc.			
CLR-5 :	Develop and publish Android applications in to Android Market			
CLR-6 :				
Course Learning Outcomes (CLO):		At the end of this course, learners will be able to:		
CLO-1 :	Acquire the knowledge on Android devices and Platform			
CLO-2 :	Acquire knowledge on basic building blocks of Android programming required for App development.			
CLO-3 :	Apply the knowledge of persistence Data storage mechanism in Android			
CLO-4 :	Apply the knowledge in advanced application concepts like networking, Animations and Google Maps services etc.			
CLO-5 :	Design and apply the knowledge to publish Android applications in to Android Market			

Learning		
1	2	3
Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
2	80	85
2	75	80
2	85	80
2	80	75
2	75	85
2	80	85

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
L	-	-	-	H	-	-	-	-	-	-	-	-	-	-
L	-	H	-	-	-	-	-	-	-	-	-	-	-	-
-	-	H	-	-	-	-	-	-	-	-	-	-	-	-
L	-	H	-	H	-	-	-	-	-	-	-	-	-	-
H	-	-	H	-	-	-	-	-	-	-	-	-	-	-
-	-	H	-	-	-	-	-	-	-	-	-	-	-	-

Duration (hour)	9	9	7	10	10
S-1	SLO-1 SLO-2	Introduction: Introduction to mobile application development, trends.	GUI for Android: Introduction to activities life-cycle	Introduction to Different Data persistence schemes	Services :introduction to services- local service,
S-2	SLO-1 SLO-2	Introduction to various platforms,	Android v7 support library form API 21 for lower versions support	Shared preferences	remote service and binding the service.,
S-3	SLO-1	introduction to smart phones	Intent : intent object	File Handling se	the communication between service and activity, Intent Service
S-4	SLO-1 SLO-2	Android platform: Android platform, features and architecture,	intent filters ,adding categories	Managing data using SQLite databa	MultiThreading: Handlers
S-5	SLO-1 SLO-2	versions ,comparison added features in each versions.	linking activities , user interface design components	Content providers:	,AsyncTask
S-6	SLO-1 SLO-2	ART(Android Runtime),ADB(Android Debug Bridge).	Views and View Groups: Basic views, picker views, adapter views, Menu, App Bar etc, basics of screen design: different layouts.	user content provider	android network programming: HttpURLConnection
S-7	SLO-1 SLO-2	Development environment/IDE: Android studio and its working environment	App widgets, Lollipop Material design: new themes, new widgets, Card layouts. RecyclerView	Android in build content providers	Connecting to REST-based and SOAP based Web services
S-8	SLO-1 SLO-2	gradle build system, emulator setup	Fragments: Introduction to activities,		Broad cast receivers: LocalBroadcastManager, Dynamic broadcast receiver

S-9	SLO-1	Application anatomy: Application framework basics: resources layout, values, asset XML representation and generated R.java file, Android manifest file. Creating a simple application.	activities life-cycle.		System Broadcast. PendingIntent, Notifications	Publishing Android Apps: Guide lines.
	SLO-2					
S-10					Telephony Manager: Sending SMS and making calls.	policies and process of uploading Apps to Google play

Learning Resources	1. Dawn Griffiths, David Griffiths, "Head First: Android Development", O'Reilly 2015, ISBN: 9781449362188.	3. Paul Deitel, Harvey Deitel, Alexander Wald, "Android 6 for Programmers, App Driven approach", 2015, Prentice Hall, ISBN: 9780134289366.
	2. Greg Milette, Adam Stroud, "PROFESSIONAL Android™ Sensor Programming", John Wiley and Sons, Inc 2012, ISBN/978111265055, 9781280678943, 978111227459	4. http://developer.android.com/training/index.html as on Date 21.4.2016

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40 %	-	30 %	-	30 %	-	30 %	-	30%	-
Level 2	Understand										
	Apply	40 %	-	40 %	-	40 %	-	40 %	-	40%	-
Level 3	Analyze										
	Evaluate	20 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1.	1. Dr.KHANNA NEHEMIAH , Professor, Ramanujan Computing, Anna University	1. Dr.M.UMA
		2. Dr.Ganesh Kumar, SRMIST
		3.Mr.K.Naveen

Course Code	18CSO103T	Course Name	SYSTEM MODELING AND SIMULATION	Course Category	O	Open Elective	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computer Science and Engineering			Data Book / Codes/Standards	Nil

Course Learning Rationale (CLR):		The purpose of learning this course is to:			Learning			Program Learning Outcomes (PLO)																
CLR-1 :	Select a suitable modeling method according to problem area and assignment, and justify their choice.	1	2	3	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
CLR-2 :	Formulate models of a system to describe the system on different levels of abstraction and from different viewpoints.																							
CLR-3 :	Learn and apply the continuous system simulation																							
CLR-4 :	Learn theory and probability concepts in simulation																							
CLR-5 :	Learn the simulation languages and tools																							
Course Learning Outcomes (CLO):		At the end of this course, learners will be able to:						Engineering Knowledge																
CLO-1 :	Implement the appropriate modeling method for the given problem	2	80	85																				
CLO-2 :	Explain the system abstraction in different levels	2	75	80																				
CLO-3 :	Apply the models under continuous system simulation	2	85	80																				
CLO-4 :	Analyze the probability concepts for simulating a system	2	80	75																				
CLO-5 :	Apply tools to like GPSS and SIMSCRIPT to check model properties of a system	2	75	85																				

Duration (hour)		9	9	9	9	9
S-1	SLO-1	Introduction to system modelling	Continuous System Simulation - Introduction	Probability Theory	Queueing Theory - Introduction	General description of GPSS and SIMSCRIPT
S-2	SLO-1	Modeling principles and concepts	Numerical solution of differential equations	Probability CONCEPTS IN SIMULATION -	Arrival Pattern distributions	programming in GPSS
S-3	SLO-1	Continuous systems and Discrete systems	Analog computers	Monte Carlo techniques	servicing times, queuing disciplines	Application of GPSS on specific problem
S-4	SLO-1	Modeling, types of models, subsystems	Hybrid computers	Application of Monte Carlo techniques	measure of queues	Simulation Programming Techniques
S-5	SLO-1	corporate model, system study..	continuous system simulation languages CSMP	Stochastic variables	mathematical solutions to queuing problems	Data Structures
S-6	SLO-1	System Simulation: Techniques,	system dynamic growth models,	probability functions	Discrete system simulation: Events	Implementation of activities
S-7	SLO-1	comparison of simulation and analytical methods	logistic curves	Random Number Generation algorithms	Generation of arrival pattern	Events and queues, event scanning
S-8	SLO-1	types of simulation, distributed log models	Illustration of Continuous System Simulation	Illustration of Probability concepts	Simulation programming tasks	Simulation algorithms in GPSS and SIMSCRIPT
S-9	SLO-1	cobweb models	Case Study	Case Study	Analysis of simulation output	Case Study

Learning Resources	<ol style="list-style-type: none"> Geoffery Gordon, "System Simulation", PHI, 2nd edition Jerry Banks, John S. Carson, Barry Nelson, David M. Nicol, "Discrete – Event System Simulation", PHI, 3rd edition Karian. Z.A., Dvdewicz .E.Z., "Modern Statistical Systems and GPSS Simulation", Freeman, 1991 	
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Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	40 %	-	30 %	-	30 %	-	30 %	-	30%	-
Level 2	Apply Analyze	40 %	-	40 %	-	40 %	-	40 %	-	40%	-
Level 3	Evaluate Create	20 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
		1. Prof.S.S.Sridhar, SRMIST
		2. Mr. C.Arun, SRMIST

Course Code	18CSO104T	Course Name	FREE AND OPEN SOURCE SOFTWARES	Course Category	O	Open Elective			
						L	T	P	C
						3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computer Science and Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):		The purpose of learning this course is to:		
CLR-1 :	Be exposed to the context and operation of free and open source software (FOSS) communities and associated software projects.			
CLR-2 :	Be familiar with participating in a FOSS project			
CLR-3 :	Learn scripting language like Python or Perl, Ruby			
CLR-4 :	Learn some important FOSS tools and techniques			

Course Learning Outcomes (CLO):		At the end of this course, learners will be able to:		
CLO-1 :	Install and run open-source operating systems.			
CLO-2 :	Gather information about Free and Open Source Software projects from software releases and from sites on the internet.			
CLO-3 :	Build and modify one or more Free and Open Source Software packages.			
CLO-4 :	Contribute software to and interact with Free and Open Source Software development projects.			
CLO-5 :	Identify and apply various linux commands			

Learning		
1	2	3
Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
3	80	70
3	85	75
3	75	70
3	85	80
3	85	75

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life long Learning	PSO-1	PSO-2	PSO- 3
L	H	-	H	L	-	-	-	L	L	-	H	-	-	-
M	H	L	M	L	-	-	-	M	L	-	H	-	-	-
M	H	M	H	L	-	-	-	M	L	-	H	-	-	-
M	H	M	H	L	-	-	-	M	L	-	H	-	-	-
H	H	M	H	L	-	-	-	M	L	-	H	-	-	-

Duration (hour)	9	9	9	9	9
S-1	SLO-1	Introduction- Open Source, Free Software, Free Software vs. Open Source software	Linux Installation and Hardware Configuration	Unix file system, Unix files, I-nodes and structure and file system related commands	Usage of design Tools like Argo UML or equivalent
S-2	SLO-2	FOSS examples	Boot Process-The Linux Loader (LILO)	Shell Programming, Shell as command processor, Shell variables	Version Control Systems like Git or equivalent
S-3	SLO-1	FOSS Characteristics	The Grand Unified Boot loader (GRUB)	Creating command substitution, Scripts	Bug Tracking Systems
S-4	SLO-2	FOSS History, Examples	Dual-Booting Linux and other Operating System	Creating commands for Functions, Conditionals	Package Management Systems
S-5	SLO-1	FOSS Copyright	Boot-Time Kernel Options	Creating commands for loops	Introduction to Programming language using Python
S-6	SLO-2	Guidelines for effectively working with FOSS community	Basic Linux Commands	Customizing environment	Case Studies : Apache, BSD, Linux, Mozilla (Firefox), Wikipedia, Joomla, GCC,
		Benefits of Community based Software Development	Linux Commands for operations - redirection, pipes, filters, job control, changing ownership/permission of files/directories		
		Requirements for being open, free software, open source software	Advanced Linux Commands like curl, wget, ftp, ssh and grep		

S-7	SLO-1 SLO-1	Four degrees of freedom	X Windows System Configuration	Shell scripting for system configurations	conditional statements, classes, Exceptions packages	Open Office
S-8	SLO-1	FOSS Licensing Models	System Administration	Shell scripting with functions and conditions		
	SLO-2	FOSS Licenses – GPL- AGPL- LGPL – FDL	Backup and Restore Procedures			
S-9	SLO-1 SLO-2	Implications	Strategies for keeping a Secure Server	Shell scripting with looping		

Learning Resources	<ol style="list-style-type: none"> 1. Ellen Siever, Stephen Figgins, Robert Love, Arnold Robbins, "Linux in a Nutshell", Sixth Edition, O'Reilly Media, 2009. 2. Linux Programming Bible by John Goerzen, IDG Books, New Delhi, 2000. 3. Your Unix - The Ultimate Guide by Sumitabha Das, TMH, 2000 4. Perl Programming book at http://www.perl.org/books/beginning-perl/. 5. Ruby programming book at http://ruby-doc.com/docs/ProgrammingRuby/. 6. Samba: URL : http://www.samba.org/.
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Learning Assessment

		Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40 %		30 %		30 %		30 %		30 %	
	Understand										
Level 2	Apply	40 %		40 %		40 %		40 %		40 %	
	Analyze										
Level 3	Evaluate	20 %		30 %		30 %		30 %		30 %	
	Create										
	Total	100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. <i>Bijoymon Soman</i> Sr. Test Analyst UST Global, Philadelphia, PA, USA	1. <i>Dr. Arun kumar M N</i> Assistant Professor, Federal Institute of Science and Technology, Angamaly, Kerala	1. <i>Mrs Aswathy K Cherian, SRMIST</i>
		2. <i>Mrs. Nimala , SRMIST</i>

Course Code	18CSO105T	Course Name	ANDROID DEVELOPMENT	Course Category	O	Open Elective	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computer Science and Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)
CLR-1 :	Understand the basics of Android devices and Platform.	1 2 3	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
CLR-2 :	Acquire knowledge on basic building blocks of Android programming required for Application development	Level of Thinking (Bloom)	Engineering Knowledge
CLR-3 :	Gain knowledge to user interfaces used in android applications	Expected Proficiency (%)	Problem Analysis
CLR-4 :	Acquire knowledge on advanced application concepts like networking, Animations and Google Maps services etc	Expected Attainment (%)	Design & Development
CLR-5 :	Develop and publish Android applications in to Android Market		Analysis, Design, Research
CLR-6 :	Understand the knowledge of JSON and MQTT		Modern Tool Usage
			Society & Culture
			Environment & Sustainability
			Ethics
			Individual & Team Work
			Communication
			Project Mgt. & Finance
			Life Long Learning
			PSO-1
			PSO-2
			PSO-3
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:		
CLO-1 :	To exposed to technology and business trends impacting Android Platform	2 80 85	H L H - - - - - - - - - - - - - -
CLO-2 :	Be competent with the characterization and architecture of mobile applications	2 75 80	L H H - - - - - - - - - - - - - -
CLO-3 :	To understanding enterprise scale requirements of mobile applications	2 85 80	H - H L - - - - - - - - - - - - - -
CLO-4 :	To designing and developing mobile applications using one application development framework	2 80 75	L L H - - - - - - - - - - M - - - - -
CLO-5 :	To understand how to handle and share android data	2 75 85	L - H H L - - - - - - - - - - - - - -
CLO-6 :	To develop an android services and to publish android application for use	2 80 85	H - H - - - - - - - - - - M - - - - -

Duration (hour)	9	9	9	9	9
S-1	SLO-1 Creating a new Android Project	Hosting a UI Fragment	Action Bar and Options Menus	Loopers, Handlers, and HandlerThread	Introduction to JSON
	SLO-2 Defining the Project and SDK setting	Creating a UI Fragment	Enabling Ancestral Navigation	Creating a search interface	JSON and Android
S-2	SLO-1 Creating an Android Virtual Device (AVD) in Android Studio	Adding a UI Fragment to the FragmentManager	An Alternative Menu Item	Hardware search button	Designing JSON and JSON Operation
	SLO-2 Android Virtual Device (AVD) in Android Studio	The FragmentManager and the fragment lifecycle	Saving and Loading Local Files	Creating an IntentService	Server reachability and Connection & Splash App
S-3	SLO-1 Configuring the Android Studio AVD Emulator	Creating User Interfaces with Layouts and Widgets	Context Menu Resource	Delayed Execution with AlarmManager	Lazy Loading Images
	SLO-2 The Emulator Environment and Toolbar Options	XML Layout Attributes	Floating Context Menu	Broadcast Intents	Lazy loading Libraries
S-4	SLO-1 Extended Control options	the Graphical Layout Tool	Contextual Action Mode	Waking Up on Boot	Lazy loading Archircture
	SLO-2 Drag and Drop Support	Creating a ListFragment	Camera I: Viewfinder	Filtering Foreground Notifications	Handling Image Assets
	SLO-1 Configuring Fingerprint Emulation	Hosting a Fragment	Using the Camera API	Receivers and Long-running Tasks	Remote Crash Logs and App
S-5	SLO-2 Android Studio Apps on a Physical Android Device	ListFragment, ListView and ArrayAdapter	Camera II: Taking Pictures and Handling Images	Browsing The Web & WebView	Push Messaging Services
S-6	SLO-1 Enabling ADB on Android based Devices	Fragment Arguments	Updating the Model Layer	Custom Views and Touch Events	Firebase Cloud Messaging
	SLO-2 Android Studio Editor	ViewPager	Updating CrimeFragment's View	Creating BoxDrawingView	Open Source Push Messaging with MQTT
S-7	SLO-1 Splitting the Editor Window, Code Completion, Statement Completion	Dialogs	Implicit Intents	Handling Touch Events	MQTT App and Project
	SLO-2 Parameter Information, Parameter Name Hints,	Audio Playback Using MediaPlayer	Two-Pane Master-Detail Interfaces	Tracking the Device's Location	Message Brokers
S-8	SLO-1 Code Generation	Retained Fragments	Adding Layout Flexibility	Locations and the LocationManager	MQTT Broker setup for AWS
	SLO-2 Code Folding	Rotation and Retained Fragments	Activity: Fragment Boss	Receiving Broadcast Location Updates	Sending Messages with MQTT Web Clients

S-9	SLO-1	Quick Documentation Lookup	Rotation Handling and onSaveInstanceState(Bundle)	Styles And Includes	Updating the UI with Location Data	Firebase Cloud Messaging
	SLO-2	Code Reformatting	Localization	Cleaning Up with Styles	Testing Locations on Real and Virtual Devices	MQTT Push Messaging

Learning Resources	1. Neil Smyth, Kotlin / Android Studio 3.0 Development Essentials - Android 8 Edition, Payload Media, Inc. 2017	3. Mark Wickham, Practical Android: 14 Complete Projects on Advanced Techniques and Approaches, Apress, 2018
	2. Bill Phillips and Brian Hardy, Android Programming: The Big Nerd Ranch Guide, Big Nerd Ranch, Inc. 2013	4. David Griffiths, Head First: Android Development, O'Reilly 2015, ISBN: 9781449362188

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Understand										
Level 2	Apply	40 %	-	40 %	-	40 %	-	40 %	-	40%	-
	Analyze										
Level 3	Evaluate	20 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry		Internal Experts
1. Dinesh Babu T, Development Manager, HP India. dinesh.thavamani@hp.com		1. Mr. S. Pradeep, SRMIST
2. Suraj Sundaram, Associate IT Consultant, TCSCanada. surajs@tcs.com		2. Mr. C. Arun, SRMIST

Course Code	18CSO106T	Course Name	DATA ANALYSIS USING OPEN SOURCE TOOL	Course Category	O	Open Elective	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computer Science and Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)
CLR-1:	Understand and write programs in R	1 2 3	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
CLR-2:	Gain knowledge on the working of statistical data in R	Level Thinking (Bloom)	Engineering Knowledge
CLR-3:	Gain knowledge on Linear regression and manipulation in R	Expected Proficiency (%)	Problem Analysis
CLR-4:	Acquire knowledge on classification and clustering in R	Expected Attainment (%)	Design & Development
CLR-5:	Acquire knowledge on Linear Model selection and regularization and working it in R		Analysis, Design, Research
CLR-6:	Introduce the Tree based methods and working it in R		Modern Tool Usage
			Society & Culture
			Environment & Sustainability
			Ethics
			Individual & Team Work
			Communication
			Project Mgt & Finance
			Life Long Learning
			PSO-1
			PSO-2
			PSO-3

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
CLO-1:	Acquire the knowledge on data analysis in R	2	80	85	H	-	-	-	H	-	-	-	-	-	-	-	-	-	-
CLO-2:	Acquire the ability to find meaning pattern using R	2	75	80	H	H	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-3:	Acquire the ability to find graphically interpret data in R	2	75	80	H	H	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-4:	Apply the knowledge for implementing analytical algorithms	2	80	75	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-5:	Handle large scale analytics projects from various domains	2	75	85	H	H	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-6:	Develop intelligent decision support systems	2	75	80	H	-	-	H	-	-	-	-	-	-	-	-	-	-	-

Duration (hour)	9	9	9	9	9
S-1	SLO-1 Data in data analytics	Simple Linear Regression	An Overview of Classification	Cross-Validation The Validation Set Approach	The Basics of Decision Trees- Regression Trees
	SLO-2 NOIR classification	Estimating the coefficients	Logistic Regression - The Logistic Model	Leave-One-Out Cross-Validation	Classification Trees
S-2	SLO-1 Introduction to R	Assessing the Accuracy of the Coefficient Estimates	Estimating the Regression Coefficients	k-Fold Cross-Validation	Trees Versus Linear Models
	SLO-2 Data types	Assessing the Accuracy of the Model	Making Predictions	Bias-Variance Trade-Off for k-Fold Cross-Validation	Advantages and Disadvantages of Trees
S-3	SLO-1 Control structures	Libraries for Simple Linear Regression in R	Multiple Logistic Regression	The Validation Set Approach in R	Bagging -Random Forests
	SLO-2 Control structures - Using the console	Programming in simple linear regression in R	Logistic Regression for >2 Response Classes	Leave-One-Out Cross-Validation in R	Boosting
S-4	SLO-1 Objects in R - Numbers, Attributes	Multiple Linear Regression - Estimating the Regression Coefficients	Linear Discriminant Analysis - Using Bayes' Theorem for Classification	k-Fold Cross-Validation in R	Fitting Classification Trees in R
	SLO-2 Vectors - create vectors	Multiple Linear Regression in R	Linear Discriminant Analysis for p = 1	The Bootstrap in R	Fitting Regression Trees in R
S-5	SLO-1 Using [] brackets	Extensions of the Linear Model	Linear Discriminant Analysis for p>1	Linear Model Selection and Regularization-Subset Selection	Bagging and Random Forests in R
	SLO-2 Vectorized operations	Potential Problems	Quadratic Discriminant Analysis	Stepwise Selection Choosing the Optimal Model	Boosting in R
S-6	SLO-1 Matrix -building a matrix, Naming dimensions, Colnames and Rownames	The Marketing Plan	Logistic Regression, LDA,	Shrinkage Methods Ridge Regression	Principal Components Analysis - What Are Principal Components?
	SLO-2 Matrix operations, Visualizing with Matplot()	Comparison of Linear Regression with K-Nearest Neighbors	QDA, and KNN in R - T	The Lasso Selecting the Tuning Parameter	More on PCA

S-7	SLO-1	Data frame	Qualitative Predictors	Example using Stock Market Data	Dimension Reduction Methods Principal Components RegressionP	Principal Components Analysis in R
	SLO-2	List	Extensions of the Linear Model	Logistic Regression in R	Partial Least Squares	More on PCA - Other Uses for Principal Components
S-8	SLO-1	Functions	Interaction Terms in R	Linear Discriminant Analysis in R	Best Subset Selection in R	Clustering Methods- K-Means Clustering
	SLO-2	Indexing data	Non-linear Transformations of the Predictors in R	Quadratic Discriminant Analysis in R	Forward and Backward Stepwise Selection in R	Hierarchical Clustering
S-9	SLO-1	Reading data	Qualitative Predictors in R	K-Nearest Neighbors in R	Choosing Among Models Using the Validation Set Approach and Cross-Validation in R	K-Means Clustering in R
	SLO-2	Writing data	Writing Functions for linear regression in R	An Application to Caravan Insurance Data in R	Ridge Regression and the Lasso in R	Hierarchical Clustering in R

Learning Resources	1. G James, D. Witten, T Hastie, and R. Tibshirani, An Introduction to Statistical Learning: with Applications in R, Springer, 2013	
	2. Chambers, John, Software for Data Analysis Programming with R, Springer, 2008	
	3. Trevor Hastie Robert Tibshirani Jerome Friedman, The Elements of Statistical Learning, Data Mining, Inference, and Prediction (2nd Edn.), Springer, 2014	
	4. Mark Gardener, Beginning R: The Statistical Programming Language, Wiley, 2013	
	5. Upadhyaya and A. Upadhyaya, Material Science and Engineering, Anshan Publications, 2007	

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Understand										
Level 2	Apply	40 %	-	40 %	-	40 %	-	40 %	-	40%	-
	Analyze										
Level 3	Evaluate	20 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Venkatesh K. Pappakrishnan, Ph.D. Data scientist Physicist, Santa Clara, California	1. Dr. J. Prakash, MIT, Chennai, prakaiit@rediffmail.com	1. Dr.V.Kavitha, SRMIST
2. Prakash V, Technical Lead at Bridgeline Digital Inc Greater Boston Area	2.Dr.Latha Karthigaa, PhD, Innovation Research Assistant, The University of Auckland	2. Dr.Alice Nithya, SRMIST

Course Code	18CSO107T	Course Name	IOS DEVELOPMENT	Course Category	O	Open Elective	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	CSE	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):		The purpose of learning this course is to:			Learning			Program Learning Outcomes (PLO)																
CLR-1 :	Understand the basics of ios device and platform	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
CLR-2 :	Understand the basic building blocks of ios programming required for App development				Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3					
CLR-3 :	Understand Data storage mechanism in ios				H	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLR-4 :	Understand advanced application concepts like animations, webservices, etc				H	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLR-5 :	Develop and publish ios application in to ios market				H	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLR-6 :	understanding enterprise scale requirements of mobile application				H	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Course Learning Outcomes (CLO):		At the end of this course, learners will be able to:			2	80	85	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
CLO-1 :	Acquire the knowledge of ios device and platform	2	75	80	H	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
CLO-2 :	Acquire the knowledge on ios programming for App Development	2	85	80	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
CLO-3 :	Apply the concepts used for data storage in ios	2	80	75	H	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
CLO-4 :	Apply the animation and webservice concepts in the App	2	75	85	H	-	-	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
CLO-5 :	Understand the basic idea to publish ios application into ios market	2	80	85	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
CLO-6 :	Understand the needs of enterprise to develop App	2	80	85	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		

Duration (hour)	9	9	9	9	9
S-1	SLO-1 Top Mobile OS in Market	The Swift Language-Types	Programmatic views-anchors,Margins	Stack Views	Webservices
	SLO-2 Difference between IOS and Android	Literals and subscripting, Initializers, Properties, Instance methods	Programmatic controls	Nested stack views	
S-2	SLO-1 IOS Architecture	Optionals,Subscripting dictionaries, Loops and String Interpolation	Localization	Segues	JSON Data
	SLO-2	Enumerations			
S-3	SLO-1 History of IOS	Views-Basics	Internalization	UINavigationController	Collection views
	SLO-2	Frames, Customizing the labels		Dismissing the keyboard	
S-4	SLO-1 Requirements	The auto Layout System	Controlling Animations	Even handling basics	Extensions
	SLO-2	Adding Constraints	Completion,constraints		
S-5	SLO-1 Versions	Text Input- Editing,Keyboard attributes	Timing functions	Camera	Image caching
	SLO-2				
S-6	SLO-1 Framework -MVC Design Pattern	Dismissing the keyboard	Debugging	Saving,Loading and Application States	Core Data
	SLO-2	Number formatters			
S-7	SLO-1 Application Life Cycle	Delegation	UITableView and Controller	Loading files, Error handling	Fetch requests and predicates
	SLO-2	Conforming to a protocol			
S-8	SLO-1 Features	View controllers	Editing UITableView	Size class	Core Data Relationships
	SLO-2	UITabBarController			
S-9	SLO-1 A simple IOS Application	Appearing and accessing views	Subclassing UITableViewcell	Touch Events and UIResponder	Accessibility
	SLO-2				

Learning Resources	1. <i>Christian Keur, Aaron Hillegass, ios programming: The Big Nerd Ranch Guide, 6th ed., Pearson, 2016.</i>	3. <i>Fahim Farook, Matthijs Hollemans, ios Apprentice, 7th ed., Razeware LLC, 2018.</i>
	2. <i>Jon Hoffman, Mastering Swift, 4th ed., Packt Publishing Ltd., 2017.</i>	4. <i>Michael Grant, ios Navigation 101, 2019.</i>

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Understand										
Level 2	Apply	40 %	-	40 %	-	40 %	-	40 %	-	40%	-
	Analyze										
Level 3	Evaluate	20 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. <i>Mr.K.Mahendran, Founder, Dreams Technologies, Chennai.</i>	1.	1. <i>Dr.D.Rajeswari, SRMIST</i>
2.	2.	2. <i>Mr.K.Navin, SRMIST</i>

Course Code	18CSP101L	Course Name	Industrial Training I (To be undergone in the prescribed semester only as per the curriculum)	Course Category	P	Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P)	L	T	P	C
							0	0	2	1

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	CSE	Data Book / Codes/Standards	As exposed to during the duration of training		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Provide an exposure to the students on the practical application of theoretical concepts in an industry or research institute

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:
CLO-1 :	Gain confidence to carry out supervisory, managerial, and design roles in an industrial context.

Learning Assessment			
Continuous Learning Assessment	Assessment tool	Final review	
	Weightage	Training Report	Presentation *
		75%	25%

*Student has to be present for the presentation for assessment. Otherwise it will be treated as non-appearance for the examination with final grade as 'Ab'

Course Code	18CSP102L	Course Name	Seminar (To be undergone in the prescribed semester only as per the curriculum)	Course Category	P	Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P)	L	T	P	C
							0	0	2	1

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	CSE	Data Book / Codes/Standards	As applicable		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Identify an area of interest within the program or a related one (multidisciplinary), carry out a literature survey on it, gain understanding and present the same before an audience.

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:
CLO-1 :	Carry out a self-study of an area of interest and communicate the same to others with clarity.

Learning Assessment			
Continuous Learning Assessment	Assessment tool	Presentation	
	Weightage	Presentation material	Presentation skills / ability to answer questions / understanding of the topic*
		60%	40%

*Student has to be present for the presentation for assessment. Otherwise it will be treated as non-appearance for the examination with final grade as 'Ab'

Course Code	18CSP103L	Course Name	Project Phase-I / Internship (To be undergone in the prescribed semester only as per the curriculum)	Course Category	P	Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P)	L	T	P	C
							0	0	6	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	CSE	Data Book / Codes/Standards	As exposed to during the duration of internship		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Provide an exposure to the students on the practical application of theoretical concepts in an industry or research institute and also to gain hands on experience in the context of design, production and maintenance

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:
CLO-1 :	Gain confidence to carry out supervisory, managerial, and design roles in an industrial context or research environment

Learning Assessment			
Continuous Learning Assessment	Assessment tool	Final review	
	Weightage	Training Report	Presentation*
		75%	25%

*Student has to be present for the presentation for assessment. Otherwise it will be treated as non-appearance for the examination with final grade as 'Ab'

Course Code	18CSP104L	Course Name	Project (Phase-II) / Semester Internship (To be undergone in the prescribed semester only as per the curriculum)	Course Category	P	Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P)	L	T	P	C
							0	0	20	10

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	CSE	Data Book / Codes/Standards	As required for the project work		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	To prepare the student to gain major design and or research experience as applicable to the profession
CLR-2 :	Apply knowledge and skills acquired through earlier course work in the chosen project
CLR-3 :	Make conversant with the codes, standards , application software and equipment
CLR-4 :	Carry out the projects within multiple design constraints
CLR-5 :	Incorporate multidisciplinary components
CLR-6 :	Acquire the skills of comprehensive report writing

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:
CLO-1 :	Design a system / process or gain research insight into a defined problem as would be encountered in engineering practice taking into consideration its impact on global, economic, environmental and social context.

Learning Assessment					
Continuous Learning Assessment	Assessment tool	Review I	Review II	Review III	Total
	Weightage	5%	20%	25%	50%
Final Evaluation	Assessment tool	Project Report	Viva Voce *		Total
	Weightage	20%	30%		50%

*Student has to be present for the viva voce for assessment. Otherwise it will be treated as non-appearance for the examination with final grade as 'Ab'

Course Code	18PDM101L	Course Name	PROFESSIONAL SKILLS AND PRACTICES	Course Category	M	Mandatory	L	T	P	C
							0	0	2	0

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Career Development Centre	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)
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CLR-1:	Utilize success habits to improve achievement in life	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2:	Develop inter personal skills and be an effective goal oriented team player to achieve success	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLR-3:	Utilize professionalism with idealistic, practical and moral values that govern the behavior																		
CLR-4:	Become an expert in communication and problem solving skills																		
CLR-5:	Re-engineer attitude required to succeed and understand its influence on behavior to achieve professionalism																		
CLR-6:	Enhance holistic development of students and improve their employability skills																		

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLO-1:	Identify success habits	2	80	75	-	-	-	-	-	-	H	H	H	H	-	H	-	-	-
CLO-2:	Acquire inter personal skills and be an effective goal oriented team player	2	75	70	-	-	-	-	-	-	H	H	H	H	-	H	-	-	-
CLO-3:	Develop professionalism with idealistic, practical and moral values	2	80	75	-	-	-	-	-	-	H	H	H	H	-	H	-	-	-
CLO-4:	Acquire communication and problem solving skills.	2	75	70	-	-	-	-	-	-	H	H	H	H	-	H	-	-	-
CLO-5:	Re-engineer their attitude and understand its influence on behavior	2	85	80	-	-	-	-	-	-	H	H	H	H	-	H	-	-	-
CLO-6:	Apply behavior changing elements to construct professionalism in character and behavior	2	85	80	-	-	-	-	-	-	H	H	H	H	-	H	-	-	-

Duration (hour)	6	6	6	6	6
S-1	SLO-1 Personality profiling	Etiquette and Grooming	Surveying and Reporting	Profile building	Innovation
	SLO-2 Being Proactive	Etiquette and Grooming	Surveying and Reporting	Profile building	Innovation
S-2	SLO-1 Begin with the end in mind	Collaborative skills	Projects	Personal Branding	Innovation
	SLO-2 Putting first things first	Collaborative skills	Projects	Personal Branding	Innovation
S-3	SLO-1 Thinking Win-Win	Networking skills	Paper presentations	Personal Branding	Creativity and out of box thinking
	SLO-2 Seeking first to understand and then to be understood	Networking skills	Paper presentations	Personal Branding	Creativity and out of box thinking
S-4	SLO-1 Synergizing	Team work and Support	Introduction to design thinking	USP	Creativity and out of box thinking
	SLO-2 Sharpening the saw	Team work and Support	Introduction to design thinking	USP	Creativity and out of box thinking
S-5	SLO-1 Character building	Leadership Skills	Generate ideas that are potential solutions to the problem identified	Developing profile	Six thinking hats
	SLO-2 IKIGAI	Leadership Skills	Generate ideas that are potential solutions to the problem identified	Developing profile	Six thinking hats
S-6	SLO-1 Self-worth	Leadership Styles	Report writing	Developing profile	Six thinking hats
	SLO-2 Attitude	Leadership Styles	Report writing	Developing profile	Six thinking hats

Learning Resources	1. Charles Harrington Elstor, Covey Sean, Seven Habits of Highly Effective Teens, New York, Fireside Publishers, 1998	2. Thomas A Harris, I am ok, You are ok, New York-Harper and Row, 1972 3. Carol Dweck, Mindset, The New Psychology of Success, Random House Pub. 2006
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Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (100% weightage)								Final Examination	
		CLA – 1 (20%)		CLA – 2 (30%)		CLA – 3 (30%)		CLA – 4 (20%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	-	40%	-	30%	-	30%	-	30%	-	-
	Understand	-	40%	-	30%	-	30%	-	30%	-	-
Level 2	Apply	-	40%	-	40%	-	40%	-	40%	-	-
	Analyze	-	40%	-	40%	-	40%	-	40%	-	-
Level 3	Evaluate	-	20%	-	30%	-	30%	-	30%	-	-
	Create	-	20%	-	30%	-	30%	-	30%	-	-
	Total	100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers				
Experts from Industry		Experts from Higher Technical Institutions		Internal Experts
1. Ms. Sudha Mahadevan, Career Launcher, sudha.m@careerlauncher.com		1. Mr. Nishith Sinha, dueNorth India Academics LLP, nsinha.alexander@gmail.com		1. Dr. T. Mythili, SRMIST
2. Mr Ajay Zenner, Career Launcher, ajay.z@careerlauncher.com		2. Dr.Dinesh Khattar, Delhi University, dinesh.khattar31@gmail.com		2. Mrs. B. Revathi, SRMIST
				3. Mr. P. Priyanand, SRMIST
				4. Mrs. M. Kavitha,, SRMIST

Course Code	18LEM101T	Course Name	CONSTITUTION OF INDIA	Course Category	M	Mandatory	L	T	P	C
							1	0	0	0

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	English	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)
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CLR-1:	Utilize the citizen's rights	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2:	Utilize the basic citizen's fundamental rights of freedom of speech, expression, equality, religion and privacy	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLR-3:	Identify the Indian constitutional framework with union parliament, government and their functions and citizen's rights																		
CLR-4:	Utilize the States functionality and provisions for the betterment of the individual and society																		
CLR-5:	Identify the emergency provisions, the functions of election and public service commissions, identify the tax system																		
CLR-6:	Utilize the rights of a citizen both individual and as a society by understanding the constitutional provision and rights																		

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLO-1:	Identify the basic provisions in the indian constitution	2	80	75	-	-	-	-	-	M	H	H	H	H	-	H	-	-	-
CLO-2:	List the fundamental rights, rights to equality, freedom, religion, culture, education and the right against exploitation	2	75	70	-	-	-	-	-	M	H	H	H	H	-	H	-	-	-
CLO-3:	Identify the fundamental duties of the Union of India, President, Vice-President, Union Ministers and Parliament functions	2	80	75	-	-	-	-	-	M	H	H	H	M	H	-	-	-	-
CLO-4:	Identify the power of states, its legislature, Governors role and the state judiciary	2	75	70	-	-	-	-	-	M	H	H	H	M	H	-	-	-	-
CLO-5:	List the special provisions and functionality of election commission, public service commission, individual tax and GST	2	85	80	-	-	-	-	-	M	H	H	H	H	H	-	-	-	-
CLO-6:	Build knowledge on the various aspects in the Indian Constitution, its provisions and right of a citizen and the society	2	85	80	-	-	-	-	-	M	H	H	H	M	H	-	-	-	-

Duration (hour)	6	6	6	6	6
S-1	SLO-1 Meaning of the constitution law and constitutionalism SLO-2 Historical perspective of the Constitution of India	The Directive Principles of State Policy Scheme of the Fundamental Right to Equality	President of India (with Powers and Functions) Prime Minister of India (with Powers and Functions)	Governor of the State (with Powers and Functions) The Chief Minister of the State (with Powers and Functions)	Local Self Government – Constitutional Scheme in India Emergency Provisions : National, President Rule, Financial Emergency
S-2	SLO-1 Salient features and characteristics of the Constitution of India SLO-2 Citizenship	Scheme of the Fundamental Right to certain Freedom under Article 19 Scope of the Right to Life and Personal Liberty under Article 21	Union Judiciary (Supreme Court) Jurisdiction of the Supreme Court State Government	State Judiciary (High Courts) Union Territories, Panchayats,	Election Commission of India (with Powers and Functions) The Union Public Service Commission (with Powers and Functions)
S-3	SLO-1 Scheme of the fundamental rights SLO-2 The scheme of the Fundamental Duties and its legal status	Union Government, Union Legislature (Parliament) Lok Sabha and Rajya Sabha (with Powers and Functions), Union Executive	State Legislature, Legislative Assembly, Legislative Council Powers and Functions of the State Legislature, State Executive	Municipalities, Scheduled and Tribal Areas Co-operative Societies	Amendment of the Constitutional Powers and Procedure Income Tax, Goods and Services Tax

Learning Resources	1. Durgadas Basu, Introduction to the Constitution of India, Lexis- Nexis, 2015 2. Subash C Kashyap, Our Parliament, National Books Trust, 2011	3. Kaushal Kumar Agarwal, India's No 1 book on Tax : Simple Language Advanced Problems: Income Tax, Kindle, 2017 4. Vivek K R Agarwal, GST Guide for students: Making GST – Good and Simple Tax, Neelam Book House, 2017
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Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (100% weightage)								Final Examination	
		CLA – 1 (20%)		CLA – 2 (30%)		CLA – 3 (30%)		CLA – 4 (20%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40%	-	30%	-	30%	-	30%	-	-	-
	Understand										
Level 2	Apply	40%	-	40%	-	40%	-	40%	-	-	-
	Analyze										
Level 3	Evaluate	20%	-	30%	-	30%	-	30%	-	-	-
	Create										
Total		100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers				
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts		
1. Dr. Usha Kodandaraman, ABK AOTS, Chenna . drushak@gmail.com	1. Dr. S. P.Dhanavel, IITM, Chennai, dhanavelsp@iitm@ac.in	1. Dr. K. Anbazhagan, SRMIST	3. Dr.Sukanya Saha, SRMIST	5. S. Ramya, SRMIST
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Course Code	18GNM101L	Course Name	PHYSICAL AND MENTAL HEALTH USING YOGA	Course Category	M	Mandatory	L	T	P	C
							0	0	2	0

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Centre for Applied Research in Education			Data Book / Codes/Standards	Nil

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)
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CLR-1:	Utilize rich Indian heritage and knowledge for self-healing and self-protection from diseases	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2:	Apply meditation for attaining happiness and balancing emotions and state of mind and body	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLR-3:	Intellectually develop oneself by identifying oneness with divine state and transform towards absolute oneness in space																		
CLR-4:	Socially transform into a meaningful and purposeful individual to both self and society																		
CLR-5:	Spiritually enlighten oneself by purifying the body, soul and have a blissful existence																		
CLR-6:	Achieve personal benefits of whole health and wellbeing by practicing yoga for physical, emotional and mental fitness																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1:	Identify Indian heritage, culture. Identify key anatomical structures in the human body and basic exercises for the same	2	80	75	-	M	-	-	-	H	H	H	H	H	-	H	-	-	-
CLO-2:	Apply yoga meditation practices for emotional development and wellbeing	2	75	70	-	M	-	-	-	H	H	H	H	H	-	H	-	-	-
CLO-3:	Identify educational and intellectual development methods using five sense realization and transformation	3	80	75	-	M	-	-	-	H	H	H	H	H	-	H	-	-	-
CLO-4:	Demonstrate human values and emotions through thorough understanding about life, naturopathy and food habits	3	75	70	-	M	-	-	-	H	H	H	H	H	-	H	-	-	-
CLO-5:	Impact self and society by peaceful coexistence with self-introspection and balanced diet charts	3	85	80	-	M	-	-	-	H	H	H	H	H	-	H	-	-	-
CLO-6:	Demonstrate yoga exercises and postures to stretch and strengthen the body and mind	3	85	80	-	M	-	-	-	H	H	H	H	H	-	H	-	-	-

Duration (hour)		Physical Development	Emotional Development	Intellectual Development	Social Development	Spiritual Development
		6	6	6	6	6
S-1	SLO-1	Indian Heritage & Culture, Concept of Yoga, Objectives, Science & Art of Yoga	Brain Functions, Bio-Magnetism, Cognitive Mind	Education & Intelligence Development using Yoga. Improving Intelligence	Introduction: Social Intelligence	Spiritual Connect & Yoga: Self-Realization, Self-Awareness, Self-Actualization
	SLO-2	Women and Yoga Practice – Classification, Modern Age, Philosophy of Life	Emotional Intelligences, Managing Stress and Emotions	Learnability through Concentration, Intelligence through learning sense organs	Human values, Ethics & Morality	Cause and Effect Realization (Karma Yoga), Harmony in Life
S-2	SLO-1	Practice1: Standing exercise, Surya Namaskar	Practice4: Surya Namaskar, Standing asanas	Practice7: Yoga for Youthfulness (Kayakalpa Yoga)	Practice10: Kayakalpa, Bhandas, Meditation (Crown)	Practice13: Management of Physical problems (Yoga therapy)
	SLO-2	Meditation (Self Realization), Relaxation	Meditation (Five Sense Realization), Relaxation	Meditation (Five Sense Realization), Relaxation	Self-introspection Practice (Moralization of Desire) & Relaxation	Meditation (Nine centre) & Relaxation
S-3	SLO-1	Physical Health: Body Structure, Diseases and Causes, Science of Human Body	Meditation for Emotional development: Eyebrow Center (Agha) Meditation	Theory of Intellectual Transformation: Divine state origin, absolute space,	Exercises for Self-Introspection: Analysis of thoughts, Moralization of desires	Spiritual Enlightenment
	SLO-2	Yoga & Youthfulness. Benefits, Comparison between other exercises and Yoga	Genetic Centre (Santhi) Meditation. Stress Relaxation Exercises	Transformation of universe, living beings, Intelligence, Knowledge, Wisdom & Peace	Anger Management, Eradicating worries, concerns & challenges	Purifying the Body (Genetic center)
S-4	SLO-1	Practice2: Surya Namaskar, Sitting Exercises	Practice5: Surya Namaskar, Sitting asanas,	Practice8: Kayakalpa Yoga, Pranayama	Practice11: Kayakalpa Yoga, Krisya Yoga	Practice14: Project Submission
	SLO-2	Meditation (Self Realization) – Relaxation	Meditation (Agha) & Relaxation	Meditation (Agha) - Relaxation	Yoga Mudhras, Meditation (Santhi) & Relaxation	Meditation, Introspection, Sublimation
S-5	SLO-1	Exercises: Hands, Legs, Neuro-Muscular breathing, Eye, Ears, Nostrils, kidney, brain	Asanas (Postures) for Body Structure: Full Body Structure Maintenance	Exercises: Intellectual development Brain Crown Centre (Thuriyam) Meditation	Therapy for Social Development: Gestures Yoga (Mudhras) – Body locks (Bhandhas)	Spirituality for Stress Management
	SLO-2	digestive tract, stomach, lungs, spine, hip, neck. Pressure points in our body	Standing, Sitting, Prone & Supine Posture, Benefits of asanas	Five Senses (Panchendriya) Meditation, Consciousness and Law of nature	Indian Medical System: Naturopathy, Food, Nutrition, Diet Chart for Youthfulness	Yoga Practices for blissful existence
S-6	SLO-1	Practice3: Prone & Supine posture Exercises	Practice6: Surya Namaskar, Prone & Supine posture Asanas	Practice9: Kayakalpa, Mudhras, Self-introspection Practice (Thought Analysis)	Practice12: Balancing Asanas,	Practice15: Practical Exam
	SLO-2	Meditation (Self Realization) – Relaxation	Meditation (Shanthi) & Relaxation	Meditation (Santhi), & Relaxation	Meditation (Crown) & Relaxation	Meditation & Relaxation

Learning Resources	1. <i>Sadhguru Jaggi Vasudev, Inner Engineering – A yogi's guide to joy, 2016</i>	6. <i>Vivekananda Kenthria Prkasan Trust, Yogam, 2006</i>
	2. <i>Shri Shri Ravi Shankar, The Art of stress-free Living, 2011</i>	7. <i>Swami Chetanananda, Meditation and Its Methods According to Swami Vivekananda, Jan 2001</i>
	3. <i>Swami Ramdev Ji Yog Its Philosophy and Practice, 2008</i>	8. <i>Dr.Lakshminarain Sharma, Yoga for the cure of Common Diseases, Mar 2016</i>
	4. <i>Yogiraj Vethathiri Maharishi, Yoga for Modern Age, Tenth edition, Vethathiri Publications, 2007</i>	9. <i>Swami Satyananda Saraswati, Asana Pranayama Mudra Bandha, Bihar School of Yoga, 1993</i>
	5. <i>Yogiraj Vethathiri Maharishi, Simplified Physical Exercises, Forty Second edition, Jan-2014</i>	10. <i>Dr. Asana Andiappan, Thirumoolar's Astanga Yoga, International Yoga Academy, 2017</i>

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (100% weightage)								Final Examination	
		CLA – 1 (20%)		CLA – 2 (30%)		CLA – 3 (30%)		CLA – 4 (20%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	-	40%	-	30%	-	30%	-	30%	-	-
	Understand										
Level 2	Apply	-	40%	-	40%	-	40%	-	40%	-	-
	Analyze										
Level 3	Evaluate	-	20%	-	30%	-	30%	-	30%	-	-
	Create										
	Total	100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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2. Mrs. R. Piramukutty, World Community Service Centre, piramukutty.gdvmvkm@gmail.com	2. Dr. N. Perumal, Vethathiri Maharishi Institute for Spiritual and Intuition Education, visionacademy@vethathiri.edu.in	2. Dr. S. Jahira Parveen SRMIST

Course Code	18LEM102J	Course Name	VALUE EDUCATION	Course Category	M	Mandatory	L	T	P	C
							1	0	1	0

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	English and Foreign Languages			Data Book / Codes/Standards	Nil

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)
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CLR-1:	Connect the learners to their potential, identify their potential to create a new positive world	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2:	Analyze the merits and demerits of different educational systems. Identify the different systems of education	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLR-3:	Draw attention towards the weaknesses they are susceptible to and inspire them through positive models																		
CLR-4:	Instill a sense of professional ethics which help them develop a safe comfortable and prosperous society																		
CLR-5:	Cultivate a spirit of willing accommodation in an increasingly diverse world																		
CLR-6:	Strengthen, enhance the spirit of positivity and facilitate positive contribution in various spheres of life																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1:	Equipped with an awareness of their positive energy and power	2	80	75	L	M	-	-	M	H	-	H	H	H	-	H	-	-	-
CLO-2:	Identify the meaning of 'education'; have a clearer and better understanding in taking education to the masses	2	75	70	M	H	M	-	H	H	M	M	H	H	-	H	-	-	-
CLO-3:	Assess their weaknesses; understand risks involved and rectify them through learning from positive and negative instances	2	80	75	M	-	-	-	M	H	M	M	H	H	-	H	-	-	-
CLO-4:	Realize their professional responsibilities	2	75	70	H	M	-	-	H	H	H	H	H	H	-	H	-	-	-
CLO-5:	Acquire the required values in an expanding pluralistic world not be swept off their feet due to the rapid changes	2	85	80	M	-	-	-	H	H	H	H	H	H	-	H	-	-	-
CLO-6:	Equip with better understanding of themselves, society they live. Identify responsibilities in creating a peaceful world	2	80	75	M	M	-	-	H	H	H	H	H	H	-	H	-	-	-

Duration (hour)	Visions for Youth	Youth and Education	Youth and Society	Youth as Professionals	Youth in Pluralistic Society
6	6	6	6	6	6
S-1	SLO-1 Introduction	Meaning and the significance of education	Need for social values in the present context	Introduction to professional values	Introduction to pluralistic society, forces of globalization
	SLO-2 Quiz	Brainstorming	Poem – "Where the mind is without fear" Write up on various instances from real life	Brainstorming through visual cues	Group Discussion
S-2	SLO-1 Two speeches by great personalities	Overview of different (traditional, modern) educational systems	Individual and group behavior, respect for others	Engineering societies in India	Science and technology intercultural proximity
	SLO-2 Oral presentations	Debate	Case study on recent happenings	Quiz	Narration of stories from various religions to illustrate the oneness of humanity
S-3	SLO-1 Quotes, proverbs relating to the power and potential of youth. Excerpts: Wings of Fire	Overview of different (traditional, modern) educational systems	Civic sense, bullying-substance abuse, uses of expletives	Challenges to be addressed by Engineers in India	Positive, Negative impact: religion, politics, gender, economic status, aesthetics
	SLO-2 Collecting proverbs highlighting the potential of youth	Debate	Case study on recent happenings	Case Study	Discussion on "To Kill a Mocking Bird"
S-4	SLO-1 Two news articles highlighting the initiatives for social causes by youth	Role of youth in education, Urban and Rural set up, dissemination	Hero worship, gender insensitivity, moral policing	Challenges in different sectors: agriculture	Values required to live in a global society
	SLO-2 Role play in a similar context	Student presentations	Case study on recent happenings	Case Study	Poster presentation on festivals of various religions
S-5	SLO-1 Two news articles highlighting the initiatives for social causes by youth	Designing and framing educational curriculum and materials	Positive contribution by youth in promoting social welfare	Challenges in different sectors: urban development, environment	Learning the etiquettes of various societies
	SLO-2 Role play in a similar context	Students' Presentation based on write ups	Short videos followed by discussions	Group activity (oral and written)	Poster presentation on festivals of various religions
S-6	SLO-1 One song exhibiting the positive energy of youth	The pressing challenges in current educational system	Positive contribution by youth in promoting social welfare	Challenges in different sectors: sustainable development, cyber security	Success of pluralistic society, enliven the society, religious harmony through literary
	SLO-2 Discussion on the song	Collage Design	Short videos followed by discussions	Case Study – from Newspapers	Writing the aspects of pluralistic society based on the text

Learning Resources	1. Kalam, APJ Abdul. <i>Wings of Fire: AN Autobiography of APJ Abdul Kalam</i> . Ed. Sangam Books Ltd., 1999 2. "Banaras Hindu University Speech" and "To Students". <i>The Voice of Truth</i> . General Editor Shriman Narayan. Navajivan Publishing House. pp. 3-13 and pp. 425-30. www.mkgandhi.org 3. Piroda, Sam. "Challenges in Science and Technology". www.nfdindia.org/loc19.htm	4. Thomas A Address to VTU Students by Narayana Murthy. https://www.karnataka.com/personalities/narayana-murthy/vtu-address-2006/ 5. World Economic forum. "India's top 7 challenged from skills to water scarcity"
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Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (100% weightage)								Final Examination	
		CLA – 1 (20%)		CLA – 2 (30%)		CLA – 3 (30%)		CLA – 4 (20%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	-	-
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	-	-
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	-	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

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