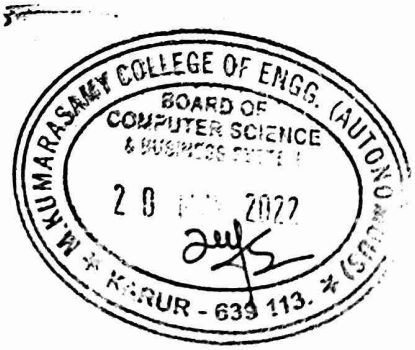
M.KUMARASAMY
COLLEGE OF ENGINEERING
NAAC Accredited Autonomous Institution
Approved by AICTE & Affiliated to Anna University
ISO 9001:2015 & ISO 14001:2015 Certified Institution
Thalavapalayam, Karur - 639 113.

CURRICULUM AND SYLLABUS

REGULATION 2018

B.Tech- Computer Science and Business Systems

Semester I to VI



CURRICULUM AND SYLLABUS
REGULATION 2018
Programme: B.Tech – Computer Science and Business Systems

Vision of the Department:

To produce competent industry relevant education, skilful research, technical and innovative computer science professionals acquaintance with managerial skills, human and social values.

Mission of the Department:

M1: To impart technical knowledge through innovative teaching, research, and consultancy.

M2: To develop and to promote student ability thereby to compete globally through excellence in education.

M3: To facilitate the development of academic-industry Collaboration.

M4: To produce competent engineers with professional ethics, technical competence and a spirit of innovation and managerial skills.

Programme Educational Objectives (PEOs):

PEO1: To acquire technical knowledge and proficiency required for the carrier advancement and higher education in the contemporary areas of computer science, business systems and various issues in the society.

PEO2: To apply their competency in design and development of innovative solutions to adapt various emerging technological challenges for real world problems.

PEO3: To demonstrate leadership qualities with high ethical standards and collaborated with other industries for the socio-economical growth of the country.

Mapping of Programme Educational Objectives with Mission of the Department:

PEOs / Department Mission Statements	M1	M2	M3	M4
PEO1	3	3	2	3
PEO2	3	2	2	2
PEO3	3	3	2	2

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

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Programme Outcomes (POs):

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

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PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes (PSOs):

PSO1: Ability to apply the analytical and business skills to provide sustainable solutions as an engineer/researcher for the real-time applications using Machine Learning, Internet of Things and Data analytics.

PSO2: Ability to practice ethical and human values with soft-skills qualities in computer science and business disciplines to emerge as an entrepreneur for the growth and development of the society.

Mapping of Programme Educational Objectives with Programme Outcomes and Programme Specific Outcomes:

PEOs / POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
PEO1	2	2	2	3	2	2	3	3	1	2	3	2	3	2
PEO2	2	2	3	2	2	3	3	2	2	3	2	3	3	1
PEO3	3	3	2	3	3	1	1	3	3	2	3	1	1	3

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

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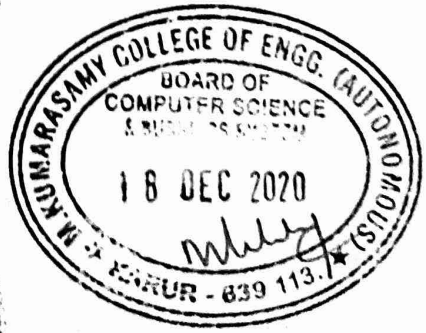
Programme Articulation

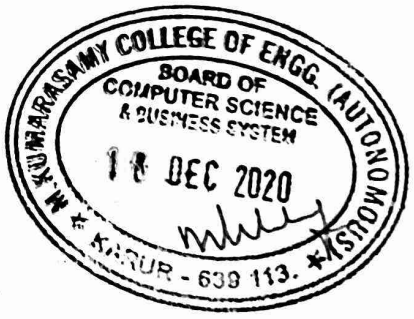
Semester	Course Code	Course Name	POs											PSOs	
			PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
I	18MAB103T	Discrete Mathematics	✓	✓											✓	
I	18MAB104T	Calculus, Statistics and Probability	✓	✓		✓								✓	✓	
I	18PYB102J	Physics for Computing Science	✓	✓	✓						✓	✓			✓	
I	18EEB102J	Principles of Electrical Engineering	✓	✓	✓											
I	18CBB101J	Problem Solving and C Programming	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
I	18CBH101J	Business Communication & Value Science – I		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
I	18LEM101T	Constitution of India							✓	✓	✓	✓	✓	✓		
I		Induction Program														
II	18MAB105T	Linear Algebra	✓	✓	✓	✓		✓					✓	✓	✓	
II	18MAB106J	Statistical Methods	✓	✓	✓	✓	✓	✓					✓	✓	✓	
II	18ECB101J	Principles of Electronics	✓	✓	✓	✓	✓	✓				✓			✓	
II	18CBC101J	Data Structures & Algorithms	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
II	18MBS101T	Fundamentals of Economics	✓	✓					✓				✓	✓		
II	18CBH102J	Business Communication & Value Science – II		✓	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓
II	18LEM102T	Value Education	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	
II	18GNM101L	Physical & Mental Health using Yoga						✓						✓		
III	18CBC201T	Formal Language and Automata Theory	✓	✓	✓	✓	✓				✓	✓	✓	✓	✓	
III	18CBC202T	Computer Organization & Architecture	✓	✓	✓	✓	✓								✓	✓
III	18CBC203T	Object Oriented Programming	✓	✓	✓	✓								✓	✓	✓
III	18CBC204J	Computational Statistics	✓	✓	✓	✓								✓	✓	✓
III	18CBC205J	Software Engineering	✓	✓	✓	✓							✓	✓	✓	✓
III	18MAB209T	Operations Research	✓	✓										✓	✓	

Semester	Course Code	Course Name	POs												PSOs	
			PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
III	18CBC206L	Object Oriented Programming Laboratory	✓	✓	✓	✓	✓						✓		✓	✓
III	18MBM201L	Competencies in Social Skills	✓								✓	✓				
III / IV	18CYM201T	Environmental Science		✓		✓		✓	✓	✓						
IV	18CBC207T	Database Management Systems	✓	✓	✓	✓									✓	✓
IV	18CBC208J	Operating Systems	✓	✓												✓
IV	18CBC209J	Software Design with UML	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
IV	18CBH103J	Business Communication & Value Science – III									✓	✓		✓		
IV	18MBS201T	Fundamentals of Management	✓	✓					✓				✓	✓		✓
IV	18MBS202T	Introduction to Innovation, IP Management & Entrepreneurship	✓	✓					✓				✓	✓		✓
IV	18CBC210L	Database Management Systems Laboratory	✓	✓	✓	✓	✓								✓	✓
IV	18MBM202L	Critical and Creative Thinking Skills	✓									✓				
III / IV	18LEM103T	Indian Tradition and Heritage	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		



Structure of Curriculum

S.No.	Category	Credits
1	Humanities and Social Sciences courses (H)	11
2	Basic Science courses including basics of Electrical / Electronics / Computer courses (B)	32
3	Engineering Science courses including Management/Innovation & Entreprenurship course (S)	28
4	Professional core courses (C)	61
5	Professional Elective courses relevant to chosen specialization/branch (E)	22
6	Open Electives - Electives offered to other Departments (O)	-
7	Project work, Minor project, seminar and internship in industry or elsewhere (P)	7
8	Mandatory Courses (M) [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge]	4
	Total Credits	165



1. Humanities and Social Sciences courses (H)

S.No.	Course Code	Course Name	Hours / Week			C
			L	T	P	
1	18CBH101J	Business Communication & Value Science – I	2	0	2	3
2	18CBH102J	Business Communication & Value Science – II	2	0	2	3
3	18CBH103J	Business Communication & Value Science – III	1	0	2	2
4	18CBH104J	Business Communication & Value Science – IV	2	0	2	3
					Total Credits	11

L-Lecture T-Tutorial P-Practical

2. Basic Science courses including basics of Electrical / Electronics / Computer courses (B)

S.No.	Course Code	Course Name	Hours / Week			C
			L	T	P	
1	18MAB103T	Discrete Mathematics	3	1	0	4
2	18MAB104T	Calculus, Statistics and Probability	3	0	0	3
3	18MAB105T	Linear Algebra	3	1	0	4
4	18MAB106J	Statistical Methods	3	0	2	4
5	18PYB102J	Physics for Computing Science	3	0	2	4
6	18EEB102J	Principles of Electrical Engineering	2	0	2	3
7	18ECB101J	Principles of Electronics	2	0	2	3
8	18CBB101J	Problem Solving and C Programming	3	0	2	4
9	18MAB209T	Operations Research	3	0	0	3
					Total Credits	32

L-Lecture T-Tutorial P-Practical

3. Engineering Science courses including Management/Innovation & Entreprenurship course (S)

S.No.	Course Code	Course Name	Hours / Week			C
			L	T	P	
1	18MBS101T	Fundamentals of Economics	2	0	0	2
2	18MBS201T	Fundamentals of Management	2	0	0	2
3	18MBS202T	Introduction to Innovation, IP Management & Entrepreneurship	3	0	0	3
4	18MBS301T	Financial & Cost Accounting	2	0	0	2
5	18MBS302T	Business Strategy	2	0	0	2
6	18MBS303J	Design Thinking	2	0	2	3
7	18MBS304T	Financial Management	2	0	0	2

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S.No.	Course Code	Course Name	Hours / Week			C
			L	T	P	
8	18MBS401T	Marketing Research & Marketing Management	2	0	0	2
9	18MBS402T	Human Resource Management	2	0	0	2
10	18MBS403J	Services Science & Service Operational Management	3	0	2	4
11	18MBS404J	IT Project Management	3	0	2	4
					Total Credits	28

L-Lecture T-Tutorial P-Practical

4. Professional core courses (C)

S.No.	Course Code	Course Name	Hours / Week			C
			L	T	P	
1	18CBC101J	Data Structures & Algorithms	3	0	2	4
2	18CBC201T	Formal Language and Automata Theory	3	1	0	4
3	18CBC202T	Computer Organization & Architecture	3	0	0	3
4	18CBC203T	Object Oriented Programming	3	0	0	3
5	18CBC204J	Computational Statistics	3	0	2	4
6	18CBC205J	Software Engineering	3	0	2	4
7	18CBC206L	Object Oriented Programming Laboratory	0	0	2	1
8	18CBC207T	Database Management Systems	3	0	0	3
9	18CBC208J	Operating Systems	3	0	2	4
10	18CBC209J	Software Design with UML	3	0	2	4
11	18CBC210L	Database Management Systems Laboratory	0	0	2	1
12	18CBC301T	Design and Analysis of Algorithms	3	0	0	3
13	18CBC302J	Compiler Design	3	0	2	4
14	18CBC303L	Design and Analysis of Algorithms Laboratory	0	0	2	1
15	18CBC304T	Computer Networks	3	0	0	3
16	18CBC305J	Information Security	3	0	2	4
17	18CBC306J	Artificial Intelligence	3	0	2	4
18	18CBC307L	Computer Networks Laboratory	0	0	2	1
19	18CBC401J	Usability Design of Software Applications	2	0	2	3
20	18CBC402J	IT Workshop Skylab / Matlab	2	0	2	3
					Total Credits	61

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5. Professional Elective Courses relevant to chosen specialization/branch (E) (Any 6 Courses)

S.No.	Course Code	Course Name	Hours / Week			C
			L	T	P	
1		Elective - 1	3	0	2	4
2		Elective – 2	3	0	2	4
3		Elective – 3	3	0	0	3
4		Elective – 4	3	0	2	4
5		Elective – 5	3	0	0	3
6		Elective - 6	3	0	2	4
					Total Credits	22

S.No	Course Code	Course Name	Hours / Week			C
			L	T	P	
		Elective – 1				
1	18CBE001J	Coversational Systems	3	0	2	4
2	18CBE002J	Cloud, Microservices and Application	3	0	2	4
3	19CBE003J	Machine Learning	3	0	2	4
		Elective - 2				
4	18CBE004J	Robotics and Embedded Systems	3	0	2	4
5	18CBE005J	Modern Web Applications	3	0	2	4
6	18CBE006J	Data Mining and Analytics	3	0	2	4
		Elective - 3				
7	18CBE007T	Cognitive Science and Analytics	3	0	0	3
8	18CBE008T	Introduction to IoT	3	0	0	3
9	18CBE009T	Cryptology	3	0	0	3
		Elective - 4				
10	18CBE010J	Quantum Computation and Quantum Information	3	0	2	4
11	18CBE011J	Advanced Social, Text and Media Analytics	3	0	2	4
12	18CBE012J	Mobile Computing	3	0	2	4
		Elective - 5				
13	18CBE013T	Behavioral Economics	3	0	0	3
14	18CBE014T	Computational Finance and Modelling	3	0	0	3
15	18CBE015T	Psychology	3	0	0	3
		Elective - 6				
16	18CBE016J	Enterprise Systems	3	0	2	4
17	18CBE017J	Advance Finance	3	0	2	4
18	18CBE018J	Image Processing and Pattern Recognition	3	0	2	4

L-Lecture T-Tutorial P-Practical

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6. Open Electives - Electives offered to other Departments (O)

S.No.	Course Code	Course Name	Hours / Week			C
			L	T	P	
1	18CBO001T	Usability Design of Software Applications	3	0	0	3
2	18CBO002T	IT Workshop Skylab / Matlab	3	0	0	3
3	18CBO003T	Software Design with UML	3	0	0	3
4	18CBO004T	Modern Web Applications	3	0	0	3
5	18CBO005T	Data Mining and Analytics	3	0	0	3
					Total Credits	15

L-Lecture T-Tutorial P-Practical

7. Project work, minor project, seminar and internship in industry or elsewhere (P)

S.No.	Course Code	Course Name	Hours / Week			C
			L	T	P	
1	18CBP301L	Mini Project	0	0	2	1
2	18CBP401L	Project Evaluation I	0	0	4	2
3	18CBP402L	Project Evaluation II	0	0	8	4
					Total Credits	7

L-Lecture T-Tutorial P-Practical

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8. Mandatory Courses (M)

S.No.	Course Code	Course Name	Hours / Week			C
			L	T	P	
1	18LEM101T	Constitution of India	1	0	0	Nil
2	18LEM102T	Value Education	1	0	0	Nil
3	18GNM101L	Physical & Mental Health using Yoga	0	0	2	Nil
4		Induction Program	2	0	0	Nil
5	18MBM201L	Competencies in Social Skills	0	0	2	1
6	18MBM202L	Critical and Creative Thinking Skills	0	0	2	1
7	18CYM201T	Environmental Science	1	0	0	Nil
8	18LEM103T	Indian Tradition and Heritage	1	0	0	Nil
9	18MBM301L	Analytical and Logical Thinking Skills	0	0	2	1
10	18MBM302L	Employability Skills and Practices	0	0	2	1
11	18LEM301T	Indian Art Forms	1	0	0	Nil
12	18LEM302T	Self Development and Entrepreneurship	1	0	0	Nil
		Total Credits				4

L-Lecture T-Tutorial P-Practical

B.Tech. – Computer Science and Business Systems

Semester I							
S.No	Category	Course Code	Course Name	Hours / Week			C
				L	T	P	
1	B	18MAB103T	Discrete Mathematics	3	1	0	4
2	B	18MAB104T	Calculus, Statistics and Probability	3	0	0	3
3	B	18PYB102J	Physics for Computing Science	3	0	2	4
4	B	18EEB102J	Principles of Electrical Engineering	2	0	2	3
5	B	18CBB101J	Problem Solving and C Programming	3	0	2	4
6	H	18CBH101J	Business Communication & Value Science – I	2	0	2	3
Mandatory Courses							
7	M	18LEM101T	Constitution of India	1	0	0	Nil
8	M		Induction Program	2	0	0	Nil
						Total Credits	21

Semester II							
S.No.	Category	Course Code	Course Name	Hours / Week			C
				L	T	P	
1	B	18MAB105T	Linear Algebra	3	1	0	4
2	B	18MAB106J	Statistical Methods	3	0	2	4
3	B	18ECB101J	Principles of Electronics	2	0	2	3
4	C	18CBC101J	Data Structures & Algorithms	3	0	2	4
5	S	18MBS101T	Fundamentals of Economics	2	0	0	2
6	H	18CBH102J	Business Communication & Value Science – II	2	0	2	3
Mandatory Courses							
7	M	18LEM102T	Value Education	1	0	0	Nil
8	M	18GNM101L	Physical & Mental Health using Yoga	0	0	2	Nil
						Total Credits	20

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Semester III							
S.No.	Category	Course Code	Course Name	Hours / Week			C
				L	T	P	
1	C	18CBC201T	Formal Language and Automata Theory	3	1	0	4
2	C	18CBC202T	Computer Organization & Architecture	3	0	0	3
3	C	18CBC203T	Object Oriented Programming	3	0	0	3
4	C	18CBC204J	Computational Statistics	3	0	2	4
5	C	18CBC205J	Software Engineering	3	0	2	4
6	B	18MAB209T	Operations Research	3	0	0	3
Laboratory Course							
7	C	18CBC206L	Object Oriented Programming Laboratory	0	0	2	1
Mandatory Courses							
8	M	18MBM201L	Competencies in Social Skills	0	0	2	1
9	M	18CYM201T / 18LEM103T	Environmental Science / Indian Tradition and Heritage	1	0	0	Nil
						Total Credits	23

Semester IV							
S.No.	Category	Course Code	Course Name	Hours / Week			C
				L	T	P	
1	C	18CBC207T	Database Management Systems	3	0	0	3
2	C	18CBC208J	Operating Systems	3	0	2	4
3	C	18CBC209J	Software Design with UML	3	0	2	4
4	H	18CBH103J	Business Communication & Value Science – III	1	0	2	2
5	S	18MBS201T	Fundamentals of Management	2	0	0	2
6	S	18MBS202T	Introduction to Innovation, IP Management & Entrepreneurship	3	0	0	3
Laboratory Course							
7	C	18CBC210L	Database Management Systems Laboratory	0	0	2	1
Mandatory Courses							
8	M	18MBM202L	Critical and Creative Thinking Skills	0	0	2	1
9	M	18LEM103T / 18CYM201T	Indian Tradition and Heritage / Environmental Science	1	0	0	Nil
						Total Credits	20

Semester V							
S.No.	Category	Course Code	Course Name	Hours / Week L	T	P	C
1	C	18CBC301T	Design and Analysis of Algorithms	3	0	0	3
2	C	18CBC302J	Compiler Design	3	0	2	4
3	S	18MBS301T	Financial & Cost Accounting	2	0	0	2
4	S	18MBS302T	Business Strategy	2	0	0	2
5	S	18MBS303J	Design Thinking	2	0	2	3
6	E		Elective I - Professional / Open	3	0	2	4
Laboratory Course							
7	C	18CBC303L	Design and Analysis of Algorithms Laboratory	0	0	2	1
8	P	18CBP301L	Mini Project	0	0	2	1
Mandatory Courses							
9	M	18MBM301L	Analytical and Logical Thinking Skills	0	0	2	1
10	M	18LEM301T / 18LEM302T	Indian Art Forms / Self Development and Entrepreneurship	1	0	0	Nil
						Total Credits	21

Semester VI							
S.No.	Category	Course Code	Course Name	Hours / Week L	T	P	C
1	C	18CBC304T	Computer Networks	3	0	0	3
2	C	18CBC305J	Information Security	3	0	2	4
3	C	18CBC306J	Artificial Intelligence	3	0	2	4
4	S	18MBS304T	Financial Management	2	0	0	2
5	H	18CBH104J	Business Communication & Value Science – IV	2	0	2	3
6	E		Elective II - Professional / Open	3	0	2	4
Laboratory Course							
7	C	18CBC307L	Computer Networks Laboratory	0	0	2	1
Mandatory Courses							
8	M	18MBM302L	Employability Skills and Practices	0	0	2	1
9	M	18LEM301T / 18LEM302T	Indian Art Forms / Self Development and Entrepreneurship	1	0	0	Nil
						Total Credits	22

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Semester VII							
S.No	Category	Course Code	Course Name	Hours / Week			C
				L	T	P	
1	C	18CBC401J	Usability Design of Software Applications	2	0	2	3
2	C	18CBC402J	IT Workshop Skylab / Matlab	2	0	2	3
3	S	18MBS401T	Marketing Research & Marketing Management	2	0	0	2
4	S	18MBS402T	Human Resource Management	2	0	0	2
5	E		Elective III / Professional / Open	3	0	0	3
6	E		Elective IV	3	0	2	4
Laboratory Course							
7	P	18CBP401L	Project Evaluation I	0	0	4	2
				Total Credits			19

Semester VIII							
S.No.	Category	Course Code	Course Name	Hours / Week			C
				L	T	P	
1	S	18MBS403J	Services Science & Service Operational Management	3	0	2	4
2	S	18MBS404J	IT Project Management	3	0	2	4
3	E		Elective V	3	0	0	3
4	E		Elective VI	3	0	2	4
Laboratory Course							
5	P	18CBP402L	Project Evaluation II	0	0	8	4
				Total Credits			19

L-Lecture T-Tutorial P-Practical

Total Credits

Semester	Credits
1	21
2	20
3	23
4	20
5	21
6	22
7	19
8	19
Total	**165**

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Regulation 2018		Semester I	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
B	18MAB103T	DISCRETE MATHEMATICS	3	1	0	4

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

1	Understand the fundamental concepts of propositions by various discrete structure techniques
2	Understand discrete structures of many levels and to know the principle of counting
3	Model situations in a mathematical way and derive useful results

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Demonstrate the concepts of logic to test the validity of a program and to arrive at inferences on logical structures
CO2	Demonstrate the concepts of Boolean algebra in analysing logic gates
CO3	Obtain the perception in the area of sets and the knowledge about functions
CO4	Use the counting principles in implementing various programmes
CO5	Apply the concepts of Graph Theory to the real world problems

CO-PO Mapping

COs	Pos												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	2	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	2	-
CO3	3	1	-	-	-	-	-	-	-	-	-	-	2	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	2	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	2	-
CO (Avg)	3	2	-	-	-	-	-	-	-	-	-	-	2	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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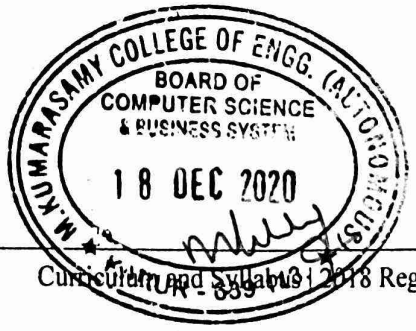
UNIT I	MATHEMATICAL LOGIC	9+3
Propositional calculus - Propositions - Connectives, Syntax; Semantics – Truth assignments - Truth tables - Validity and satisfiability - Tautology; Adequate set of connectives; Equivalence - Normal forms; Compactness - Resolution; Formal reducibility - Natural deduction system - Axiom system; Soundness - Completeness.		
UNIT II	**BOOLEAN ALGEBRA**	**9+3**
Introduction of Boolean algebra - Truth table - Basic logic gate - Basic postulates of Boolean algebra - Principle of duality - Canonical form -Karnaugh map.		
UNIT III	**ABSTRACT ALGEBRA**	**9+3**
Set - Types of sets – Set operation; Relation - Equivalence Relation; Algebraic System - Groups – Sub groups – Homomorphism – Cosets - Lagrange's theorem – Ring and Field (definition).		
UNIT IV	**COMBINATORICS**	**9+3**
Basic counting - Balls and bins problems - Generating functions - Recurrence relations. Proof techniques - Principle of mathematical induction - Pigeonhole principle.		
UNIT V	**GRAPH THEORY**	**9+3**
Graphs and digraphs – Complement – Isomorphism - Connectedness – Reachability - Adjacency matrix -Eulerian paths and circuits in graphs and digraphs - Hamiltonian paths and circuits in graphs and tournaments - trees; Planar graphs - Euler's formula -Dual of a planer graph - Independence number and clique number - Chromatic number - Statement of Four-color theorem.		

Text Book (s)	
1	C. L. Liu, Elements of Discrete Mathematics, Second Edition, McGraw Hill, New Delhi, 1985.
2	Lu Zhongwan, Mathematical Logic for Computer Science, 2nd Edition ,World Scientific, Singapore, 1998.
Reference (s)	
1	R. A. Brualdi, Introductory Combinatorics, 5th Edition , North-Holland, New York, 2009.
2	N. Deo, Graph Theory with Applications to Engineering and Computer Science, Prentice Hall, Englewood Cliffs, 2016.
3	E. Mendelsohn, Introduction to Mathematical Logic, Second Edition, Van-Nostrand, London, 1979.
4	I. N. Herstein, Topics in Algebra, 2nd Edition, John Wiley and Sons, 1975.
5	M. Morris Mano,Digital Logic & Computer Design, 1st Edition, Pearson, 2016.



Regulation 2018		Semester I	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
B	18MAB104T	CALCULUS, STATISTICS AND PROBABILITY	3	0	0	3

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

1	Provide basic tools of calculus for the purpose of modelling Engineering Problems
2	Equip the students in using Statistical techniques to solve problems
3	Analyze the various data by different statistical techniques
4	Study the basic probability concepts
5	Understand and have a well – founded knowledge of standard distributions which can describe real life phenomena

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Apply the concept of differentiation to solve maxima and minima problems
CO2	Solve problems involving integration using different methods
CO3	Collect, analyse and process the data for various purposes
CO4	Solve problems involving conditional probability and moments
CO5	Use various distributions that arise in data analysis

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	2	2	-
CO2	3	2	-	-	-	-	-	-	-	-	-	2	2	-
CO3	3	2	-	-	-	-	-	-	-	-	-	1	2	-
CO4	3	2	-	1	-	-	-	-	-	-	-	1	3	-
CO5	3	3	-	1	-	-	-	-	-	-	-	1	3	-
CO (Avg)	3	2.4	-	1	-	-	-	-	-	-	-	1.4	2.4	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	DIFFERENTIAL CALCULUS	9+3
Limits and Derivatives - Differentiation – Rules of Differentiation – Maxima and Minima of single variable.		
UNIT II	**INTEGRAL CALCULUS**	**9+3**
Definite and Indefinite integrals – Integration by parts - Double and Triple integrals in Cartesian form – Area and Volume.		
UNIT III	**INTRODUCTION TO STATISTICS**	**9+3**
Definition of Statistics - Basic objectives - Applications in various branches of science with examples. Collection of Data: Internal and external data, Primary and secondarydata. Population and Sample, Representative sample. Descriptive Statistics: Classification and tabulation of univariate data, Graphical representation, Frequency curves. Descriptive measures - Central tendency and Dispersion.		
UNIT IV	**PROBABILITY**	**9+3**
Concept of experiments, sample space, event - Definition of Combinatorial Probability, Conditional Probability, Bayes' Theorem (Statement only) - Expected values and moments: mathematical expectation and its properties (Statements only), Moments (including variance) and their properties, interpretation, Moment generating function – Two dimensional random variables: Joint distributions - Marginal and conditional distributions.		
UNIT V	**PROBABILITY DISTRIBUTIONS**	**9+3**
Discrete and Continuous distributions:Binomial, Poisson and Geometric distributions, Uniform, Exponential, and Normal distributions.		

Text Book (s)

1	B.S.Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publication, Delhi, 2017.
2	Douglas C. Montgomery, George C. Runger, Applied Statistics and Probability for Engineers, Third Edition, John Wiley & Sons, 2003.

Reference (s)

1	S. M. Ross, A first course in Probability, 9th Edition, Prentice Hall, 2012.
2	I. R. Miller, J.E. Freund and R. Johnson, Probability and Statistics for Engineers, 9th Edition, Pearson, 2017.
3	A. M. Mood, F.A. Graybill and D.C. Boes, Introduction to the Theory of Statistics, 3rd Edition, McGraw Hill Education, 2001.
4	A. M. Gun, M.K. Gupta and B. Dasgupta, Fundamentals of Statistics, Vol. I & II, World Press, 2013 & 2017.
5	Peter V. O'Neil, Advanced Engineering Mathematics, Seventh Edition, Thomson Learning, 2011.

Regulation 2018		Semester I	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
B	18PYB102J	PHYSICS FOR COMPUTING SCIENCE	3	0	2	4

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

CLR-1	create insights to the concepts of optical effects
CLR-2	identify the significance of quantum theory
CLR-3	analyze the working principle of lasers and optical fibers
CLR-4	utilize the concepts in physics for the understanding of engineering and technology
CLR-5	understand the fundamentals of thermodynamics

Course Outcome (s) (Cos):

At the end of this course, learners will be able to:

CO1	analyse the behavior of different types of harmonic oscillations
CO2	explain the concept of interference,diffraction and polarisation
CO3	ellobrate the basic principles of Quantum mechanics
CO4	elucidate the structure of different crystal systems
CO5	explain the different types of laser and their applications

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	1	1	-	-	-	-
CO2	3	2	1	-	-	-	-	-	1	1	-	-	-	-
CO3	3	1	1	-	-	-	-	-	1	1	-	-	-	-
CO4	3	2	1	-	-	-	-	-	1	1	-	-	-	-
CO5	3	1	1	-	-	-	-	-	1	1	-	-	1	-
CO (Avg)	3.00	1.60	1	-	-	-	-	-	1.00	1.00	-	-	1.00	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	OSCILLATIONS	9

Oscillation: Periodic motion-simple harmonic motion-characteristics of simple harmonic motion-vibration of simple spring mass system. Resonance-definition., damped harmonic oscillator – heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor

UNIT II	WAVE OPTICS	9

Interference-principle of superposition-young's experiment: Theory of interference fringes-types of interference-Fresnel's prism-Newton's rings, Diffraction-Two kinds of diffraction-Difference between interference and diffraction- Fresnel's half period zone and zone plate - Fraunhofer diffraction at single slit-plane diffraction grating. Temporal and Spatial Coherence.

Polarization of light: Polarization - Concept of production of polarized beam of light from two SHM acting at right angle; plane, elliptical and circularly polarized light, Brewster's law, double refraction.

UNIT III	QUANTUM MECHANICS	9

Quantum Mechanics: Introduction- Planck's quantum theory- Matter waves, de-Broglie wavelength, Heisenberg's Uncertainty principle, Compton effect, time independent and time dependent Schrodinger's wave equation, Physical significance of wave function, Particle in a one dimensional potential box.

UNIT IV	CRYSTALLOGRAPHY & THERMODYNAMICS	9

Crystallography: Basic terms-types of crystal systems, Bravais lattices, miller indices, d spacing, Atomic packing factor for SC, BCC, FCC and HCP structures. Semiconductor Physics - conductor, semiconductor and Insulator; Basic concept of Band theory.

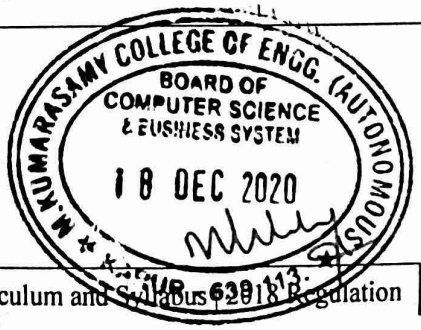
Thermodynamics: Zeroth law of thermodynamics, first law of thermodynamics, brief discussion on application of 1st law, second law of thermodynamics and concept of Engine, entropy, change in entropy in reversible and irreversible processes.

UNIT V	LASER AND FIBER OPTICS	9

Laser and Fiber optics: Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: Ruby Laser, CO2 and Neodymium lasers;, applications of lasers in engineering. Fiber optics, Acceptance angle and Numerical aperature, Types of optical fibers, Applications of fiber - Optical fiber communications system-Optical sensors.

For Further Reading: (not for Exaninations)

Basic Idea of Electromagnetisms: Continuity equation for current densities, Maxwell's equation in vacuum and non-conducting medium.



LIST OF EXPERIMENTS	15
1. Magnetic field along the axis of current carrying coil – Stewart and Gee 2. Determination of Hall coefficient of semi-conductor 3. Determination of Plank constant 4. Determination of wave length of light by Laser diffraction method 5. Determination of wave length of light by Newton's Ring method 6. Determination of laser and optical fiber parameters 7. Determination of Stefan's Constant 8. Determination of band gap of a semiconductor 9. Determination of moment of interia of a wire using torisional pendulum	

Text books	
1	Concepts of Modern Physics, (Fifth Edition) A Beiser, McGraw Hill International, 1995
2	Fundamentals of Physics, David Halliday, Robert Resnick and Jearl Walker, Wileyplus, 2013

References:	
1.	Optics, (Fifth Edition) AjoyGhatak, Tata McGraw Hill, 2012
2.	University Physics, Sears &Zemansky, Addison-Wesley. 1999
3.	Fundamentals of Optics, (Third Edition) Jenkins and White, McGraw-Hill, 1957

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Regulation 2018		Semester I	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
B	18EEB102J	PRINCIPLES OF ELECTRICAL ENGINEERING	2	0	2	3

Prerequisite Course (s)

Nil

Course Objective (s):
The purpose of learning this course is to:

1	Introduce the basic concepts of electrical circuits and its terminology.
2	Understand the various theorems to solve DC circuits
3	Learn the basic concepts of AC circuits
4	Understand the importance of electrostatic field and electromagnetic field in electromechanical energy conversions.
5	Provide knowledge on measuring devices / sensors, transducers and electrical wiring.

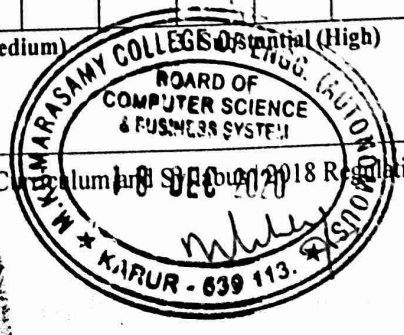
Course Outcome (s) (COs):
At the end of this course, learners will be able to:

CO1	Explain the basic concepts and terminology of electrical circuits.
CO2	Analyze the DC circuit using various network theorems
CO3	Analyze the transient response of AC circuits with R-L-C parameters.
CO4	Analyze the Static and dynamic characteristics of Electro-static and Electromagnetic fields.
CO5	Demonstrate the measurement of various electrical quantities in AC and DC systems with the necessary sensors and devices.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO (Avg)	3	3	3	-	-	-	-	-	-	-	-	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)



UNIT I	INTRODUCTION	6
Concept of Potential difference, voltage, current, Fundamental linear passive and active elements to their functional current-voltage relation, Terminology and symbols in order to describe electric networks, voltage source and current sources, ideal and practical sources, concept of dependent and independent sources, Kirchhoff's laws and applications to network solutions using mesh and nodal analysis, Concept of work, power, energy, and conversion of energy.		
UNIT II	**DC CIRCUITS**	**6**
Current-voltage relations of the electric network by mathematical equations to analyze the network (Thevenin's theorem, Norton's Theorem, Maximum Power Transfer theorem) Simplifications of networks using series-parallel, Star/Delta transformation. Superposition theorem.		
UNIT III	**AC CIRCUITS**	**6**
AC waveform definitions, form factor, peak factor, study of R-L, R-C,RLC series circuit, R-L-C parallel circuit, phasor representation in polar and rectangular form, concept of impedance, admittance, active, reactive, apparent and complex power, power factor, 3 phase Balanced AC Circuits (λ-Δ&λ-λ).		
UNIT IV	**ELECTROSTATICS AND ELECTRO-MECHANICS**	**6**
Electrostatic field, electric field strength, concept of permittivity in dielectrics, capacitor composite, dielectric capacitors, capacitors in series and parallel, energy stored in capacitors, charging and discharging of capacitors, Electricity and Magnetism, magnetic field and Faraday's law, self and mutual inductance, Ampere's law, Magnetic circuit, Single phase transformer, principle of operation, EMF equation, voltage ratio, current ratio, KVA rating, efficiency and regulation, Electromechanical energy conversion.		
UNIT V	**MEASUREMENTS AND SENSORS**	**6**
Introduction to measuring devices/sensors and transducers (Piezoelectric and thermo-couple) related to electrical signals, Elementary methods for the measurement of electrical quantities in DC and AC systems (Current & Single-phase power). Electrical Wiring and Illumination system: Basic layout of the distribution system, Types of Wiring System &Wiring Accessories, Necessity of earthing, Types of earthing, Safety devices & system.		
For Further Reading - Principle of batteries, types, construction and application, Magnetic material and B-H Curve, Basic concept of indicating and integrating instruments.		

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LIST OF EXPERIMENTS	15

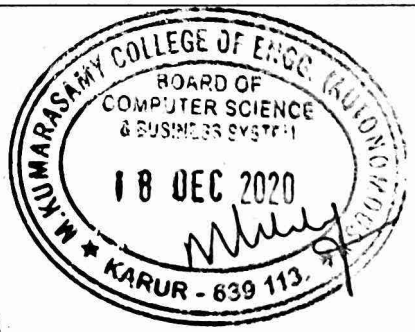
1. Familiarization of electrical Elements, sources, measuring devices and transducers related to electrical circuits
2. Determination of resistance temperature coefficient
3. Verification of Network Theorem (Superposition, Thevenin, Norton, Maximum Power Transfer theorem)
4. Simulation of R-L-C series circuits for XL>XC , XL< XC
5. Simulation of Time response of RC circuit
6. Verification of relation in between voltage and current in three phase balanced star and delta connected loads.
7. Demonstration of measurement of electrical quantities in DC and AC systems.

Text Book (s)

1	*A Textbook of Electrical Technology*, (vol. I) (23rd Edition), B. L. Theraja& A. K.Theraja, S.Chand and Company Ltd., New Delhi, 2012.
2	*Basic Electrical Engineering (Revised Edition)*, V. K. Mehta, S. Chand and Company Ltd., New Delhi, 2012.

Reference (s)

1	*Electric Machinery(Seventh Edition)*, A. E. Fitzgerald, Kingsely Jr Charles, D. Umans Stephen, Tata McGraw Hill, 2020.
2	*Theory and problems of Basic Electrical Engineering*, (Second Edition), J. Nagrath and Kothari, Prentice Hall of India Pvt. Ltd., 2004.
3	*Basic Electrical Engineering (Third Edition)*, T. K. Nagsarkar and M. S. Sukhija, Oxford University Press, 2018.
4	*Introduction to Electrodynamics (Fourth Edition)*, D. J. Griffiths, Cambridge University Press, 2017.
5	*Engineering Circuit Analysis (Eighth Edition)*, William H. Hayt, Jack E. Kemmerly & Steven M Durbin, Tata McGraw Hill, 2013.
6	*Fundamentals of Electrical and Electronics Engineering (Second Edition)*, Smarjith Ghosh, Prentice Hall (India) Pvt. Ltd, 2007.



Regulation 2018		Semester I	Total Hours			60
			Hours / Week			C
Category	Course Code	Course Name	L	T	P	
B	18CBB101J	PROBLEM SOLVING AND C PROGRAMMING	3	0	2	4

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

1	Know the fundamental concepts of programming to solve problems.
2	Understand various operations and controls mechanisms in C programming
3	Learn about arrays, functions and pre-processor directives in C.
4	Understand the concept of pointers in C.
5	Learn the basics of structures and various file operations.

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Explain the algorithm, flowchart and C constructs for solving problems in Mathematical and Engineering application.
CO2	Develop C programs using different types of operators, expressions and control structures.
CO3	Use the concept of arrays, modules and recursive functions to solve real world problems.
CO4	Explain the concept of pointers using C program.
CO5	Write programs using Structures, Unions and explain various file operations.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	-	-	-	-	-	2	2	-	-	-
CO2	3	2	1	1	2	2	-	2	1	2	3	2	2	1
CO3	3	3	2	2	2	2	2	2	2	2	3	2	2	1
CO4	3	2	2	2	2	2	2	2	2	2	2	2	2	1
CO5	3	2	2	2	2	2	2	2	2	2	2	2	2	1
CO (Avg)	3	2.4	1.75	1.75	2	2	2	2	[illegible]	[illegible]	[illegible]	2	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	GENERAL PROBLEM SOLVING AND INTRODUCTION TO C	9

Algorithm and Flowchart for problem solving with Sequential Logic Structure, Decisions and Loops- Imperative languages- Introduction to C- syntax and constructs of ANSI C - Variable Names, Data Type and Sizes (Little Endian, Big Endian), Constants, Declarations, proper variable naming and Hungarian Notation - Standard I/O, Formatted Output – printf, Variable length argument list, Formatted Input – scanf Statements

UNIT II	OPERATORS, EXPRESSIONS AND CONTROL FLOW	9

Arithmetic Operators, Relational Operators, Logical Operators, Type Conversion, Increment Decrement Operators, Bitwise Operators, Assignment Operators and Expressions, Precedence and Order of Evaluation, if-else if, switch, Loops – while, do, for, break and continue, goto-structured and unstructured programming.

UNIT III	ARRAYS AND FUNCTIONS	9

Arrays, Multi-dimensional array and Row/column major formats, Strings, Functions and Program Structures, Basics of functions, parameter passing and returning type, External, Auto, Local, Static, Register Variables, Scope Rules, Block structure, Initialisation, Recursion, C Pre-processors, Standard Library Functions and return types.

UNIT IV	POINTERS	9

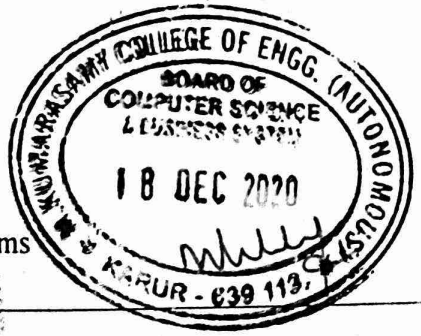
Pointers and address, Pointers and Function Arguments, Pointers and Arrays, Address Arithmetic, Character Pointers and Functions, Pointer Arrays; Pointer to Pointer, Initialisation of Pointer Arrays, Command line arguments, Pointer to functions, Complicated declarations.

UNIT V	STRUCTURES AND FILES	9

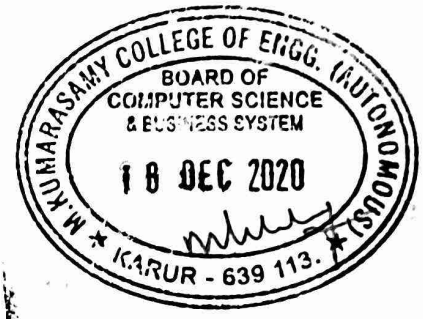
Basic Structures, Structures and Functions, Array of structures, Pointer of structures, Self-referral Structures, Table look up, Typedef, Unions, Bit-fields, File access, Error Handling- including exit, perror and error.h, Line Input and Output, Miscellaneous functions.

LIST OF EXPERIMENTS	15

1. Algorithm and flowcharts of small problems like GCD B
2. Structured code writing with:
   - i) Small but tricky codes
   - ii) Proper parameter passing
   - iii) Command line Arguments
   - iv) Variable parameter
   - v) Pointer to functions
   - vi) User defined header
   - vii) Make file utility
   - viii) Multi file program and user defined libraries
   - ix) Interesting substring matching / searching programs
   - x) Parsing related assignments



Contents for Further Reading	
Unix system Interface: File Descriptor, Low level I/O – read and write, Open, create, close and unlink, Random access – lseek, Discussions on Listing Directory, Storage allocator Programming Method: Debugging, Macro, User Defined Header, User Defined Library Function, makefile utility	
Text Book (s)	
1	B. W. Kernighan and D. M. Ritchi, "The C Programming Language", Second Edition, Pearson Education, 2016.
2	B. Gottfried, "Programming in C", Fourth Edition, Schaum Outline Series, 2018.
Reference (s)	
1	Herbert Schildt, "C: The Complete Reference", Fourth Edition, McGraw Hill, 2017.
2	Yashavant Kanetkar, "Let Us C", Fifteenth Edition, BPB Publications, 2017.



Regulation 2018		Semester I	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
H	18CBH101J	BUSINESS COMMUNICATION & VALUE SCIENCE – I	2	0	2	3

Prerequisite Course (s)

Nil

Course Objective (s):
The purpose of learning this course is to:

CLR-1	Introduce them to key concepts of values, life skills and business communication.
CLR-2	Motivate students to look within and create a better version of self.
CLR-3	Focus on the development of basic fluency in English, usage of vocabulary in the technical field.
CLR-4	Strengthen reading and official written communication skill.
CLR-5	Understand what life skills are and their importance in leading a happy and well-adjusted life.

Course Outcome (s) (COs):
At the end of this course, learners will be able to:

CO1	Recognize the need for life skills and values.
CO2	Recognize own strengths and opportunities
CO3	Recognize the importance of words
CO4	Understand the basic tenets of communication and apply the basic communication practices in different types of communication.
CO5	Apply the life skills to different situations

CO-PO Mapping

COs	Pos												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	1	1	1	2	1	2	3	3	2	2	3	-	-
CO2	-	1	-	1	1	1	2	2	3	1	1	3	-	-
CO3	-	2	2	2	2	1	1	3	3	2	3	3	-	-
CO4	-	1	1	-	-	1	1	2	3	2	1	3	-	-
CO5	-	1	2	-	2	1	2	2	3	1	2	3	-	-
CO (Avg)	-	1.2	1.5	1.33	1.75	1	1.6	2.4	3	1.6	1.8	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	HUMAN VALUES AND BUSINESS COMMUNICATION	6

Values – Self exploration – Values of individuals: Self Introduction-Presentation on favourite personality and the skills and values they demonstrate – Self-work with immersion(Interviewing Community Workers) and narrate what you think are the values that drive them – Writing: newspaper report– record conversation between a celebrity and an interviewer - Self-awareness; Stress management-Team Work

UNIT II	BASIC GRAMMAR AND COMMUNICATION	6

Parts of Speech - Applications of tenses - Sentence formation, sentence structure, Common Errors-Voices – Questioning-Barriers of Communication; Effective Communication; Verbal and Non – Verbal- Pronunciation- Toastmaster Speech -Importance of Listening Skills; Listening vs Hearing; Types of Listening; SWOT Analysis

UNIT III	VOCABULARY ENRICHMENT	6

Vocabulary Enrichment: Word formation: - Synonyms, antonyms, abbreviations - compound words –single word substitution- Exposure to words from General Service List (GSL) by West, Academic word list (AWL) technical specific terms related to the field of technology, phrases, idioms, significant abbreviations formal business vocabulary.

UNIT IV	READING AND WRITING SKILLS	6

Reading articles – Summary writing, Story writing - writing your comprehensive CV - Create a podcast on a topic. E-Mail Writing.

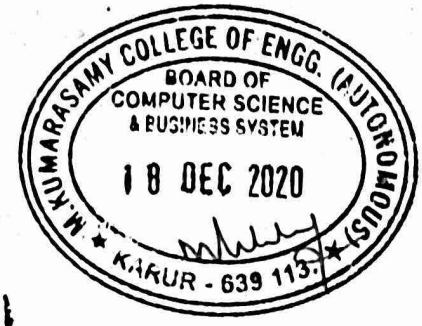
UNIT V	LIFE SKILL	6

Life Skills: Movie based learning – identifying skills and values - critical life skills - appreciation of diversity - Multiple Intelligences - Leadership Quality- Dealing with Ambiguity-Motivating the People - Community service – work with an NGO and make a presentation.

LAB ACTIVITIES	15

1. Presentation on the persona of any well-known person & Role-Play
2. Conversation between celebrity
3. Newspaper Report
4. Create a Podcast on a topic
5. Skit Based Communication
6. Listening Responding to audio
7. Working with an NGO and making a presentation
8. Join a trek –Values to be learned: Leadership, teamwork, dealing with ambiguity, managing stress, motivating people, creativity, result orientation
9. Create a musical using the learning from.

Text Book (s)	
There are no prescribed texts for semester 1-there will be handouts and reference links shared.	
Reference (s)	
1	Alan Mc'carthy and O'dell, "English vocabulary in use". Cambridge University Press,2017
2	APAART: Speak Well 1 (English language and communication)
3	APAART: Speak Well 2 (Soft Skills)
4	Dr.SarojHiremath, "Business Communication". Nirali Prakashan,2018
Web References	
1	Train your mind to perform under pressure- Simon sinek https://curiosity.com/videos/simon-sinek-on-training-your-mind-to-perform-under-pressure-capture-your-flag/
2	Brilliant way one CEO rallied his team in the middle of layoffs https://www.inc.com/video/simon-sinek-explains-why-you-should-put-people-before-numbers.html
3	Will Smith's Top Ten rules for success https://www.youtube.com/watch?v=bBsT9omTeh0
Online References	
1	https://www.coursera.org/learn/learning-how-to-learn
2	https://www.coursera.org/specializations/effective-business-communication



Regulation 2018		Semester I	Total Hours			15
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	18LEM101T	CONSTITUTION OF INDIA	1	0	0	NIL

Prerequisite Course (s)

NIL

Course Objective (s):
The purpose of learning this course is to:

CLR-1	Utilize the citizen's rights
CLR-2	Utilize the basic citizen's fundamental rights of freedom of speech, expression, equality, religion and privacy
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

Course Outcome (s) (COs):
At the end of this course, learners will be able to:

CO1	Identify the basic provisions in the Indian constitution
CO2	List the fundamental rights, rights to equality, freedom, religion, culture, education and the right against exploitation
CO3	Identify the fundamental duties of the Union of India, President, Vice-President, Union Ministers and Parliament functions
CO4	Identify the power of states, its legislature, Governors role and the state judiciary
CO5	List the special provisions and functionality of election commission, public service commission, individual tax and GST

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	2	3	3	3	-	3	-	-
CO2	-	-	-	-	-	-	2	3	3	3	-	3	-	-
CO3	-	-	-	-	-	-	2	3	3	3	2	3	-	-
CO4	-	-	-	-	-	-	2	3	3	3	2	3	-	-
CO5	-	-	-	-	-	-	2	3	3	3	2	3	-	-
CO (Avg)	-	-	-	-	-	-	2	3	3	3	2	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	INDIAN CONSTITUTION	3
Meaning of the Constitution law and Constitutionalism- Historical perspective of the Constitution of India- Salient features and characteristics of the Constitution of India Citizenship- Scheme of the fundamental rights- Scheme of the Fundamental Duties and its legal status		
UNIT II	**FUNDAMENTAL RIGHTS**	**3**
The Directive Principles of State Policy- Scheme of the Fundamental Right to Equality- Scheme of the Fundamental Right to certain Freedom under Article 19- Scope of the Right to Life and Personal Liberty under Article 21- Union Government, Union Legislature (Parliament)- Lok Sabha and Rajya Sabha (with Powers and Functions), Union Executive		
UNIT III	**POWERS AND FUNCTIONS OF CENTRAL GOVERNMENT**	**3**
President of India (with Powers and Functions)- Prime Minister of India (with Powers and Functions) - Union Judiciary (Supreme Court)- Jurisdiction of the Supreme Court - State Government, Legislature, Legislative Assembly, Legislative Council- Powers and Functions of the State Legislature, State Executive- Governor of the State (with Powers and Functions)		
UNIT IV	**POWERS AND FUNCTIONS OF STATE GOVERNMENT**	**3**
The Chief Minister of the State (with Powers and Functions)- State Judiciary (High Courts) Union Territory, Panchayat, Municipality- Scheduled and Tribal Areas- Co-operative Societies Consumer Rights - Consumer Protection Act		
UNIT V	**POWERS AND FUNCTIONS OF ELECTION AND SERVICE COMMISSION**	**3**
Local Self Government – Constitutional Scheme in India-Emergency Provisions : National, President Rule, Financial Emergency - Election Commission of India (with Powers and Functions) - The Union Public Service Commission (with Powers and Functions) - Amendment of the Constitutional Powers and Procedure -Income Tax, Goods and Services Tax		

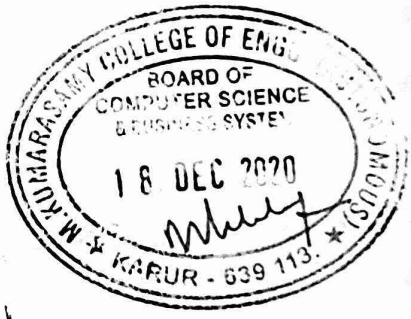
Text Book (s)

NIL

Reference (s)

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

Regulation 2018		Semester I	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M		INDUCTION PROGRAM	2	0	0	Nil
MODULE – MATHS						**10**
Set Theory, Relations and Functions - Differential and Integral Calculus - Matrices and Determinants - Complex Numbers - Differential Equations - Analytical Geometry & Vector Algebra - Trigonometry – Probability - Statistics						
MODULE – PHYSICS						**10**
Mechanics - Mechanical Properties of Solids and Fluids - Waves and Oscillations - Electricity and Magnetism - Electromagnetic Signal - Optics - Semiconductor Electronics - Modern Physics - Atomic and Nuclear Physics						
MODULE - UNIVERSAL HUMAN VALUES						**10**
Understanding the Need, Basic Guidelines, Content & Process for Value Education- Process of Self-Exploration-Happiness-Understanding the Human being as Co-existence of the Self and the Body-The Body as an Instrument of the Self-Understanding Harmony in the Self-Understanding Prosperity and Health-Harmony in the Family-Trust-Respect- Justice-Harmony in society						



Regulation 2018		Semester II	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
B	18MAB105T	LINEAR ALGEBRA	3	1	0	4

Prerequisite Course (s)

NIL

Course Objective (s):
The purpose of learning this course is to:

1	Analyze and solve a linear system of equations using Matrix Algebra techniques
2	Understand the concepts of independence, basis and dimensions in vectorspaces
3	Have well founded knowledge in inner product spaces and orthogonality
4	Compute and apply Eigen values and Eigen vectors
5	Apply the concepts of linear algebra in the field of computer science

Course Outcome (s) (Cos):
At the end of this course, learners will be able to:

CO1	Implement the various matrix techniques in solving the system of linear equations
CO2	Use the concept of vector spaces to predict an orthonormal basis
CO3	Orthonormalize a set of vectors in an inner product space using Gram-Schmidt orthogonalisation and decompose a given matrix using QR decomposition
CO4	Solve the problems of linear transformations using Eigen values and Eigen vectors
CO5	Perform dimensionally reduction on the given data using Singular value decomposition and Principal component analysis

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	1	-	-	-	-	1	2	2	-
CO2	3	2	1	1	-	1	-	-	-	-	1	2	2	-
CO3	3	2	1	1	-	1	-	-	-	-	1	2	2	-
CO4	3	2	2	1	-	1	-	-	-	-	1	2	2	-
CO5	3	2	2	1	-	1	-	-	-	-	1	2	2	-
CO (Avg)	3	2	1.4	1	-	1	-	-	-	-	1	2	2	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

	REVIEW	
Introduction to Matrices and Determinants - Solution of system of linear equations by Cramer's rule - Inverse of a Matrix (using determinant)		
UNIT I	**MATRICES**	**9+3**
Vectors and Linear combinations - Rank of a matrix - Solution of system of linear equations by Gaussian Elimination, Gauss Jordan and LU Decomposition methods.		
UNIT II	**VECTOR SPACE**	**9+3**
Vector Space: Linear combination – Linear independence – Basis – Dimension - Simple problems		
UNIT III	**INNER PRODUCT SPACE**	**9+3**
Innerproduct – Norm – Angle - Orthogonality: Definition and simple problems - Projections – Gram-Schmidt orthogonalization and QR decomposition (theorems not included).		
UNIT IV	**EIGENVALUE PROBLEMS**	**9+3**
Linear transformations – Range, Kernel and problems - Eigenvalues and Eigenvectors - Hermitian and Unitary matrices (simple problems).		
UNIT V	**PRINCIPAL COMPONENT ANALYSIS**	**9+3**
Positive definite matrices – Cayley-Hamilton theorem - Singular value decomposition and Principal component analysis using the covariance method - Introduction to their applications in Image Processing and Machine Learning (problems not included).		

Text Book (s)

1	B.S.Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publication, Delhi, 2017.
2	Howard Anton, Chris Rorres, Elementary Linear Algebra – Applications version, Ninth Edition, John Wiley & Sons, 2005.

Reference (s)

1	Michael. D. Greenberg, Advanced Engineering Mathematics,Second Edition, Pearson Education, 2002.
2	Gilbert Strang,Introduction to Linear Algebra, 5th Edition, Wellesley Publishers, 2016.
3	R. C. Gonzalez & R. E. Woods, Digital Image Processing, 4th Edition, Pearson Education, 2018.
4	https://machinelearningmastery.com/introduction-matrices-machine-learning/

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Regulation 2018		Semester II	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
B	18MAB106J	STATISTICAL METHODS	3	0	2	4

Prerequisite Course (s)

CALCULUS, STATISTICS AND PROBABILITY

Course Objective (s):
The purpose of learning this course is to:

1	Have a well – founded knowledge of statistical techniques and methods of estimation
2	Gain the knowledge on test of hypothesis and how they relate to engineering applications
3	Know the fundamental concepts of Non parametric inference
4	Understand the basic concepts of design of experiments and linear statistical models
5	Understand how to use statistical models in forecasting
6	Develop the skills in writing programme language using R

Course Outcome (s) (COs):
At the end of this course, learners will be able to:

CO1	Apply the concept of sampling distribution and estimation theory in forecasting
CO2	Identify the right test statistic to test the hypothesis formulated from the given data
CO3	Use the appropriate non parametric hypothesis testing procedures based on inferences
CO4	Apply the concepts of correlation, regression using R Programming and design experiments
CO5	Develop the model for the given time series and estimate the required forecasting
CO6	Explore the features of R language to implement statistical tests for the given data

CO-PO Mapping

COs	Pos												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	2	1	-	-	-	-	2	2	2	-
CO2	3	3	3	3	2	1	-	-	-	-	2	2	3	-
CO3	3	3	2	3	2	1	-	-	-	-	2	2	3	-
CO4	3	3	2	3	2	1	-	-	-	-	2	2	3	-
CO5	3	3	3	3	2	1	-	-	-	-	2	2	3	-
CO6	3	3	-	3	-	1	-	-	-	-	2	2	3	-
CO (Avg)	3	3	2.4	3	2	1	-	-	-	-	2	2	2.8	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	SAMPLING TECHNIQUES AND ESTIMATION THEORY	9

Random sampling – Sampling from finite and infinite populations – Estimates and standard error (sampling with replacement and sampling without replacement) – Sampling distribution of sample mean – Stratified random sampling. Estimation: Point estimation – Criteria for good estimates (unbiasedness, consistency) – Methods of estimation including maximum likelihood estimation. Sufficient Statistic: Concept and examples – Complete sufficiency, their application in estimation – Central limit theorem (Excluding proof).

UNIT II	TESTING OF HYPOTHESIS	9

Concept and formulation – Type I and Type II errors – Procedures of Testing: Large Samples: Tests for single mean, difference of means and single proportion - Small samples – Student's t test: Tests for single mean and difference of means - F test: Test for equality of variances - Chi-Square test: Tests for Goodness of fit and Independence of attributes.

UNIT III	NON PARAMETRIC INFERENCE	9

Comparison with parametric inference – Use of order statistics – Sign test – Wilcoxon signed rank test – Mann-Whitney test – Run test – Kolmogorov-Smirnov test – Spearman's and Kendall's test – Tolerance region (Simple problems only).

UNIT IV	DESIGN OF EXPERIMENTS AND LINEAR STATISTICAL MODELS	9

Analysis of variance: Completely Randomized Design – Randomized Block Design. Simple Linear regression and correlation –Least Squares method – Rank correlation.

UNIT V	BASICS OF TIME SERIES ANALYSIS AND FORECASTING	9

Stationary – ARIMA Models: Least Square method and maximum likelihood Identification – Estimation – Forecasting.

R STATISTICAL PROGRAMMING LANGUAGE: LIST OF EXPERIMENTS	15

1. Introduction to R, Functions, Control flow and Loops
2. Working with Vectors and Matrices
3. Reading in and Writing Data
4. Working with Data
5. Manipulating Data
6. Simulation
7. Linear Model
8. Data Frame
9. Graphics in R

FOR FURTHER READING:

Multiple regression and multiple correlation, Neyman Pearson lemma, Procedures of Testing: Large samples – Variance.

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Text Book (s)	
1	Douglas C. Montgomery, George C. Runger, Applied Statistics and Probability for Engineers, Third Edition, John Wiley & Sons, 2003.
2	Chris Chatfield, The Analysis of Time Series: An Introduction, 6th Edition, Chapman and Hall/CRC, 2003.
3	Garrett Grolemund, Hands-on Programming with R, 1st Edition, O'Reilly, 2014.
Reference (s)	
1	D.C.Montgomery & E.A.Peck & G.G.Vining, Introduction to Linear Regression Analysis, 5th Edition, Wiley, 2012.
2	A.M.Mood, F.A.Graybill & D.C.Boes, Introduction to the Theory of Statistics, 3rd Edition, McGraw Hill, 2001.
3	N.Draper & H.Smith, Applied Regression Analysis, 3rd Edition, Wiley, 1998.
4	Jared P.Lander, R for Everyone: Advanced Analytics and Graphics, 2nd Edition, Addison-Wesley Professional, 2017.

Regulation 2018		Semester II	Total Hours			45
			Hours / Week			C
Category	Course Code	Course Name	L	T	P	
B	18ECB101J	PRINCIPLES OF ELECTRONICS	2	0	2	3

Prerequisite Course (s)

Discrete Mathematics
Statistics, Probability and Calculus
Fundamentals of Physics
Principles of Electrical Engineering

Course Objective (s): The purpose of learning this course is to

1	Study the operation of semiconductor diodes and their characteristics.
2	Acquire knowledge about the operation and characteristics of BJT under various configurations.
3	Introduce the structure and terminal characteristics of FET and MOSFET.
4	Understand the concepts of feedback and operational amplifiers with its applications
5	Gain knowledge about digital logic circuits

Course Outcome (s) (COs):

CO1	Demonstrate the characteristics of the diode.
CO2	Analyse the BJT terminal characteristics and its utilization.
CO3	Develop a high degree of familiarity with the FET and MOSFET
CO4	Design suitable amplifiers for any specific applications
CO5	Construct simple digital logic circuits

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	1	-	-	-	-	-	-	-	3	-
CO2	3	3	2	-	1	-	-	-	-	-	-	-	3	-
CO3	3	3	2	-	1	1	-	-	-	1	-	-	3	-
CO4	3	3	2	1	1	1	-	-	-	-	-	-	3	-
CO5	3	3	2	1	1	1	-	-	-	-	-	-	3	-
CO (Avg)	3.00	3.00	2.00	1.00	1.00	0.6	-	-	-	1.00	-	-	3.00	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	SEMICONDUCTORS DIODES AND CIRCUITS	6

Semiconductors: Crystalline material: Mechanical properties, Energy band theory, Fermi levels; Conductors, Semiconductors & Insulators: electrical properties, band diagrams. Semiconductors: intrinsic & extrinsic, energy band diagram, P&N-type semiconductors, drift & diffusion carriers **Diodes and Diode Circuits:** Formation of P-N junction, energy band diagram, built-in-potential, forward and reverse biased P-N junction, formation of depletion zone, V-I characteristics, Zener breakdown, Avalanche breakdown and its reverse characteristics; Junction capacitance and Varactor diode. Simple diode circuits, load line, linear piecewise model; Rectifier circuits: half wave, full wave, PIV, DC voltage and current, ripple factor, efficiency, idea of regulation.

UNIT II	BIPOLAR JUNCTION TRANSISTORS	6

Formation of PNP / NPN junctions, transistor mechanism and principle of transistors, CE, CB, CC configuration, transistor characteristics: cut-off active and saturation mode, transistor action, injection efficiency, base transport factor. Biasing and Bias stability: calculation of stability factor.

UNIT III	FIELD EFFECT TRANSISTORS	6

Concept of Field Effect Transistors (channel width modulation), Gate isolation types, JFET Structure and characteristics, MOSFET Structure and characteristics, depletion and enhancement type; CS, CG, CD configurations

UNIT IV	FEED BACK AMPLIFIER AND OPERATIONAL AMPLIFIERS	6

Concept (Block diagram), properties, positive and negative feedback, loop gain, open loop gain, feedback factors; topologies of feedback amplifier; effect of feedback on gain, output impedance, input impedance, sensitivities (qualitative), bandwidth stability; effect of positive feedback: instability and oscillation, condition of oscillation, Barkhausen criteria. Introduction to integrated circuits, operational amplifier and its terminal properties.

UNIT V	DIGITAL ELECTRONICS FUNDAMENTALS	6

Difference between analog and digital signals, Logic ICs, half and full adder/subtractor, multiplexers, demultiplexers.

CASE STUDY

Bipolar Junction Transistors: Energy band diagram, current amplification factors for CB and CE modes

Field Effect Transistors: CMOS: Basic Principles

Feed Back Amplifier, Oscillators and Operational Amplifiers: Application of operational amplifier; inverting and non-inverting mode of operation, Adders, Subtractors, Constant-gain multiplier, Voltage follower, Comparator, Integrator, Differentiator.

Digital Electronics Fundamentals: Flip-flops, Shift registers, Counters

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LIST OF EXPERIMENTS	15

1. Characteristics of PN junction diode and Zener diode.
2. Design of DC voltage regulator using zener diode.
3. Design of Rectifier with and without filter.
4. Characteristics of BJT, FET.
5. Design of CE amplifier.
6. Study of OP-AMP circuits: Inverting and Non-inverting Amplifier.
7. Implementation of basic logic functions using combinational circuits.

Text Book(s)

1	Adel S. Sedra and Kenneth C. Smith, "Microelectronic Circuits: Theory and Application", 7th Edition, Oxford University Press, 2017.
2	Jacob millman, Christos halkias, Chetan parikh,"Millman's Integrated Electronics "McGraw Hill education (India) Private Limited,2010
3	M. Morris Mano, "Digital Logic & Computer Design", Pearson India Education Services, 2016.

Reference(s)

1	Robert L. Boylestad, Louis Nashelsky. "Electronic Devices and Circuit Theory", 8th Edition, Pearson Education Limited, 2002.
2	Ben Streetman, Sanjay Banerjee ,"Solid State Electronic Devices", 6th Edition, 2002.
3	Albert Paul Malvino and David J.Bates,"Electronic Principle",7th Edition, Tata McGraw-Hill, 2008.
4	D Schilling, C Belove, T Apelewicz, R Saccardi , "Electronics Circuits: Discrete & Integrated", 3rd Edition, Tata McGraw- Hill, 2008.
5	Jacob Millman and Arvin Grabel, "Microelectronics", 2nd Edition, Tata McGraw- Hill, 2009.
6	S. Salivahanan, N. Suresh Kumar and A.Vallavaraj, " Electronics Devices & Circuits",2nd Edition,Tata McGraw- Hill,2007
7	Robert L. Boylestad and Louis Nashelsky, "Electronic Devices & Circuit Theory", 10thEdition, Pearson Education Limited, 2009.

Regulation 2018		Semester II	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18CBC101J	DATA STRUCTURES & ALGORITHMS	3	0	2	4

Prerequisite Course (s)

Programming in C

Course Objective (s):

The purpose of learning this course is to:

1	Know various operations on the data structures, and algorithm complexities.
2	Study about linear data structures and its operations.
3	Learn about tree data structures and apply it for various applications
4	Know about graph data structures and apply it for solving different applications
5	Understand various searching, sorting and hashing techniques.

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Understand various operations on the data structures with time and space complexity analysis of an algorithm.
CO2	Describe the concept of linear data structures like array, linked list, stack, queue and its applications.
CO3	Apply the concept of tree data structures for various applications.
CO4	Understand and apply the concept of graph data structures for complex applications.
CO5	Explain about the computations of various searching, sorting and hashing techniques.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	1	2	1	-	-	-	2	3	1	3	-
CO2	3	2	1	1	1	1	-	-	1	2	3	2	2	1
CO3	3	3	2	2	2	2	2	-	1	2	3	2	2	1
CO4	3	3	2	2	2	2	2	-	1	2	3	2	2	1
CO5	3	2	1	1	1	-	-	-	1	2	2	2	2	1
CO (Avg)	3	2.6	1.8	1.4	1.6	1.2	0.4	-	0.4	2	2.8	1.8	1.2	0.8

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	BASIC TERMINOLOGIES AND INTRODUCTION TO ALGORITHM	9

Algorithm specification, Recursion, Performance analysis, Asymptotic Notation - The Big-O, Omega and Theta notation, Programming Style, Refinement of Coding - Time-Space Trade Off, Testing, Data Abstraction.

UNIT II	LINEAR DATA STRUCTURE	9

Array, Stack, Queue, Linked-list and its types, Various Representations, Operations and Applications of Linear Data Structures.

UNIT III	NON-LINEAR DATA STRUCTURE - TREES	9

Trees, Binary Tree, Threaded Binary Tree, Binary Search Tree, B & B+ Tree, AVL Tree, Splay Tree.

UNIT IV	NON-LINEAR DATA STRUCTURE - GRAPHS	9

Graphs - Various Representations, Directed, Undirected GraphOperations, Breadth First search, Depth First Search, Minimum Spanning Tree, Prims and Kruskals Algorithm, complexity analysis, Applications of Non-linear Data Structures.

UNIT V	SEARCHING, SORTING AND HASHING	9

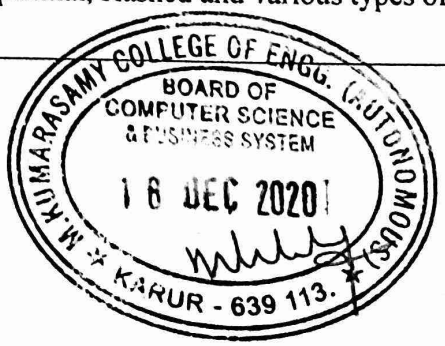
Sequential Search, Binary Search, Insertion Sort, Selection Sort, Shell Sort, Divide and Conquer Sort, Merge Sort, Quick Sort, Heap Sort, Introduction to Hashing.

LIST OF EXPERIMENTS	15

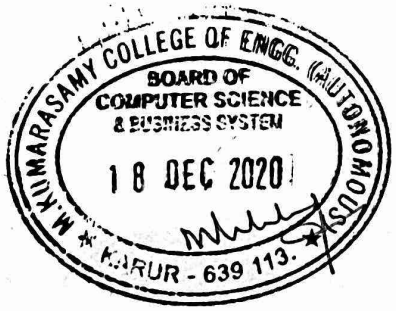
1. Towers of Hanoi using user defined stacks.
2. Reading, writing, and addition of polynomials.
3. Line editors with line count, word count showing on the screen.
4. Trees with all operations.
5. All graph algorithms.
6. Saving / retrieving non-linear data structure in/from a file.
7. Linear and Binary Search algorithms.
8. Selection, Insertion, Merge, Quick Sort

Contents for Further Reading

Definition, File Organization: Sequential, Direct, Indexed Sequential, Hashed and various types of accessing schemes.



Text Book (s)	
1	E. Horowitz and S. Sahni, Fundamentals of Data Structures,Second Edition,Universities Press, 2008.
2	V. Aho, J.E. Hopcroft and J. D. Ullman, "Data Structures and Algorithms", 1st Edition,Pearson India, 2002.
Reference (s)	
1	Donald E. Knuth, "The Art of Computer Programming: Volume 1: Fundamental Algorithms", 3rd edition, Addison Wesley,2008.
2	Thomas, H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", 3rd edition, MIT Press, 2010
3	Pat Morin, "Open Data Structures: An Introduction (Open Paths to Enriched Learning)", 31st ed. Edition, UBC Press, 2013.



Regulation 2018		Semester II	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
S	18MBS101T	FUNDAMENTALS OF ECONOMICS	2	0	0	2

Prerequisite Course (s)

Nil

Course Objective (s):
The purpose of learning this course is to:

1	Familiarize the students with the basic concept of microeconomics.
2	Make student understand the demand and supply analysis in business applications.
3	Familiarize students with the production and cost structure under different stages of production.
4	Understand the pricing and output decisions under various market structures.
5	Help students understand and apply the various decision tools to understand the market structure.

Course Outcome (s) (COs):
At the end of this course, learners will be able to:

CO1	Explain about principles of Demand and Supply.
CO2	Describe and explain about Consumer Behavior.
CO3	Gain knowledge on the Theory of Production.
CO4	Understands the concept of National Income and its Components.
CO5	Understands about the Monetary and Fiscal Policy.

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	-	-	-	-	-	-	-	-	1	1	1	1	-
CO2	-	-	-	-	-	-	1	-	-	-	1	1	-	-	-
CO3	-	-	-	-	-	-	1	-	-	-	-	-	-	1	-
CO4	-	-	-	-	-	-	-	-	-	-	1	1	-	1	-
CO5	-	-	-	-	-	-	-	-	-	-	1	1	-	1	-
CO (Avg)	1	1	-	-	-	-	1	-	-	-	1	1	-	1	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	MICROECONOMICS - PRINCIPLES OF DEMAND AND SUPPLY	6
Principles of Demand and Supply - Supply Curves of Firms - Elasticity of Supply - Demand Curves of Households - Elasticity of Demand - Equilibrium and Comparative Statics (Shift of a Curve and Movement along the Curve) - Welfare Analysis - Consumers' and Producers' Surplus - Price Ceilings and Price Floors.		
UNIT II	**MICROECONOMICS - CONSUMER BEHAVIOUR**	**6**
Consumer Behavior - Axioms of Choice - Budget Constraints and Indifference Curves - Consumer's Equilibrium - Effects of a Price Change, Income and Substitution Effects -Derivation of a Demand Curve - Applications - Tax and Subsidies – Intertemporal Consumption - Suppliers' Income Effect.		
UNIT III	**MICROECONOMICS - THEORY OF PRODUCTION**	**6**
Theory of Production - Production Function and Iso - quants - Cost Minimization - Cost Curves - Total, Average and Marginal Costs - Long Run and Short Run Costs - Equilibrium of a Firm Under Perfect Competition - Monopoly and Monopolistic Competition		
UNIT IV	**MACROECONOMICS - NATIONAL INCOME**	**6**
National Income and its Components - GNP, NNP, GDP, NDP - Consumption Function – Investment - Simple Keynesian Model of Income Determination and the Keynesian Multiplier - Government Sector - Taxes and Subsidies - External Sector - Exports and Imports		
UNIT V	**MACROECONOMICS - MONEY**	**6**
Money – Definitions - Demand for Money -Transactionary and Speculative Demand - Supply of Money - Bank's Credit Creation Multiplier - Integrating Money and Commodity Markets - IS, LM Model - Business Cycles and Stabilization - Monetary and Fiscal Policy - Central Bank and the Government - The Classical Paradigm - Price and Wage Rigidities - Voluntary and Involuntary Unemployment.		

Text Book (s)	
1	Pindyck, Robert S., and Daniel L. Rubinfeld, Microeconomics, Eighth Edition ,Pearson.
2	Macroeconomics, by Rudiger Dornbusch, ,StanleyFischer and Startz 12th Edition Sep 7 2017.
3	Economics, Paul Anthony Samuelson, William D. Nordhaus. 19th Edition 2018
Reference (s)	
1	Intermediate Microeconomics: A Modern Approach, Hal R, Varian 9th Edition 2014. W.W.Norton Company.
2	Principles of Macroeconomics, N. Gregory Mankiw 9th Edition.

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Regulation 2018		Semester II	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
H	18CBH102J	BUSINESS COMMUNICATION & VALUE SCIENCE – II	2	0	2	3

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

CLR-1	Develop effective writing, reading, presentation and group discussion skills
CLR-2	Introduce the organizational concepts and theory dedicated to a social cause.
CLR-3	Help students identify personality traits and evolve as a better team player.
CLR-4	Introduce them to key concepts of a) Morality b) Behavior and beliefs c) Diversity &Inclusion
CLR-5	Motivate students to adopt social activities.

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Understand and use tools of structured written communication
CO2	Develop materials to create an identity for an organization dedicated to a social cause
CO3	Identify individual personality types and role in a team.
CO4	Understand the basic concepts of Morality and Diversity
CO5	Organize an event to generate awareness and get support for a cause

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	2	-	1	1	-	3	3	-	3	-	2
CO2	-	-	2	-	-	2	2	2	3	1	-	3	-	2
CO3	-	1	1	-	-	1	1	1	3	3	3	3	-	2
CO4	-	1	1	-	-	2	2	2	3	2	2	3	-	2
CO5	-	-	1	-	-	2	1	-	3	2	3	3	-	2
CO (Avg)	-	1	1.33	2	-	1.6	1.4	1.66			2.66	3	-	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	LAUNCHING E MAGAZINE	6

Writing: Good and bad writing - Common errors, punctuation rules, use of words - writing techniques of Catherine Morris and Joanie McMahon's – Creating and launching E-magazine. **Speaking:** Icebreaker - Participating in 'Join Hands Movement' - Individual identification of social issues – addressing social issues - **Reading:** Sharing the learning points from GD – SATORI –Report writing on Discussion.

UNIT II	FORMULATING AN ORGANIZATIONAL STRUCTURE	6

Each group forming an NGO - create vision, mission, value statement, and tagline and design a logo. Introduction to basic presentation skills & ORAI app - Groups to present their NGOs – Presentation recording and sharing the findings from recording. **Writing:** individual write up for E- magazine and evaluation - preparation and publication of second episode of E Magazine. Speed Reading session: Introduction to skimming and scanning; SATORI – Join the dots

UNIT III	TEAM PLAY	6

Ad campaign - Brain storming session - discussing and exploring the means of articulating and amplifying the social issue their NGOs are working for - Designing skits: write the script articulating the message of their respective NGOs - Promote the play through a social media and gather audience - Enact the play - reviews. Group Activity: Prepare and publish the third episode of the E Magazine. Berbin's 8 Team roles and Lindgren's big 5 personality traits – SATORI joining dots.

UNIT IV	DIVERSITY AND INCLUSION	6

Learn from movies - film on diversity – discussion on key take away of the film - Theory to connect and concept of empathy. Create story – Group activity – a person's life affected by the social issue – narration of story in first person - Feedbacks by other groups. Research on a book, incident or film based on the topic of your respective NGO - Write a review in a blog on the topics they are covering in their research. Diversity & Inclusion - Different forms of Diversity in our society - Debate on diversity with an angle of ethics, morality and respect for individual. Prepared speech - Every student will narrate the challenges faced by a member of a diverse group. Video recording interviews of people from diverse groups with 5 questions. Touch the target, film: 'The Fish and I' by BabakHabibifar. Discussion on TCS values, Respect for Individual and Integrity. Preparation of final episode of the E Magazine. Revisit your resume: Include your recent achievements in your resume. SATORI .

UNIT V	ORGANIZING AWARENESS CAMPAIGN	6

Project- 1) Each team to look for an NGO/ social group in the city which is working on the issue their college group is supporting. 2) Spend **a day with the NGO/ social group** to understand exactly how they work and the challenges they face. 3) Render voluntary service to the group for one day 4) Invite the NGO/ social group to address their university students for couple of hours. Plan the entire event, decide a suitable venue in the university, gather audience, invite faculty members etc. (they need to get their plan ratified their professor). Outcome-- Host an interactive session with the NGO spokesperson 5) The groups to present their experience of **a day with the NGO** and inspire students to work for the cause.

LAB ACTIVITIES	15
1. Group Discussion 2. Create the magazine 3. Launching an E Magazine 4. Prepare and Publish the Second Episode of the E Magazine 5. Enact and Read out the Script of a Skit 6. Promote the Play in Social Media 7. Presentation 8. Prepare and Publish the Third Episode of the E Magazine 9. Narrating a Story 10. Writing a Review in a Blog 11. Debate 12. Giving Persuasive Speech 13. A day with NGO and Share the Experience	

Text Book (s)

There are no prescribed texts for semester 2 - there will be handouts and reference links shared

Reference (s)

1	Abundance: The Future is Better Than You Think; Peter H. Diamandis and Steven Kotler; Published: 21 Feb, 2012; Publisher: Free Press
2	Advertising & IMC: Principles and Practice; Sandra Moriarty, Nancy D. Mitchell, William D. Wells; Published: 15 June 2016; Publisher: Pearson Education India
3	Forge Your Future: Candid, Forthright, Inspiring ; Dr. A.P.J Abdul Kalam; Publishing year: 2014
4	Guiding Souls : Dialogues on the purpose of life; Dr. A.P.J Abdul Kalam ;Publishing Year-2005; Co-author--Arun Tiwari
5	Start With Why: How Great Leaders Inspire Everyone to Take Action; Simon Sinek; Published: 6 October 2011; Publisher: Penguin
6	The Family and the Nation; Dr. A.P.J Abdul Kalam; Publishing year: 2015; Co-author: Acharya Mahapragya
7	The Scientific India: A twenty First Century Guide to the World around Us; Dr. A.P.J Abdul Kalam; Publishing year: 2011; Co-author- Y.S.Rajan

Web References	
1	ETHICS FUNDAMENTALS AND APPROACHES TO ETHICS https://www.eolss.net/Sample-Chapters/C14/E1-37-01-00.pdf
2	A Framework for Making Ethical Decisions https://www.brown.edu/academics/science-and-technology-studies/framework-making-ethical-decisions
3	Five Basic Approaches to Ethical Decision http://faculty.winthrop.edu/meelerd/docs/rolos/5_Ethical_Approaches.pdf
Online References	
1	https://youtu.be/CsaTslhSDI
2	https://m.youtube.com/watch?feature=youtu.be&v=IIKvV8_T95M
3	https://m.youtube.com/watch?feature=youtu.be&v=e80BbX05D7Y
4	https://m.youtube.com/watch?v=dT_D68RJ5T8&feature=youtu.be
5	https://m.youtube.com/watch?v=7sLLEdBgYYY&feature=youtu.be

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Regulation 2018		Semester II	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	18LEM102T	VALUE EDUCATION	1	0	0	-

Prerequisite Course (s)

NIL

Course Objective (s):
The purpose of learning this course is to:

CLR-1	Connect the learners to their potential, identify their potential to create a new positive world
CLR-2	Analyze the merits and demerits of different educational systems. Identify the different systems of education
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

Course Outcome (s) (COs):
At the end of this course, learners will be able to:

CO1	Equipped with an awareness of their positive energy and power
CO2	Identify the meaning of 'education'; have a clear and better understanding in taking education crowd/people.
CO3	Assess their weaknesses; understand risks involved and rectify them through learning from positive and negative instances
CO4	Realize their professional responsibilities
CO5	Acquire the required values in an expanding pluralistic world not be swept off their feet due to the rapid changes

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	-	-	2	3	-	3	3	3	-	3	1	-
CO2	2	3	2	-	3	3	2	2	3	3	-	3	1	-
CO3	2	-	-	-	2	3	2	2	3	3	-	3	1	-
CO4	2	2	-	-	3	3	3	3	3	3	-	3	1	-
CO5	2	-	-	-	3	3	3	3	3	3	-	3	1	-
CO (Avg)	2.00	2.33	2.00	-	2.6	3	2.5	2.6	3	3	-	3	1	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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

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18 DEC 2020

Text Book (s)	
Nil	
Reference (s)	
1	Kalam, APJ Abdul. Wings of Fire: AN Autobiography of APJ Abdul Kalam. Ed. Sangam Books Ltd., 1999
2	"Banaras Hindu University Speech" and "To Students". The Voice of Truth. 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 challenges from skills to water scarcity"

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Regulation 2018		Semester II	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	18GNM101L	PHYSICAL & MENTAL HEALTH USING YOGA	0	0	2	Nil

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

CLR-1	Provide Deeper insight into the curriculum of Yogic Sciences along with practical applications of Yoga
CLR-2	Intend that students should get familiar with the poses if Yogasanam.
CLR-3	Promote positive health in the Student through Yoga and enabling and imparting skill in them to practice and apply Yogic
CLR-4	Practice for Health to general public and teach Yoga for Total personality development and spiritual evolution.

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Increase the muscle strength
CO2	Improve respiration, energy and vitality.
CO3	Maintain a balanced metabolism and weight reduction.
CO4	Maintain cardio and circulatory health.
CO5	Improve athletic performance and protection from injury.

CO-PO Mapping

COs	Pos												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	1	-	-	-	-	-	2	-	-
CO2	-	-	-	-	-	1	-	-	-	-	-	2	-	-
CO3	-	-	-	-	-	1	-	-	-	-	-	2	-	-
CO4	-	-	-	-	-	1	-	-	-	-	-	2	-	-
CO5	-	-	-	-	-	1	-	-	-	-	-	2	-	-
CO (Avg)	-	-	-	-	-	1	-	-	-	-	-	2	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

	Introduction	**6**

- Human Body – Meaning and its Importance in Yoga
- Definition of Anatomy and Physiology
- Cell: Structure & Function

	General Information, Different parts, Structure, Function and Effect of Yogic Practices.	**24**

- Tissues: Types, Structure & Function
- Musculo-Skeletal System
- Digestive System
- Excretory System
- Respiratory System
- Circulatory System
- Nervous System
- Endocrinal System

Text/ Reference (s) Books

1	Shirley Telles – A Glimpse of the Human Body The structure and Functions, Swami Vivekananda Yoga Prakashana, Bangalore.
2	Makarand Madhukar Gore – Anatomy and Physiology of Yogic Practices, motilal Banarsidass, New Delhi, 2007.
3	Anne Waugh, Allison Grant – Iross and Wilson Anatomy and Physiology in Health & Illness, Churchill Livingstone; 2010.

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Regulation 2018		Semester III	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18CBC201T	FORMAL LANGUAGE AND AUTOMATA THEORY	3	1	0	4

Prerequisite Course (s)

Basics of Discrete Mathematics- Sets and Relations

Course Objective (s):
The purpose of learning this course is to:

1	Know the fundamental concepts of formal language and expressions.
2	Understand the relation between regular expression and finite automata.
3	Learn the languages for pushdown automata for recognizing a language.
4	Know the concept of linear bound automata, Turing machine and their computational capability.
5	Understand the basics of undecidable problems and complexity theory.

Course Outcome (s) (COs):
At the end of this course, learners will be able to:

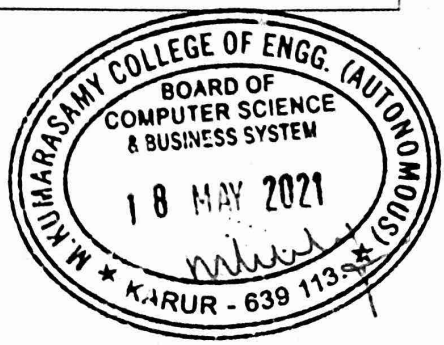
CO1	Explain the concepts in formal language and automata theory.
CO2	Explain regular expression and its equivalence with finite automata.
CO3	Utilize the push down automata to recognize a given language.
CO4	Explain the capability of linear bound automata and Turing machine in solving a recursive problem.
CO5	Elucidate the undecidablity of various problems and concepts of complexity theory.

CO-PO Mapping

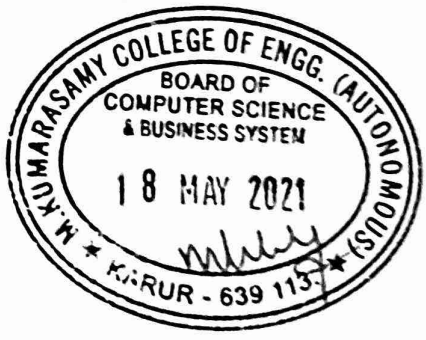
COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	1	-	-	-	-	-	-	-	2	-
CO2	3	2	2	1	1	-	-	-	-	-	2	2	2	-
CO3	3	2	2	1	1	-	-	-	-	-	-	-	2	-
CO4	3	2	2	1	1	-	-	-	-	-	-	-	2	-
CO5	3	2	1	1	1	-	-	-	-	-	-	-	2	-
CO (Avg)	3	2	1.8	1	1	-	-	-	-	-	0.4	0.4	2	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	INTRODUCTION TO FINITE AUTOMATA	9 + 3
Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages, deterministic finite automata (DFA), nondeterministic finite automata (NFA) and equivalence with DFA, Finite Automata with Epsilon Transitions.		
UNIT II	**REGULAR EXPRESSIONS AND LANGUAGES**	**9 + 3**
Regular expressions and languages, finite automata and equivalence with regular expressions, regular grammars and equivalence with finite automata, properties of regular languages, Kleene's theorem, pumping lemma for regular languages, Myhill-Nerode theorem and its uses, minimization of finite automata.		
UNIT III	**CONTEXT-FREE LANGUAGES, PUSHDOWN AUTOMATA,**	**9 + 3**
Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic pushdown automata, closure properties of CFLs.		
UNIT IV	**LINEAR BOUNDED AUTOMATA AND TURING MACHINES**	**9 + 3**
Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG. The basic model for Turing machines (TM), Turing recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, Nondeterministic TMs and equivalence with deterministic TMs.		
UNIT V	**UNDECIDABILITY**	**9 + 3**
Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice s theorem, undecidable problems about languages, P and NP, NP- completeness		
Contents for Further Reading		
Unrestricted grammars and equivalence with Turing machines, TMs as enumerators. **Basic Introduction to Complexity:** Introductory ideas on Time complexity of deterministic and nondeterministic Turing machines, Cook's Theorem, other NP -Complete problems.		



Text Book (s)	
1	John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, "Introduction to Automata Theory, Languages and Computation", Third Edition, Pearson Education, 2009.
2	Peter Linz, "An Introduction to formal Languages and Automata", 6th Edition, Jones & Bartlett Pub, 2016.
Reference (s)	
1	John C.Martin, "Introduction to Languages and the Theory of Computation", Fourth Edition, McGraw Hill Education, 2010.
2	Harry R.Lewis, Christos U.Papadimitriou, Elements of the Theory of Computation, Prentice Hall India Learning Private Limited; Second edition, 2002.
Web Resource (s)	
1	http://gaia.cs.umass.edu/ntu_socket
2	http://www.cs.bilgi.edu.tr/~mgencer/coursemat/NP-LectureNotes.pdf
3	www.jflap.org/
4	automatonsimulator.com/
5	http://www.jflap.org/tutorial/grammar/bruteforceCFG/index.html
6	https://turingmachinesimulator.com/
7	http://weitz.de/pump/
8	https://nptel.ac.in/courses/106104028/
9	https://nptel.ac.in/courses/106103070/



Regulation 2018		Semester III	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18CBC202T	COMPUTER ORGANIZATION & ARCHITECTURE	3	0	0	3

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

1	Recognize the basic structure of a digital computer and representation of non-numeric data.
2	Learn different arithmetic operations and organization of control unit.
3	Study memory organization, different ways of communication with I/O devices and parallel processors.
4	Understand the concept of pipelining and its impact in processor design.
5	Learn the hierarchical memory system.

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Discuss the functionalities of various blocks of a digital computer and express the data representation.
CO2	Illustrate the logic design of Arithmetic and control Unit.
CO3	Infer the concepts of memory system, concurrence access in parallel processors and classify the approaches for I/O communication.
CO4	Distinguish hazards in pipelining and outline its impact in the performance of the processors.
CO5	Determine the performance of different types of memory.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	1	-	-	-	-	-	-	-	2	-
CO2	3	2	3	1	2	-	-	-	-	-	-	-	2	-
CO3	3	2	2	1	3	-	-	-	-	-	-	-	3	-
CO4	3	1	2	1	2	-	-	-	-	-	-	-	3	-
CO5	3	1	2	1	2	-	-	-	-	-	-	-	3	-
CO (Avg)	3	1.6	2.2	1	2	-	-	-	-	-	-	-	2.6	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	INTRODUCTION TO COMPUTER ARCHITECTURE	9
Functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU: Registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Outlining instruction sets of some common CPUs. Data representation: Signed number representation, fixed and floating-point representations, character representation.		
UNIT II	**COMPUTER ARITHMETIC**	**9**
Integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication – shift-and- add, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic, IEEE 754 format.		
UNIT III	**CONTROL UNIT AND PIPELINING**	**9**
Introduction to x86 architecture. CPU control unit design: Hardwired and micro-programmed design approaches, design of a simple hypothetical CPU. Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards. Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency.		
UNIT IV	**PERIPHERAL DEVICES AND THEIR CHARACTERISTICS**	**9**
Input-output subsystems, I/O device interface, I/O transfers – program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes – role of interrupts in process state transitions, I/O device interfaces – SCII, USB.		
UNIT V	**MEMORY ORGANIZATION AND SYSTEM DESIGN**	**9**
Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies. Memory system design: Semiconductor memory technologies, memory organization.		

Text Book (s)

1	Morris Mano, "Computer System Architecture" 3rd Edition, Prentice Hall of India, New Delhi, 2014.

Reference (s)

1	David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software Interface", Elsevier, 5th Edition 2013.
2	Carl Hamacher, Zvonko Vranesic, SafwatZaky, Naraig Manjikian, "Computer Organization and Embedded Systems" McGraw-Hill, 6th Edition 2014.
3	John P. Hayes, Computer Architecture and Organization, McGraw-Hill ,3rd Edition,2013.
4	William Stallings, "Computer Organization and Architecture – Designing for Performance", 10th Edition, Pearson Education, 2015.
5	Vincent P. Heuring and Harry F. Jordan," Computer System Design and Architecture", Prentice Hall, 2 nd Edition, 2004.

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Regulation 2018		Semester III	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18CBC203T	OBJECT ORIENTED PROGRAMMING	3	0	0	3

Prerequisite Course (s)

NIL

Course Objective (s):
The purpose of learning this course is to:

1	To explain the difference between object oriented programming and procedural programming.
2	To build C++ classes using appropriate encapsulation and design principles.
3	To introduce advanced C++ features such as composition of objects, operator overloads, dynamic memory allocation, inheritance and polymorphism, file I/O, exception handling, etc.
4	To apply object oriented concepts to solve bigger computing problems.
5	Develop C++ applications using OOP concepts, files, templates and exceptions.

Course Outcome (s) (COs):
At the end of this course, learners will be able to:

CO1	Understand the concepts and relative merits of C++.
CO2	Implement programs using object oriented concepts such as encapsulation, inheritance and polymorphism.
CO3	Implement stream I/O, templates and operator overloading.
CO4	Develop applications with concepts of files, templates and exceptions.
CO5	Understand Object Oriented Design and Modeling.

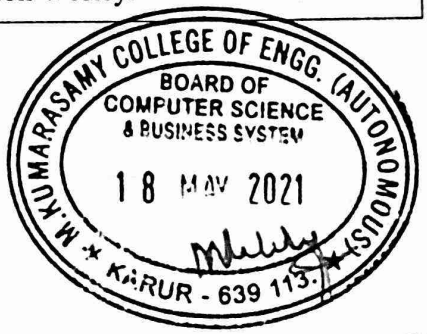
CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	-	-	-	-	-	3	2	3	2
CO2	3	3	3	3	3	-	-	-	-	-	3	2	3	2
CO3	3	3	3	3	3	-	-	-	-	-	3	2	3	2
CO4	3	3	3	3	3	-	-	-	-	-	3	2	2	2
CO5	2	3	3	3	3	-	-	-	-	-	3	2	2	2
CO (Avg)	2.8	3	3	3	3	-	-	-	-	-				

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	PROCEDURAL PROGRAMMING	9
An Overview of C: Types Operator and Expressions, Scope and Lifetime, Constants, Pointers, Arrays, and References, Control Flow, Functions and Program Structure, Namespaces, error handling, Input and Output (*C*-way), Library Functions (*string*, *math*, *stdlib*), Command line arguments, Pre-processor directive - Some difference between C and C++: Single line comments, Local variable declaration within function scope, function declaration, function overloading, stronger type checking, Reference variable, parameter passing – value vs reference, passing pointer by value or reference, Operator new and delete, the typecasting operator,Inline Functions in contrast to macro, default arguments		
UNIT II	**CONCEPTS OF OBJECT ORIENTED PROGRAMMING**	**9**
Necessity for OOP, Data Hiding, Data Abstraction, Encapsulation, Procedural Abstraction, Class and Object - More extensions to C in C++ to provide OOP Facilities: Scope of Class and Scope Resolution Operator, Member Function of a Class, private, protected and public Access Specifier, this Keyword, Constructors and Destructors, friend class, error handling (exception)		
UNIT III	**ESSENTIALS OF OBJECT ORIENTED PROGRAMMING**	**9**
Operator overloading – Inheritance: Single and Multiple, Class Hierarchy, Pointers to Objects, Assignment of an Object to another Object, Polymorphism through dynamic binding, Virtual Functions, Overloading, overriding and hiding, Error Handling		
UNIT IV	**GENERIC PROGRAMMING**	**9**
Template concept, class template, function template, template specialization - Input and Output: Streams, Files, Library functions, formatted output.		
UNIT V	**OBJECT ORIENTED DESIGN AND MODELLING**	**9**
UML concept, Use case for requirement capturing, Class diagram, Activity diagram and Sequence Diagram for design, Corresponding C++ code from design		

Text Book (s)	
1	The C++ Programming Language, Bjarne Stroustrup, Addison Wesley.
2	C++ and Object-Oriented Programming Paradigm, Debasish Jana, PHI Learning Pvt. Ltd.
Reference (s)	
1	Programming – Principles and Practice Using C++, Bjarne Stroustrup, Addison Wesley.
2	The Design and Evolution of C++, Bjarne Stroustrup, Addison Wesley.



Regulation 2018		Semester III	Total Hours			60
			Hours / Week			C
Category	Course Code	Course Name	L	T	P	
B	18CBC204J	COMPUTATIONAL STATISTICS	3	0	2	4

Prerequisite Course (s)

NIL

Course Objective (s):
The purpose of learning this course is to:

1	Understand the fundamental concepts of Python & implementation of Data Visualization.
2	Use the fundamental concepts of computational statistical models and multivariate regression in applications.
3	Understand the basic concepts of Discriminant analysis and Principal component analysis
4	Gain knowledge in the concepts of Factor Analysis.
5	Understand the fundamental concepts of Clustering and Segmentation Analysis.

Course Outcome (s) (COs):
At the end of this course, learners will be able to:

CO1	Utilize the introductory, concepts of Python and Data Visualization techniques in Computational Statistics.
CO2	Understand the basic concepts of Statistical techniques and multivariate regression models.
CO3	Acquire knowledge in the basic concepts of Discriminant analysis and Principal component analysis.
CO4	Have the well founded knowledge in the concepts of factor analysis.
CO5	Implement the Clustering Analysis concept.

CO-PO Mapping

Cos	Pos												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2	-	-	-	-	-	2	1	3	3
CO2	3	3	3	2	2	-	-	-	-	-	2	1	3	1
CO3	3	3	3	2	2	-	-	-	-	-	2	1	3	1
CO4	3	3	3	2	2	-	-	-	-	-	2	1	3	1
CO5	2	3	3	2	2	-	-	1	-	-	2	1	3	1
CO (Avg)	3	3	3	2	2	-	-	1	-	-	2	1	3	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	PYTHON CONCEPTS AND DATA VISUALIZATION	11

Python Concepts, Data Structures, Classes: Interpreter, Program Execution, Statements, Expressions, Flow Controls, Functions, Numeric Types, Sequences and Class Constructors, Text & Binary Files - Reading and Writing. Visualization in Python: Matplotlib package, Plotting Graphs, Controlling Graph, Adding Text, More Graph Types, Getting and setting values, Patches.

UNIT II	MULTIVARIATE NORMAL DISTRIBUTION AND MULTIVARIATE REGRESSION	9

Multivariate Normal Distribution: Multivariate Normal Distribution, Conditional Distribution, Estimation of parameters. Multiple Linear Regression Model: Standard multiple regression models collinearity, outliers, non-normality and autocorrelation, Multivariate Regression: Parameter estimation, Multivariate Analysis of variance and covariance.

UNIT III	DISCRIMINANT ANALYSIS AND PRINCIPAL COMPONENT ANALYSIS	9

Discriminant Analysis: Statistical background, linear discriminant function analysis, Estimating linear discriminant functions and their properties. Principal Component Analysis: Principal components, Algorithm for conducting principal component analysis, H-plot.

UNIT IV	FACTOR ANALYSIS	8

Factor Analysis: Factor analysis model, Extracting common factors, determining number of factors, Transformation of factor analysis solutions, Factor scores.

UNIT V	CLUSTER ANALYSIS	8

Clustering and Segmentation Analysis: Introduction, Types of clustering, Correlations and distances, clustering by partitioning methods, hierarchical clustering, overlapping clustering. K-Means Clustering.

LIST OF EXPERIMENTS	15

1. Basic Python Programs
2. Program using String Operations
3. Program on python Data structures
4. Perform various numpy operations and special functions
5. Draw statistical graphics using seaborn
6. Implement k-means, logistic and time series algorithm using Scikit-learn
7. Multi Variable analysis with regression in python
8. Factor analysis with python
9. Data Aggregation in python
10. Visualization in python using Altair

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Text Book (s)	
1	An Introduction to Multivariate Statistical Analysis. T.W. Anderson, Wiley Series in Probability and Statistics (Third Edition). 2003.
2	Applied Multivariate Data Analysis. Vol I & II. J.D. Jobson. Springer. 1991.
3	Beginning Python: From Novice to Professional. Magnus Lie Hetland. Edition. 2005
Reference (s)	
1	The Foundations of Factor Analysis. A.S. Mulaik. Chapman and Hall/CRC. 2009
2	Introduction to Linear Regression Analysis. D.C. Montgomery and E.A. Peck.
3	Python for Data Analysis. Wes Mc Kinney.
4	Programming Python. Mark Lutz.
5	Python 3 for Absolute Beginners. Tim Hall and J-P Stacey.

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Regulation 2018(R)		Semester III	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18CBC205J (R)	SOFTWARE ENGINEERING	3	0	2	4

Prerequisite course

Nil

Course Objective (s):

The purpose of learning this course is to:

1	Gain knowledge about various phases in software development life cycle.
2	Implement the basic of software requirements, project management and cost estimation.
3	Learn the metrics and models used to estimate the software quality and reliability.
4	Understand the various methodologies in software design using case tools.
5	Analyze various testing strategies used to identify faults and failures in software development.

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO 1	Explain the various phases in a software development life cycle.
CO 2	Elucidate the software requirement specification and cost estimation for a project management.
CO 3	Utilize the metrics and models for estimating the software quality and reliability.
CO 4	Develop software using object oriented case tools for a real time application.
CO 5	Explain various testing techniques used in verification and validation of a software.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	1	-	-	-	-	2	2	1	1	1
CO2	3	3	2	2	1	1	1	2	2	2	2	2	2	1
CO3	3	3	3	2	1	1	1	2	2	2	2	2	2	1
CO4	3	3	3	2	2	1	1	2	2	2	2	2	2	1
CO5	3	3	2	2	2	1	-	2	2	2	2	2	2	1
CO (Avg)	3	2.8	2.2	1.8	1.4	1	1	2	2	2	2	1.8	1.8	1

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

UNIT 1	Introduction	9

Introduction: Programming in the small vs. programming in the large; software project failures and importance of software quality and timely availability; of software engineering towards successful execution of large software projects; emergence of software engineering as a discipline, Software Engineering Historical Development from Jackson Structured Programming to Agile Development.

UNIT 2	Software Project Management and Agile Software Engineering	9

Basic concepts of life cycle models – different models and milestones; software project planning – identification of activities and resources; concepts of feasibility study; techniques for estimation of schedule and effort; software cost estimation models and concepts of software engineering economics; techniques of software project control and reporting; introduction to measurement of software size; introduction to the concepts of risk and its mitigation; configuration management.

Agile Software Engineering: Concepts of Agile Methods, Extreme Programming;Agile Process Model - Scrum, Feature; Scenarios and Stories.

UNIT 3	Software Quality Management and Software Requirements Analysis	9

Software quality; Garvin's quality dimensions, McCall's quality factor, ISO 9126 quality factor; Software Quality Dilemma; Introduction to Capability Maturity Models (CMM and CMMI); Introduction to software reliability, reliability models and estimation.

Software Requirements Introduction to Software Requirements Specifications (SRS) and requirement elicitation techniques; techniques for requirement modelling – decision tables, event tables, state transition tables, Petri nets; requirements documentation through use cases; introduction to UML, introduction to software metrics and metrics-based control methods; measures of code and design quality.

UNIT 4	Object Oriented Analysis, Design and Construction	9

Concepts: The principles of abstraction, modularity, specification, encapsulation and information hiding; concepts of abstract data type; Class Responsibility Collaborator (CRC) model; quality of design; design measurements; concepts of design patterns; Refactoring; object-oriented construction principles; object oriented metrics.

UNIT 5	Software Testing	9

Introduction to faults and failures; basic testing concepts; concepts of verification and validation; black box and white box tests; white box test coverage – code coverage, condition coverage, branch coverage; basic concepts of black-box tests – equivalence classes, boundary value tests, usage of state tables; testing use cases; transaction based testing; testing for non-functional requirements – volume, performance and efficiency; concepts of inspection; Unit Testing, Integration Testing, System Testing and Acceptance Testing.

	Total Periods	45

LIST OF EXPERIMENTS	15

Development of requirement specification, function oriented design using SA/SD, object-oriented design using UML, test case design, implementation using c++ and testing use of appropriate CASE tools and other tools such as configuration management tools, program analysis tools in the software life cycle.

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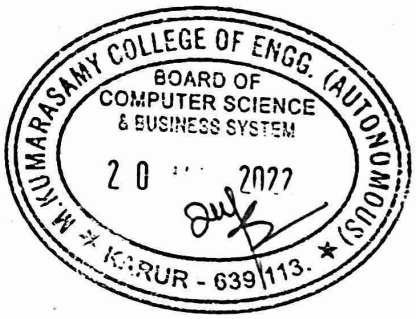
Text Book (s)	
1	Ian Sommerville, Software Engineering,Tenth edition,pearson education,2017
2	Roger S.Pressman and Bruce Maxim, Software Engineering – A Practitioner's Approach, Ninth Edition, Mc Graw-Hill Education,2019
Reference (s)	
1	Ivar Jacobson, Object Oriented Software Engineering: A Use Case Driven Approach,First Edition,2007
2	Shari Lawrence Pfleeger and Joanne M. Atlee, Software Engineering: Theory and Practice, Fourth Edition, Pearson Education India, 2011.
3	D. E. Knuth, "The Art of Computer Programming, Vol. 1, Vol. 2 and Vol. 3", Third Edition, Mathematical Science Publishers, 1997.
4	Michael A. Nielsen and Isaac L. Chuang ,"Quantum Computation and Quantum Information",2006



Regulation 2018		Semester III	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18CBC205J	SOFTWARE ENGINEERING	3	0	2	4

Prerequisite Course (s)

Nil

Course Objective (s):
The purpose of learning this course is to:

1	Gain knowledge about the various phases in a software development life cycle.
2	Understand the basic of software requirements, project management and cost estimation.
3	Learn the metrics and models used to estimate the software quality and reliability.
4	Understand the various methodologies in software design using case tools.
5	Learn various testing strategies used to identify faults and failures in software development.

Course Outcome (s) (COs):
At the end of this course, learners will be able to:

CO1	Explain the various phases in a software development life cycle.
CO2	Elucidate the software requirement specification and cost estimation for a project management.
CO3	Utilize the metrics and models for estimating the software quality and reliability.
CO4	Develop software using object oriented case tools for a real time application.
CO5	Explain various testing techniques used in verification and validation of a software.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	2	1	2	2	2	2	2	2	1
CO2	3	3	2	2	2	1	1	2	2	2	2	2	2	1
CO3	3	3	2	2	2	1	1	2	2	2	2	2	2	1
CO4	3	3	3	2	2	1	1	2	2	2	2	2	2	1
CO5	3	3	2	2	2	1	1	2	2	2	2	2	2	1
CO (Avg)	3	2.8	2.2	2	2	1.2	1	2	2	2	2	2	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	INTRODUCTION	9

Programming in the small vs. programming in the large; software project failures and importance of software quality and timely availability; engineering approach to software development; role of software engineering towards successful execution of large software projects; emergence of software engineering as a discipline, Basic concepts of life cycle models – different models and milestones.

UNIT II	SOFTWARE PROJECT MANAGEMENT AND COST ESTIMATION	9

Software project planning – identification of activities and resources; concepts of feasibility study; techniques for estimation of schedule and effort, Introduction to Software Requirements Specifications (SRS) and requirement elicitation techniques; techniques for requirement modelling – decision tables, event tables, state transition tables, Petri nets, requirements documentation through use cases. Software cost estimation models and concepts of software engineering economics; techniques of software project control and reporting, introduction to measurement of software size; introduction to the concepts of risk and its mitigation; configuration management.

UNIT III	SOFTWARE QUALITY AND RELIABILITY	9

Internal and external qualities; process and product quality; principles to achieve software quality; introduction to different software quality models like McCall, Boehm model. Introduction to software reliability, reliability models and estimation, introduction to software metrics and metrics based control methods, measures of code and design quality.

UNIT IV	OBJECT ORIENTED ANALYSIS, DESIGN AND CONSTRUCTION	9

Introduction to UML, Concepts -- the principles of abstraction, modularity, specification, encapsulation and information hiding; concepts of abstract data type; Class Responsibility Collaborator (CRC) model; quality of design; design measurements; concepts of design patterns; Refactoring; object oriented construction principles, object oriented metrics.

UNIT V	SOFTWARE TESTING	9

Introduction to faults and failures; basic testing concepts; concepts of verification and validation; black box and white box tests; white box test coverage – code coverage, condition coverage, branch coverage; basic concepts of black-box tests – equivalence classes, boundary value tests, usage of state tables; testing use cases; transaction based testing; testing for non-functional requirements – volume, performance and efficiency; concepts of inspection.

Contents for Further Reading

Software quality models like FURPS / FURPS+, Dromey, ISO – 9126; introduction to Capability Maturity Models (CMM and CMMI).

	LIST OF EXPERIMENTS	15

Development of requirements specification, function oriented design using SA/SD, object-oriented design using UML, test case design, implementation using C++ and testing. Use of appropriate CASE tools and other tools such as configuration management tools, program analysis tools in the software life cycle. Develop the software using software engineering methodology and for each experiment prepare the following documents

- Problem Analysis and Project Planning.
- Software Requirement Analysis.

- Data Modelling.
- Software Development and Debugging
- Software Testing.

1. Course Registration System
2. Student marks analysing system
3. Online ticket reservation system
4. ATM system
5. Stock maintenance
6. Quiz System
7. Expert system to prescribe the medicines for the given symptoms
8. Remote computer monitoring

Text Book (s)	
1	Ian Sommerville, Software Engineering, Tenth Edition, Pearson Education, 2017
2	Roger S. Pressman and Bruce Maxim, Software Engineering – A Practitioner's Approach, Ninth Edition, Mc Graw-Hill Education, 2019.
Reference (s)	
1	Ivar Jacobson, Object Oriented Software Engineering: A Use Case Driven Approach, First Edition, 2007.
2	Shari Lawrence Pfleeger and Joanne M. Atlee, Software Engineering: Theory and Practice, Fourth Edition, Pearson Education India, 2011.
3	Ivar Jacobson, Grady Booch, James Rumbaugh, The Unified Development Process, First Edition, Addison-Wesley, 2012.

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Regulation 2018		Semester III	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
B	18MAB209T	OPERATIONS RESEARCH	3	0	0	3

Prerequisite Course (s)

NIL

Course Objective (s):
The purpose of learning this course is to:

1	Apply the fundamental concepts of operations research and solving techniques in linear programming to the decision - making processes in Management and Engineering
2	Acquire the knowledge in Optimization techniques in Transportation and Assignment problems and apply in decision making problems
3	Analyze the results and propose recommendations for CPM,PERT techniques and Inventory models
4	Understand and apply the methodologies of the Queueing theory
5	Apply the simulation techniques in Management and Engineering

Course Outcome (s) (COs):
At the end of this course, learners will be able to:

CO1	Understand the basic concepts of operational research techniques from the verbal description of the real system
CO2	Understand the mathematical tools that are needed to solve optimization problems for transhipment problems.
CO3	Understand the concepts of network use PERT and CPM techniques to plan, schedule and control project activities
CO4	Identify and apply the queuing methodologies to optimize the result of the waiting line
CO5	Understand the fundamental concepts related to random number generation in simulation techniques

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	1	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	1	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	1	-	-
CO4	2	2	-	-	-	-	-	-	-	-	-	1	-	-
CO5	2	2	-	-	-	-	-	-	-	-	-	1	-	-
CO (Avg)	2.6	2.2	-	-	-	-	-	-	-	-	-	1	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	LINEAR PROGRAMMING	9

Linear programming – Examples from industrial cases, formulation & definitions, Matrix form. Basic concepts, Special cases – infeasibility, unboundedness, redundancy and degeneracy, Sensitivity analysis. Simplex Algorithm – slack, surplus & artificial variables, computational details, big-M method, identification and resolution of special cases through simplex iterations. Duality – formulation, results, fundamental theorem of duality, dual-simplex and primal-dual algorithms.

UNIT II	TRANSPORTATION AND ASSIGNMENT PROBLEMS	9

TP - Examples, Definitions – decision variables, supply & demand constraints, formulation, Balanced &unbalanced situations, Solution methods – NWCR, minimum cost and VAM, test for optimality (MODI method), degeneracy and its resolution.

AP - Examples, Definitions – decision variables, constraints, formulation, Balanced &unbalanced situations, Solution method – Hungarian, test for optimality (MODI method), degeneracy & its resolution.

UNIT III	PERT – CPM AND INVENTORY CONTROL	9

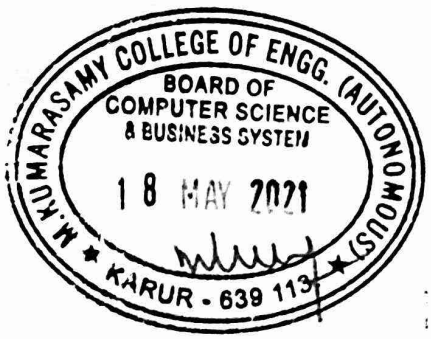
Project definition, Project scheduling techniques – Gantt chart, PERT & CPM, Determination of critical paths, Estimation of Project time and its variance in PERT using statistical principles, Concept of project crashing/time-cost trade-off. Inventory Control: Functions of inventory and its disadvantages, ABC analysis, Concept of inventory costs, Basics of inventory policy (order, lead time, types), Fixed orderquantity models – EOQ, POQ & Quantity discount models. EOQ models for discrete units, sensitivity analysis and Robustness.

UNIT IV	QUEUING THEORY	9

Definitions – queue (waiting line), waiting costs, characteristics (arrival, queue, service discipline) of queuing system, queue types (channel vs. phase). Kendall's notation, Little's law, steady state behavior ,Poisson's Process & queue, Models with examples - M/M/1 and its performance measures; M/M/m and its performance measures.

UNIT V	SIMULATION METHODOLOGY	9

Definition and steps of simulation, random number, random number generator, Discrete Event System Simulation – clock, event list, Application in Scheduling, Queuing systems and Inventory systems.



Text Book (s)	
1	Operations Research: An Introduction. H.A. Taha, Pearson, 10th Edition, 2017.
Reference (s)	
1	Linear Programming. K.G. Murthy.
2	Linear Programming. G. Hadley
3	Principles of OR with Application to Managerial Decisions. H.M. Wagner.
4	Introduction to Operations Research. F.S. Hiller and G.J. Lieberman.
5	Elements of Queuing Theory. Thomas L. Saaty.
6	Operations Research and Management Science, Hand Book: Edited By A. Ravi Ravindran
7	Management Guide to PERT/CPM. Wiest& Levy.
8	Modern Inventory Management. J.W. Prichard and R.H. Eagle

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Regulation 2018		Semester III	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18CBC206L	OBJECT ORIENTED PROGRAMMING LABORATORY	0	0	2	1

Prerequisite Course (s)

Programming Fundamentals

Course Objective (s):
The purpose of learning this course is to:

1	To study about different UML diagrams.
2	To familiarize with constructors, inheritance, polymorphism, templates and exception handling.
3	To develop applications using files in C++.
4	Able to make use of objects and classes for developing programs.
5	Able to use various object oriented concepts to solve different problems.

Course Outcome (s) (COs):
At the end of this course, learners will be able to:

CO1	Understand the different UML diagrams.
CO2	Apply object oriented programming concepts to solve real time problems.
CO3	Employ the concepts of constructors, inheritance and polymorphism.
CO4	Develop software applications using templates, exception handling and files in C++.
CO5	Apply virtual and pure virtual function & complex programming situations.

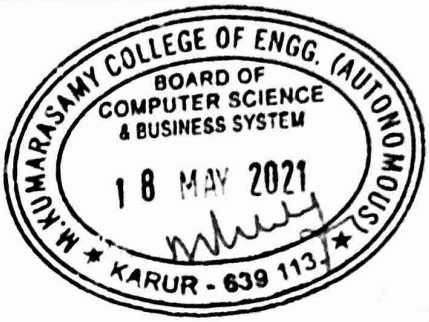
CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	-	-	-	-	-	2	-	3	2
CO2	3	3	3	3	3	-	-	-	-	-	3	-	3	3
CO3	3	3	3	3	3	-	-	-	-	-	3	-	3	2
CO4	3	3	3	3	3	-	-	-	-	-	3	-	2	2
CO5	3	3	3	3	3	-	-	-	-	-	3	-	3	2
CO (Avg)	3	3	3	3	3	-	-	-	-	-	2.8	-	2.8	2.2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

LIST OF EXPERIMENTS	30

1. Study of different UML diagrams
2. Programs on concept of classes and objects
3. Programs using friend functions
4. Programs using static polymorphism
5. Programs using constructors
6. Programs using inheritance
7. Programs on dynamic polymorphism
8. Programs on exception handling
9. Programs on generic programming using template function & template class
10. Programs on file handling



Regulation 2018		Semester III	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	18MBM201L	COMPETENCIES IN SOCIAL SKILLS	0	0	2	1

Prerequisite Course (s)

NIL

Course Objective (s):
The purpose of learning this course is to:

1	To sharpen problem solving skill and to improve thinking capability of the students.
2	To hone soft skill and analytical ability of students.
3	To engage learners in using language purposefully and cooperatively.
4	To expertise the writing and presentation skill to fulfill the corporate expectations.

Course Outcome (s) (COs):
At the end of this course, learners will be able to:

CO1	Students should be able to solve both analytical and logical problems in an effective manner.
CO2	Students can design and deliver information in a proper manner.
CO3	Presentation skills of students will be improved individually as well as a team member.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	2	-	-	-	-
CO3	-	-	-	-	-	-	-	-	2	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO (Avg)	3	-	-	-	-	-	-	-	2	2	-	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	Module - 1	6
Aptitude: Coding & Decoding - Direction Sense Test. **Communication:** Self-Introduction and SWOT analysis - Letter writing - types.		
UNIT II	**Module - 2**	**6**
Aptitude: Venn Diagrams - Data Interpretation. **Communication:** Phrasal verbs - Voice of Valluvar.		
UNIT III	**Module - 3**	**6**
Aptitude: Averages. **Communication:** Idioms and Phrases - Skits.		
UNIT IV	**Module - 4**	**6**
Aptitude: Time and Distance - Problems on Trains. **Communication:** Prefix/Suffix - Root words - Adjectives - JAM (Extempore Speech).		
UNIT V	**Module - 5**	**6**
Aptitude: Clocks & Calendars. **Communication:** Homophones - Frame Tales.		
Text Book (s)		
1	Dr.R.S.Aggarwal, "Quantitative Aptitude", S. Chand & Company Limited, 2015	
2	Dr.R.S.Aggarwal, "A Modern Approach to Verbal & Non - Verbal Reasoning", S. Chand & Company Limited, 2015	

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Regulation 2018		Semester III / IV	Total Hours			15
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	18CYM201T	ENVIRONMENTAL SCIENCE	1	0	0	-

Prerequisite Course (s)

NIL

Course Objective (s):
The purpose of learning this course is to:

1	To demonstrate in-depth knowledge within environmental engineering and an awareness of social, economic, political, and environmental impacts of engineering practices.
2	To have competence for working with multi-disciplinary teams to arrive at solutions to environmental engineering problems.
3	To get solutions which will minimize the negative impact of human activities on the environment and to protect human health.

Course Outcome (s) (COs):
At the end of this course, learners will be able to:

CO1	Improve fundamental knowledge of the inter-relationships between the built environment and natural systems.
CO2	Characterize and mitigate man-made hazards like nuclear hazards. Understand the principles involved in the generation of different forms of energy.
CO3	Improve the reliability, performance, disaster-management of natural calamities and solid waste and water supplies and treatment processes.
CO4	Understand the source, effects and control measure of various environmental pollution.
CO5	Apply information technology in the control of human population, women and child welfare.

CO-PO Mapping

Cos	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2	-	-	-	-	3	-	-	-	-	-	-	-
CO2	-	2	-	-	-	3	3	-	-	-	-	-	-	-
CO3	-	2	-	2	-	3	3	-	-	-	-	-	-	-
CO4	-	2	-	-	-	3	3	2	-	-	-	-	-	-
CO5	-	2	-	2	-	3	3	-	-	-	-	-	-	-
CO (Avg)	-	2.00	-	2.00	-	3.00	3.00	2.00	-	-	-	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	ENVIRONMENT& BIODIVERSITY	3
Definition-types of environment, components of environment, scope-importance of environmental studies- Bio diversity-definition-value of biodiversity-Threats to biodiversity - India a mega diversity nation-endangered and endemic species of India-conservation of biodiversity.		
UNIT II	**ENERGY SOURCES**	**3**
Energy resources- Growing energy needs- Renewable and Nonrenewable energy sources- Use of alternate energy sources - Nuclear Energy- Alternative energy fuels-power alcohol-Bio diesel (preparation, properties &uses)		
UNIT III	**SOCIAL ISSUES AND ENVIRONMENT**	**3**
Environment ethics – Climate change – Global warming – Acid rain – Ozone layer depletion – Nuclear accidents-holocaust. Solid waste management - Rain water Harvesting-watershed management		
UNIT IV	**ENVIRONMENTAL POLLUTION & ACTs**	**3**
Source, types, effects & control- Air pollution -Water pollution – Soil pollution – Marine pollution and Plastic Pollution -The Environment (Protection) Act - Air (Prevention and control of pollution) Act - Water (Prevention and control of pollution) Act- Role of individual in prevention of pollution.		
UNIT V	**HUMAN POPULATION AND ENVIRONMENT**	**3**
Sustainable development – Urban Population growth and distribution – Population explosion – Family Welfare Program –Women and child welfare- Role of information technology in environment and human health- case studies		

Text Book (s)

1	Dr.J.P.Sharma, "Environmental studies", Laxmi Publications(p) Ltd, New Delhi.
2	Miller "Environmental Science" 11th Edition, Cengage Learning India Private Limited, New Delhi, (2006).

Reference (s)

1	Master. G.M., "Introduction to Environmental Engineering and Science", Pearson Education Pvt Ltd., (2004)
2	Dr.A.Ravikrishnan " Environmental Science and Engineering " Sri Krishna publications, Chennai(2015)
3	P.Anandan, R.Kumaravelan "Environmental Science and Engineering" Scitech Publication (India) Pvt. Ltd, Chennai, Reprint 2009.

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Regulation 2018		Semester IV	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18CBC207T	DATABASE MANAGEMENT SYSTEMS	3	0	0	3

Prerequisite Course (s)

NIL

Course Objective (s):
The purpose of learning this course is to:

1	To discuss the fundamentals of data models to conceptualize and depict a database system using ER diagram.
2	To illustrate the relational database implementation using SQL with effective relational database design concepts.
3	To explain the fundamental concepts of transaction processing- concurrency control techniques and recovery procedure.
4	To demonstrate Query evaluation and optimization techniques.
5	To introduce the concepts of Database Security, Object Oriented, Data Warehousing and Data Mining.

Course Outcome (s) (COs):
At the end of this course, learners will be able to:

CO1	Distinguish database systems from file systems and describe data models and DBMS architecture.
CO2	Identify the basic issues of transaction processing and concurrency control.
CO3	Demonstrate with understanding of SQL Programming language and normalization theory.
CO4	Practice the query evaluation techniques, query optimization and familiar with basic database storage structures and access techniques.
CO5	Analyze and derive an information model expressed in the form of an entity relation diagram and transform into a relational database schema.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	-	-	1	-	2	2
CO2	3	3	3	2	-	-	-	-	-	-	1	-	2	2
CO3	3	3	3	2	-	-	-	-	-	-	1	-	2	2
CO4	3	3	3	2	-	-	-	-	-	-	1	-	2	2
CO5	3	3	3	2	-	-	-	-	-	-	1	-	2	2
CO (Avg)	3	3	2.8	2	-	-	-	-	-	-	1	-	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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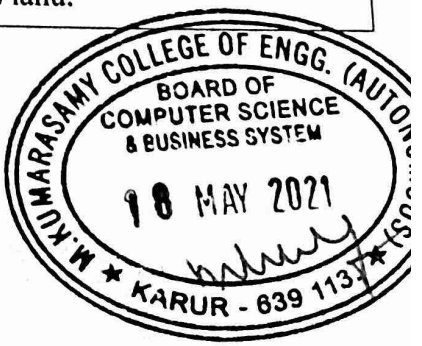
UNIT I	INTRODUCTION	9
Introduction to Database: Hierarchical, Network and Relational Models - Database system architecture: Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML)		
UNIT II	**DATA MODELS**	**9**
Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations - Relational query languages: Relational algebra, Tuple and domain relational calculus,SQL3, DDL and DML constructs, Open source and Commercial DBMS – MYSQL MongoDB, ORACLE, DB2, SQL server		
UNIT III	**RELATIONAL DATABASE DESIGN**	**9**
Domain and data dependency, Armstrong's axioms, Functional Dependencies, Normal forms, Dependency preservation, Lossless design - Query processing and optimization: Evaluation of relational algebra expressions, Queryequivalence, Join strategies, Query optimization algorithms		
UNIT IV	**STORAGE STRATEGIES**	**9**
Indices, B-trees, Hashing - Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery		
UNIT V	**DATABASE SECURITY**	**9**
Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection - Advanced topics: Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.		

Text Book (s)	
1	Database System Concepts. Abraham Silberschatz, Henry F. Korth and S. Sudarshan.
2	Principles of Database and Knowledge – Base Systems, Vol 1 by J. D. Ullman.
Reference (s)	
1	Fundamentals of Database Systems. R. Elmasri and S. Navathe.
2	Foundations of Databases. Serge Abiteboul, Richard Hull, Victor Vianu.



Regulation 2018		Semester IV	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18CBC208J	OPERATING SYSTEMS	3	0	2	4

Prerequisite Course (s)

NIL

Course Objective (s):
The purpose of learning this course is to:

1	To recognize the fundamentals of operating systems.
2	To describe the mechanisms of OS to handle processes and threads and their Communication.
3	To discuss the principles of concurrency and Deadlocks.
4	To identify the mechanisms involved in memory management and its schemes.
5	To identify I/O management, File systems and security issues.

Course Outcome (s) (COs):
At the end of this course, learners will be able to:

CO1	Identify the basic concepts and design issues of operating systems.
CO2	Apply Process management concepts including scheduling, Inter process communication, deadlocks and multithreading in real world problems.
CO3	Apply concepts of memory management including Virtual Memory and Page Replacement to the issues that occur in Real time applications.
CO4	Apply the concept of Concurrent Programming.
CO5	Identify issues related to IO hardware, file system and disk management.

CO-PO Mapping

COs	Pos												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	1	-	-	-	-	-	1	-	1	-
CO2	3	2	2	1	1	-	-	-	-	-	1	-	1	-
CO3	3	2	2	1	1	-	-	-	-	-	1	-	2	-
CO4	3	2	2	1	1	-	-	-	-	-	1	-	2	-
CO5	3	2	2	1	1	-	-	-	-	-	1	-	2	-
CO (Avg)	3	2.2	2	1	1	-	-	-	-	-	1	-	1.6	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	INTRODUCTION	9

Concept of Operating Systems (OS), Generations of OS, Typesof OS, OS Services, Interrupt handling and System Calls, Basic architectural concepts of an OS, Concept of Virtual Machine, Resource Manager view, process view and hierarchical view of an OS

UNIT II	PROCESSES, THREAD, PROCESS SCHEDULING	9

Processes: Definition, Process Relationship, Different states of a Process, Process Statetransitions, Process Control Block (PCB), Context switching - Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads - Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers - Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time - Scheduling algorithms: Pre-emptive and non-pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF

UNIT III	INTER-PROCESS COMMUNICATION	9

Concurrent processes, precedence graphs, Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Semaphores, Strict Alternation, Peterson's Solution, The Producer / Consumer Problem, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem, Barber's shop problem - Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery

UNIT IV	CONCURRENT PROGRAMMING	9

Critical region, conditional critical region, monitors, concurrent languages, communicating sequential process (CSP); Deadlocks - prevention, avoidance, detection and recovery - Memory Management: Basic concept, Logical and Physical address maps, Memory allocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation and Compaction - Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Localityof reference, Page allocation, Partitioning, Paging, Page fault, Working Set, Segmentation, Demand paging, PageReplacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Notrecently used (NRU) and Least Recently used (LRU)

UNIT V	I/O HARDWARE, FILE AND DISK MANAGEMENT	9

I/O devices, Device controllers, Direct Memory Access, Principles of I/O - File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation(linear list, hash table), efficiency and performance - Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks.

Case study: UNIX OS file system, shell, filters, shell programming, programming with the standard I/O, UNIX system calls.

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LIST OF EXPERIMENTS	15

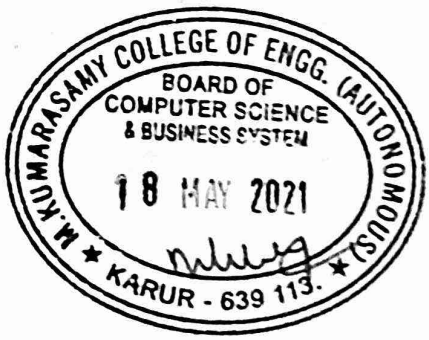
1. Analysis and Synthesis of Basic Linux Commands
2. Programs using Shell Programming
3. Implementation of Unix System Calls
4. Simulation and Analysis of Non pre-emptive and Pre-emptive CPU Scheduling Algorithms
5. Simulation of Producer – Consumer Problem using Semaphores and Implementation of Dining Philosopher's Problem to demonstrate Process Synchronization
6. Simulation of Banker's Algorithm for Deadlock Avoidance
7. Analysis and Simulation of Memory Allocation and Management Techniques
8. Implementation of Page Replacement Techniques
9. Simulation of Disk Scheduling Algorithms
10. Implementation of File organization Techniques.

Text Book (s)

1	Operating System Concepts Essentials. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne.
2	Operating Systems: Internals and Design Principles. William Stallings

Reference (s)

1	Operating System: A Design-oriented Approach. Charles Patrick Crowley.
2	Operating Systems: A Modern Perspective. Gary J. Nutt.
3	Design of the Unix Operating Systems. Maurice J. Bach.
4	Understanding the Linux Kernel, Daniel Pierre Bovet, Marco Cesati.



Regulation 2018		Semester IV	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18CBC209J	SOFTWARE DESIGN WITH UML	3	0	2	4

Prerequisite Course (s)

Software Engineering

Course Objective (s):
The purpose of learning this course is to:

1	Know the importance of modeling in the software development life cycle.
2	Understand the object-oriented analysis approach for system requirement and analysis.
3	Identify the elements required for characterization and design of an interactive model.
4	Understand the design methods for building user interface UML system.
5	Learn to interface the UML design with a database application system.

Course Outcome (s) (COs):
At the end of this course, learners will be able to:

CO1	Exemplify the software development process models and standards in software development.
CO2	Elucidate use case design and its association with requirement analysis.
CO3	Explain the design and dependencies of an object oriented model using interaction diagrams.
CO4	Apply various software design methods and components to develop an interactive system.
CO5	Explain the UML design for building an interface for real-time database application.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	1	-	-	-	1	1	1	1	2	1
CO2	3	2	2	2	1	1	-	-	2	2	2	1	2	1
CO3	3	3	3	2	1	1	-	-	2	2	2	1	2	1
CO4	3	3	3	2	1	1	-	-	2	2	2	1	2	1
CO5	3	2	1	1	1	-	-	-	1	1	1	1	2	1
CO (Avg)	3	2.4	2	1.8	1	0.6	-	-	1.6	1.6	1.6			

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	INTRODUCTION TO UML METHOD AND LANGUAGE	9

Software development process: The Waterfall Model vs. The Spiral Model -The Software Crisis, description of the real world using the Objects Model - Classes, inheritance and multiple configurations - Quality software characteristics - Description of the Object Oriented Analysis process vs. the Structure Analysis Model - Introduction to the UML Language: Standards, Elements of the language, General description of various models, The process of Object Oriented software development, Description of Design Patterns, Technological Description of Distributed Systems

UNIT II	REQUIREMENTS ANALYSIS USING CASE MODELING	9

Analysis of system requirements, Actor definitions, Writing a case goal, Use Case Diagrams, Use Case Relationships - Transfer from Analysis to Design in the Characterization Stage: Interaction Diagrams- Description of goal, Defining UML Method, Operation, Object Interface, Class - Sequence Diagram, Finding objects from Flow of Events, Describing the process of finding objects using a Sequence Diagram, Describing the process of finding objects using a Collaboration Diagram

UNIT III	THE LOGICAL VIEW DESIGN STAGE	9

Static Structure Diagrams: The Class Diagram Model, Attributes descriptions, Operations descriptions, Connections descriptions in the Static Model, Association, Generalization, Aggregation, Dependency, Interfacing, Multiplicity - Package Diagram Model: Description of the model, White box, black box, Connections between packagers, Interfaces, Create Package Diagram, Drill Down

UNIT IV	DYNAMIC MODEL	9

State Diagram / Activity Diagram: Description of the State Diagram, Events Handling, Description of the Activity Diagram, Exercise in State Machines - Component Diagram Model: Physical Aspect, Logical Aspect, Connections and Dependencies, User face, Initial DB design in a UML environment

UNIT V	DEPLOYMENT MODEL	9

Processors, Connections, Components, Tasks, Threads, Signals and Events

LIST OF EXPERIMENTS	15

To develop a mini-project by following the 9 exercises listed below.

1. To develop a problem statement.
2. Identify Use Cases and develop the Use Case model.
3. Identify the conceptual classes and develop a domain model with UML Class diagram.
4. Using the identified scenarios find the interaction between objects and represent them using UML Sequence diagrams.
5. Draw relevant state charts and activity diagrams.
6. Identify the User Interface, Domain objects, and Technical services. Draw the partial layered, logical architecture diagram with UML package diagram notation.
7. Develop and test the Technical services layer.
8. Develop and test the Domain objects layer.
9. Develop and test the User interface layer.

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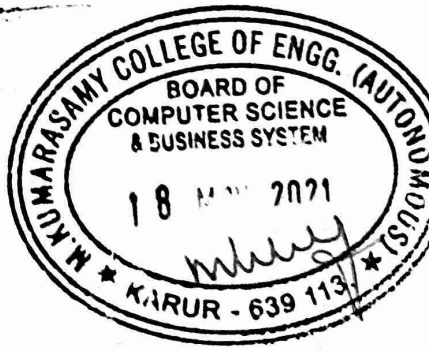
Suggested domains for Mini-Project:

1. Passport automation system.
2. Book bank
3. Exam Registration
4. Stock maintenance system.
5. Online course reservation system
6. E-ticketing
7. Software personnel management system
8. Credit card processing
9. e-book management system
10. Recruitment system

Text Book (s)	
1	Bernd Bruegge and Allen H. Dutoit, "Object-Oriented Software Engineering: using UML, Patterns, and Java", Pearson, 3rd Edition, 2013
2	Craig Larman, "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development", Pearson Education, 3rd Edition, 2005

Reference (s)	
1	Erich Gamma, Richard Helm, Ralph Johnson, John M. Vlissides, "Design Patterns: Elements of Reusable Object-Oriented Software", Pearson, 2012
2	Roger. S. Pressman and Bruce R. Maxim, "Software Engineering – A Practitioner's Approach", 7th Edition, Tata McGraw Hill, 2015
3	Martin Fowler, Kendall Scott, "UML Distilled: A Brief Guide to the Standard Object Modeling Language", Addison Wesley, 3rd Edition, 2003
4	Grady Booch, Robert A. Maksimchuk, Michael W. Engle, Bobbi J. Young, Ph.D., Jim Conallen Kelli A. Houston, "Object Oriented Analysis and Design with Applications", Addision - Wesely, 3rd Edition, 2007
5	Freeman, Eric & Robson, Elisabeth, "Head First Design Patterns" 1st Edition, O'Reilly, 2004



Regulation 2018		Semester IV	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
H	18CBH103J	BUSINESS COMMUNICATION & VALUE SCIENCE – III	1	0	2	2

Prerequisite Course (s)

Basic Knowledge of English (Verbal and written) Completion of all units from semesters1, 2 and 3.

Course Objective (s):
The purpose of learning this course is to:

CLR-1	Introduce self-analysis techniques like SWOT &TOWS.
CLR-2	Introduce the key concepts of pluralism, cultural spaces and sensitise the cross-cultural communication.
CLR-3	Develop the Science of Nation building.
CLR-4	Understand Artificial Intelligence in daily life.
CLR-5	Develop technical writing skills.

Course Outcome (s) (COs):
At the end of this course, learners will be able to:

CO1	Apply & analyze the basic principles of SWOT & life positions, understand, analyze and leverage the power of motivation in real life.
CO2	Analyze, Understand pluralism in cultural spaces, concepts of global and glocal, roles and relations of different genders, diverse cultures of India, cross cultural communication and Identify the common mistakes made in cross-cultural communication.
CO3	Apply the Science of Nation building.
CO4	Understand Artificial intelligence and recognize its impact in daily life.
CO5	Identify the best practices of technical writing and apply technical writing in real life scenarios.

CO-PO Mapping

Cos	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	2	1	-	2	-	-
CO2	-	-	-	-	-	-	-	-	1	-	-	1	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO4	-	-	-	-	-	-	-	-	-	1	-	1	-	-
CO5	-	-	-	-	-	-	-	-	1	1	-	-	-	-
CO (Avg)	-	-	-	-	-	-	-	-	1.25	1.6	-	1.25	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	SWOT AND TOWS	6

REUNION – Recap activity on the earlier learning - Summarize the basic principles of SWOT and Life Positions – Apply SWOT in real life scenarios - Pat your back activity – strength will be written by others – Create your SWOT – SWOT Vs. TOWS The Balancing Act- Group Presentations on what are the strengths they have identified to survive in the VUCA World- Recognize how motivation helps real life – Motivation Stories - Maslow's Theory – Leverage motivation in real life scenarios –Scenario based activity on identifying and leveraging motivation.

UNIT II	PLURALISM, CROSS CULTURE AND GENDER AWARENESS	6

Identifying Pluralism in cultural spaces - Rivers of India - Awareness and respect for pluralism in cultural spaces -Differentiate between the different cultures of India- Rhythms of India (Cultures in India) - Define the terms global, glocal and translocational- Differentiate between global, glocal and translocational culture- Debate on Global and global impacts- Cross – cultural communication – Recognize the implications of cross - cultural communication - Apply cross cultural communication – Identify the common mistakes made in cross – cultural communication- Gender awareness –Gender awareness campaign – Differentiate between the roles and relations of different genders – Quiz Time

UNIT III	ROLE OF SCIENCE IN NATION BUILDING	6

Role of science in nation building - Introduce the topic and discuss the role of scientists and mathematicians from ancient India – Summarize the role of science in nation building – Role of science in pre and post - independence.

UNIT IV	ARTIFICIAL INTELLIGENCE	6

Define AI (Artificial Intelligence) - "Voice of the Future" Activity- Recognize the importance of AI-AI in Everyday Life- -Design your college in the year 2090- Communicating with machines -debate related to Artificial Intelligence in the presence of an external moderator.

UNIT V	TECHNICAL WRITING	6

Introduction to technical writing- Basic rules of technical writing through examples- Identify the best practices of technical writing- Practice activity on technical writing- Apply technical writing in real-life scenarios- Applying technical writing in profession-Assessment on technical writing on certain topic- Project- Visit rural area/ underprivileged parts of city to address some of the local issues; if relevant, suggest a practical technology solution to the issues

	LAB ACTIVITIES	15

1. SWOT Vs TOWS
2. The Balancing act TED talks on Biomimicry and stories
3. You tube video on Maslow's Theory
4. Rhythms of India (Cultures in India)- Presentation
5. Cross-Cultural Communication (Debate & Group Discussion)
6. Role of Science in Nation Building
7. Role of Science in Nation Building (Post-Independence)
8. AI in everyday life (Presentation)
9. Design your college in the year 2090
10. Technical Article writing

Text Book (s)	
There are no prescribed texts for semester 4-there will be handouts and reference links shared.	
Reference (s)	
1	Raman, Meenakshi and Sangeeta Sharma, Fundamentals of Technical Communication.(2014)
2	Fine, Lawrence G. The SWOT Analysis: Using your strength to overcome Weakness, Using Opportunities to Overcome Threats.(2009)
3	Gerald.J.Alred,Charles T. Brusaw,Walter E.Oliu,Bedford/St.Martin's Boston, Newyork, Handbook of Technical Writing .(2009)
4	Liz Hamp-Lyons and Ben Heasly, Study Writing,Cambridge University Pres.2006
5	Sanjay Kumar and PushpLata, Communication Skills.OxfordUniversity Press. 2011.
6	Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. OxfordUniversity Press
Web References	
1	Examples of Technical Writing for Students https://freelance-writing.lovetoknow.com/kinds-technical-writing
2	11 Skills of a Good Technical Writer https://clickhelp.com/clickhelp-technical-writing-blog/11-skills-of-a- good-technical writer/
3	13 benefits and challenges of cultural diversity in the workplace https://www.hult.edu/blog/benefits-challenges-cultural-diversity-workplace/
Online References	
1	https://youtu.be/CsaTslhSDI
2	https://m.youtube.com/watch?feature=youtu.be&v=IIKvV8_T95M
3	https://m.youtube.com/watch?feature=youtu.be&v=e80BbX05D7Y
4	https://m.youtube.com/watch?v=dT_D68RJ5T8&feature=youtu.be
5	https://www.youtube.com/watch?app=desktop&v=7sLLEdBgYYY&feature=youtu.be

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Regulation 2018		Semester IV	Total Hours			30
			Hours / Week			C
Category	Course Code	Course Name	L	T	P	
S	18MBS201T	FUNDAMENTALS OF MANAGEMENT	2	0	0	2

Prerequisite Course (s)

NIL

Course Objective (s):
The purpose of learning this course is to:

1	Understand the Management Theories.
2	Explain the Functions of Management.
3	Provide insights on Organizational Design and Organizational Behaviour.
4	Understand the Managerial Ethics.
5	Emphasize on Leadership and its aspects.

Course Outcome (s) (COs):
At the end of this course, learners will be able to:

CO1	Apply the various Management Theories.
CO2	Identify the various Functions of Management.
CO3	Exhibit the apt Organizational Behaviour.
CO4	Follow the Managerial and Work Ethics.
CO5	Demonstrate Leadership Quality and Skills.

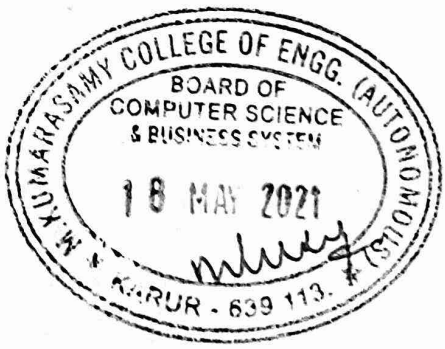
CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	-	-	-	-	-	-	-	-	1	1	1	1
CO2	-	-	-	-	-	-	1	-	-	-	1	1	-	1
CO3	-	-	-	-	-	-	1	-	-	-	-	-	-	1
CO4	-	-	-	-	-	-	-	-	-	-	1	1	-	1
CO5	-	-	-	-	-	-	-	-	-	-	1	1	-	1
CO (Avg)	1	1	-	-	-	-	1	-	-	-				

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	MANAGEMENT THEORIES	6
Concept and Foundations of Management-Evolution of Management Thoughts [Pre-Scientific Management Era (before 1880)-Classical management Era (1880-1930)-Neo-classical Management Era (1930-1950)-Modern Management era (1950-on word)-Contribution of Management Thinkers - Taylor, Fayol and Elton Mayo.		
UNIT II	**FUNCTIONS OF MANAGEMENT**	**6**
Importance of Management-Planning-Organizing-Staffing-Directing-Controlling		
UNIT III	**ORGANIZATIONAL BEHAVIOUR AND DESIGN**	**6**
Introduction-Personality, Perception-Learning and Reinforcement-Motivation-Group Dynamics, Power &Influence-Work Stress and Stress Management Classical- Neoclassical and Contingency approaches to organizational design- Organizational theory and design-Organizational structure (Simple Structure, Functional Structure, Divisional Structure, Matrix Structure)		
UNIT IV	**MANAGERIAL ETHICS**	**6**
Ethics and Business- Ethics of Marketing & advertising-Ethics of Finance & Accounting, Decision – making .Frameworks-Business and Social Responsibility-International Standards-Corporate Governance-Corporate Citizenship-Corporate Social Responsibility		
UNIT V	**LEADERSHIP**	**6**
Concept-Nature-Importance-Attributes of a leader- Types of Leadership - developing leaders across the organization-Leadership Grid		

Text Book (s)	
1	Stephen Robbins, Mary Coulter ,David de Cenzo-Fundamentals of Management- 9th edition
Reference (s)	
1	Richard L. Daft, Understanding the Theory and Design of Organizations 11th Edition
2	Stephen P. Robbins, Timothy A. Judge, Neharika Vohra, Organizational Behavior 18th edition



Regulation 2018		Semester IV	Total Hours			45
			Hours / Week			C
Category	Course Code	Course Name	L	T	P	
S	18MBS202T	INTRODUCTION TO INNOVATION, IP MANAGEMENT & ENTREPRENEURSHIP	3	0	0	3

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

1	Introduction to the fundamentals of technology innovation, intellectual property rights and entrepreneurship.
2	Identifying and discovering market needs.
3	Understanding the management of innovation program.
4	Identifying the ways to create, protect, assertive and commercialize intellectual property.
5	Provide insights on opportunities and challenges for entrepreneurs.

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Understand the fundamentals of innovation, intellectual property rights and Entrepreneurship.
CO2	Identify the different types of needs in the market.
CO3	Understand the concept of innovation.
CO4	Know about intellectual property.
CO5	Know about the opportunities and challenges for entrepreneurs.

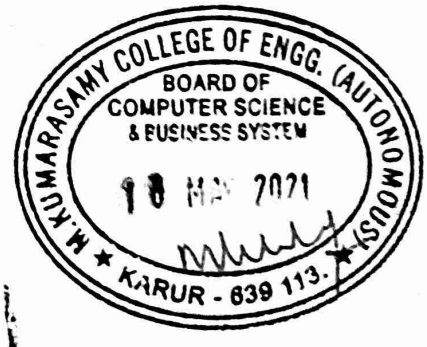
CO-PO Mapping

COs	Pos												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	-	-	-	-	-	-	-	-	1	1	-	1
CO2	-	-	-	-	-	-	1	-	-	-	1	1	-	-
CO3	-	-	-	-	-	-	1	-	-	-	-	-	-	1
CO4	-	-	-	-	-	-	-	-	-	-	1	1	-	1
CO5	-	-	-	-	-	-	-	-	-	-	1	1		1
CO (Avg)	1	1	-	-	-	-	1	-	-	-				

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	INTRODUCTION TO INNOVATION	9
Understanding Innovation- Nature of Innovation -Types of Innovation – Lifecycle of Innovation– Innovation Assessment – Challenges in Innovation–Co innovation and Open Innovation		
UNIT II	**INTELLECTUAL PROPERTY**	**9**
Intellectual Property-Intellectual Property Rights – Types of IPR – Lifecycle of IP– Balancing IP risks and Rewards- IP valuation- Measurement of Operational Risk		
UNIT III	**INTRODUCTION TO TECHNOLOGY ENTREPRENEURSHIP**	**9**
Understanding Technology Entrepreneurship-Opportunity Identification in Technology Entrepreneurship - Technology-driven Social Innovation and Entrepreneurship- Types of Technology Entrepreneurship-Technology Innovation: Two Case Studies		
UNIT IV	**FORECASTING**	**9**
Needs for Forecasting – Types of Forecasting – Forecasting Method – Forecasting Costs – Forecasting Error – Approaches		
UNIT V	**INNOVATION, IP MANAGEMENT AND ENTREPRENEURSHIP: PRACTISING PRINCIPLES**	**9**
Market Research, Segmentation and Sizing –Product Positioning, Pricing, and Go-To-Market Strategy-Start-up Business Models-Innovation, Incubation and Entrepreneurship in Corporate Context - Manage Innovation, IP and Entrepreneurship Programs – Processes, Governance and Tools		

Text Book (s)	
1	Innovation, Intellectual Property and Entrepreneurship by Gopal Menon | G Hari Kishore | K Subodh Kumar |Volume 8 Issue 4
Reference (s)	
1	Entrepreneurial Development by SS Khanka 1st Edition
2	Inteilectual Property and Innovation Management in Small Firms by Robert.A.Blackburn 1st Edition
3	Intellectual Property, Design Innovation and Entrepreneurship by Matthias Hilner 1st Edition



Regulation 2018		Semester IV	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18CBC210L	DATABASE MANAGEMENT SYSTEMS LABORATORY	0	0	2	1

Prerequisite Course (s)

NIL

Course Objective (s):
The purpose of learning this course is to:

1	To design database using ER diagram.
2	To illustrate the relational database implementation using SQL.
3	To demonstrate procedural extensions such as procedure, function, cursors and Triggers.
4	To develop application using front end and back end.
5	To explain cloud storage for real time systems.

Course Outcome (s) (COs):
At the end of this course, learners will be able to:

CO1	Sketch ER diagrams for real world applications.
CO2	Select suitable SQL commands to manage the database.
CO3	Create databases using MongoDB.
CO4	Design front end and back end for enterprise applications.
CO5	Analyze and Select storage and recovery techniques of database system.

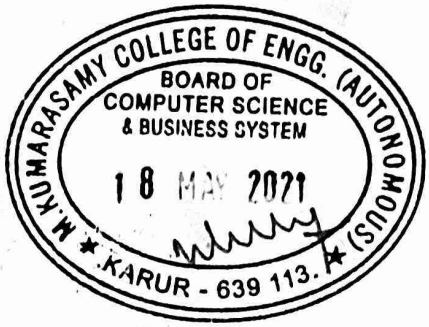
CO-PO Mapping

COs	Pos												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	-	-	-	-	-	-	-	3	2
CO2	3	3	3	3	3	-	-	-	-	-	-	-	3	2
CO3	3	3	3	2	3	-	-	-	-	-	-	-	3	2
CO4	3	3	3	2	3	-	-	-	-	-	-	-	3	2
CO5	3	3	3	2	3	-	-	-	-	-	-	-	3	2
CO (Avg)	3	3	3	2.4	2.8	-	-	-	-	-	-	-	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

LIST OF EXPERIMENTS	30

1. Conceptual Database design using E-R DIAGRAM
2. Implementation of SQL commands DDL, DML, DCL and TCL
3. Queries to demonstrate implementation of Integrity Constraints
4. Practice of Inbuilt functions
5. Implementation of Join and Nested Queries AND Set operators
6. Implementation of virtual tables using Views
7. Practice of Procedural extensions (Procedure, Function, Cursors, Triggers)
8. Application Development using front end tools
9. Document Database creation using MongoDB
10. Study of Cloud Storage
    i)IT Training Group Database
    ii) Blood Donation System
    iii)Salary Management System
    iv)Traffic Light Information System



Regulation 2018		Semester IV	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	18MBM202L	CRITICAL AND CREATIVE THINKING SKILLS	0	0	2	1

Prerequisite Course (s)

NIL

Course Objective (s):
The purpose of learning this course is to:

1	To focus on listening, speaking, & writing skills through audio & video sessions.
2	To hone soft skill and analytical ability of students.
3	To overcome the fear in group communication and to provide the effective communication.
4	To expertise intelligible pronunciation, stress and intonation patterns.

Course Outcome (s) (COs):
At the end of this course, learners will be able to:

CO1	Students can be able to solve both analytical and logical problems in an effective manner.
CO2	Students can demonstrate an ability to design and deliver messages.
CO3	The quality of student's communication with practical experience is improved.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	2	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	2	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO (Avg)	3	-	-	-	-	-	-	-	-	2	-	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	Module - 1	6
Aptitude: Time and Work - Pipes and Cisterns. **Communication:** Sentence Pattern - Debate.		
UNIT II	**Module - 2**	6
Aptitude: Boats and Streams. **Communication:** Tenses and voices - Tech Talk.		
UNIT III	**Module - 3**	6
Aptitude: Problems on Ages - Probability **Communication:** Analogies - Biography.		
UNIT IV	**Module - 4**	6
Aptitude: Data sufficiency - Logical Puzzles. **Communication:** Punctuation - Connection.		
UNIT V	**Module - 5**	6
Aptitude: Mensuration. **Communication:** Preposition - News of the Week.		

Text Book (s)

1	Dr.R.S.Aggarwal, "Quantitative Aptitude", S. Chand & Company Limited, 2015
2	Dr.R.S.Aggarwal, "A Modern Approach to Verbal & Non - Verbal Reasoning", S. Chand & Company Limited, 2015

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Regulation 2018		Semester III / IV	Total Hours			15
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	18LEM103T	INDIAN TRADITION AND HERITAGE	1	0	0	-

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

CLR-1:	Make students understand the role and impact of culture in human life.
CLR-2:	Draw attention towards languages and literatures of ancient period.
CLR-3:	Cultivate secularism in students.
CLR-4:	Equip students with the knowledge of Indian art and architectural evolution over years.
CLR-5:	Make students identify Indian culture in abroad.

Course Outcome (s) (Cos):

At the end of this course, learners will be able to:

CO1	Understand the meaning of culture, tracc the influence and significance of geographical features on Indian culture.
CO2	Develop an awareness of the variety of languages and literatures in India.
CO3	Recognise the characteristics of various religious movements in ancient India.
CO4	Identify the characteristics and various styles of Indian architecture and sculpture at different times.
CO5	Examine various modes through which Indian culture spread abroad.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	2	2	2	2	2	-	2	-	-
CO2	-	-	-	-	-	2	2	1	2	2	1	2	-	-
CO3	-	-	-	-	-	1	1	1	1	1	1	1	-	-
CO4	2	2	2	2	2	2	2	2	2	2	1	2	-	-
CO5	-	-	-	-	-	2	2	2	2	2	-	2	-	-
CO (Avg)	2	2	2	2	2	1.8	1.8	1.6	1.8	1.8	1	1.8	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	HISTORY OF INDIAN CULTURE	2
Characteristics of Indian Culture - Significance of Geography on Indian Culture -Society in India through ages- Ancient Period - Varna and Jati, family and marriage in India - Position of women in ancient India- Contemporary period; Caste system and communalism.		
UNIT II	**LITERATURE AND EDUCATION**	**4**
Evolution of script and languages in India : Harappan Script and Brahmi Script, Short History of the Sanskrit Literature: The Vedas, The Brahmanas and Upanishads and Sutras, Epics: Ramayana and Mahabharata & Puranas - History of Buddhist and Jain Literature in Pali, Prakrit and Sanskrit, Sangam Literature and Odia Literature.		
UNIT III	**RELIGION AND PHILOSOPHY**	**4**
Religion and Philosophy in India: Ancient Period: Pre-Vedic and Vedic Religion, Buddhism and Jainisim, Indian Philosophy - Vedanta and Mimansa school of Philosophy.		
UNIT IV	**ART AND ARCHITECTURE**	**2**
Indian Art & Architecture: Gandhara School and Mathura School of Art; Hindu Temple Architecture, Budhhist Architecture, Medieval Architecture and Colonial Architecture, Indian Painting Tradition, Performing Arts: Divisions of Indian classical music: Hindustani and Carnatic, Dances of India, Rise of modern theatre and Indian cinema.		
UNIT V	**SPREAD OF INDIAN CULTURE ABROAD**	**3**
Causes, Significance and Modes of Cultural Exchange - Through Traders, Teachers, Emissaries, Missionaries and Gypsies, Indian Culture in South East Asia, India, Central Asia and Western World through ages.		
Reference (s)		
1	Chakravarti, Ranabir: Merchants, Merchandise & Merchantmen, in: Prakash, Om (ed.): *The Trading World of the Indian Ocean, 1500-1800* (*History of Science, Philosophy and Culture in Indian Civilization,* ed. by D.P. Chattopadhyaya, vol. III, 7), Pearson, Delhi, 2012.