Study & Evaluation Scheme of

Master of Technology In Computer Science & Engineering

[Applicable for Batch 2018-20]

[As per CBCS guidelines given by UGC]

Approved in BOS	Approved in BOF	Approved in Academic Council
03-03-2018	05-06-2018	11-06-2018 Vide Agenda No 1.7.1

QUANTUM UNIVERSITY, ROORKEE
22 KM Milestone, Dehradun-Roorkee Highway, Roorkee (Uttarakhand)
Website: www.quantumuniversity.edu.in

Study & Evaluation Scheme

Study Summary

Name of the Faculty	Faculty of Technology
Name of the School	Quantum School of Technology
Name of the Department	Department of Computer Science and Engineering
Program Name	Master of Technology in Computer Science & Engineering
Duration	2 Years
Medium	English

Evaluation Scheme

Type of Papers	**Internal Evaluation (%)**	**End Semester Evaluation (%)**	**Total (%)**
Theory	40	60	100
Practical/ Dissertations/Project Report/ Viva-Voce	40	60	100
Internal Evaluation Components (Theory Papers)			
Sessional Examination I	50 Marks		
Sessional Examination II	50 Marks		
Assignment –I	25 Marks		
Assignment-II	25 Marks		
Attendance	50 Marks		
Internal Evaluation Components (Practical Papers)			
Quiz One	25 Marks		
Quiz Two	25 Marks		
Quiz Three	25 Marks		
Lab Records/ Mini Project	75 Marks		
Attendance	50 Marks		
End Semester Evaluation (Practical Papers)			
ESE Quiz	30 Marks		
ESE Practical Examination	50 Marks		
Viva- Voce	20 Marks		

Structure of Question Paper (ESE Theory Paper)

The question paper will consist of 5 questions, one from each unit. Student has to Attempt all questions. All five questions are compulsory and carry 20 marks each. Internal choice is given in each question. Answer any two parts of each question carrying 10 marks for each part. [20*5 = 100]

Important Note:

1. *The purpose of examination should be to assess the Course Outcomes (CO) that will ultimately lead to attainment of Programme Outcomes (PO). A question paper must assess the following aspects of learning as planned for a specific course i.e Remember, Understand, Apply, Analyze, Evaluate & Create (reference to Bloom's Taxonomy). The standard of question paper will be based on mapped BL level complexity of the unit of the syllabus, which is the basis of CO attainment model adopted in the university.*

2. Case Study is essential in every question paper (wherever it is being taught as a part of pedagogy) for evaluating higher-order learning. Not all the courses might have case teaching method used as pedagogy.

3. There shall be continuous evaluation of the student and there will be a provision of real time reporting on QUMS. All the assignments will evaluate through module available on ERP for time and access management of the class.

Program Structure – Master of Technology in Computer Science & Engineering

Introduction

Master of Technology in Computer Science & Engineering is a two-year professional post-graduate programme for candidates wanting to delve deeper into the world of computer application development with the help of learning modern programming language. The programme is a blend of both theoretical and practical knowledge. An M. Tech in Computer Science & Engineering degree endows students' an opportunity to work with tools meant to develop better and faster applications.

Master of Technology in Computer Science & Engineering degree is designed to meet the shortage of qualified professionals in the IT (Information Technology) industry, an M. Tech in Computer Science & Engineering degree. M. Tech in Computer Science & Engineering degree in India is offered by many colleges and there are various colleges that also offer integrated M. Tech in Computer Science & Engineering programmes as well.

CAREER SCOPE OF COMPUTER SCIENCE ENGINEERING

There is no dearth of lucrative job opportunities for M. Tech in Computer Science & Engineering graduates. A candidate with a master's degree in computer science & engineering along with the right amount of relevant work experience, skill set and caliber can easily find great job opportunities at leading IT firms (both private and government) across India and abroad

COMPUTER SCIENCE ENGINEERING: ELIGIBILITY CRITERIA

- According to AICTE, to pursue an M. Tech in Computer Science & Engineering course candidates must have pursued B.Tech/ MCA degree with Mathematics as one of the subjects at 10+2 level or at graduation.
- Also, Minimum marks required: 50% to 60% (a CGPA above 6/10 is considered good) in Bachelor's; 55% and above in Class 12th.

Quantum School of Technology
Master of Technology in Computer Science & Engineering
CURRICULUM (2018-19)
Program Code-01-4-03

BREAKUP OF COURSES

Sr. No	CATEGORY	CREDITS
1	Program Core (PC)	27
2	Program Electives (PE)	15
3	Project/Dissertation	15
4	Seminar	6
5	General Proficiency	3
	TOTAL NO. OF CREDITS	66

SEMESTER-WISE BREAKUP OF CREDITS

Sr.No	CATEGORY	SEM1	SEM 2	SEM3	SEM 4	TOTAL
1	Program Core	19	5	3		27
2	Program Electives		9	6		15
3	Projects/Dissertation			4	11	15
4	Seminar	2	2	2		6
5	General Proficiency	1	1	1		3
	TOTAL	22	17	16	11	66

MINIMUM CREDIT REQUIREMENT = 66

SEMESTER 1

Course Code	Category	Course Title	L	T	P	C	Version	Course Prerequisite
CS4106	PC	Advanced Discrete Structure	3	2	0	4	1.0	Nil
CS4107	PC	Advanced Design and Analysis of Algorithm	3	2	0	4	1.0	Nil
CS4108	PC	Computer Network and Distributed Systems	3	2	0	4	1.0	Nil
CS4109	PC	Advanced Operating Systems	2	2	0	3	1.0	Nil
CS4110	PC	Advanced Computer Architecture	2	2	0	3	1.0	
CS4141	PC	Advanced Operating Systems Lab	0	0	2	1	1.0	Nil
CS4171	FW	Seminar-I	2	0	0	2		
GP4101	GP	General Proficiency	0	0	0	1		
		TOTAL	15	10	2	22		

Contact Hrs:27

SEMESTER 2

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CS4208	PC	Advanced Data Base Management System	3	1	0	4	1.0	Nil
CS4241	PC	Advanced Data Base Management System Lab	0	0	2	1	1.0	Nil
	PE	Program Elective-I	3	0	0	3	1.0	Nil
	PE	Program Elective-II	3	0	0	3	1.0	Nil
	PE	Program Elective-III	3	0	0	3	1.0	Nil
CS4271	FW	Seminar-II	2	0	0	2		
GP4201	GP	General Proficiency	0	0	0	1		
		TOTAL	14	1	2	17		

Contact Hrs:17

SEMESTER 3

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
	PE	Program Elective IV	3	0	0	3	1.0	Nil
	PE	Program Elective V	3	0	0	3	1.0	Nil
CS4372	FW	Project	0	0	8	4	1.0	Nil
ME4307	PC	Research Methodology	2	0	0	2	1.0	Nil
ME4340	PC	Research Methodology Lab	0	0	2	1	1.0	Nil
CS4373	FW	Seminar-III	2	0	0	2	1.0	Nil
GP4301	GP	General Proficiency	0	0	0	1		
		Total	**10**	**0**	**10**	**16**		

Contact Hrs:20

SEMESTER 4

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CS4471	FW	Dissertation	0	0	4	11	1.0	Nil
		Total	**0**	**0**	**4**	**11**		

Contact Hrs:4

Program Elective (PE)

Elective	Course Code	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
I	CS4209	Web Technology	3	0	0	3	1.0	Nil
	CS4210	Advanced Theory of Computation	3	0	0	3	1.0	Nil
II	CS4211	Data Mining and Data Warehousing	3	0	0	3	1.0	Nil
	CS4212	Modeling and Simulation	3	0	0	3	1.0	Nil
III	CS4213	Soft Computing	3	0	0	3	1.0	Nil
	CS4214	Artificial Intelligence	3	0	0	3	1.0	Nil
IV	CS4304	Pattern Recognition	3	0	0	3	1.0	Nil
	CS4305	Information System Audit	3	0	0	3	1.0	Nil
V	CS4306	Multimedia and Graphics	3	0	0	3	1.0	Nil
	CS4303	Cyber Laws	3	0	0	3	1.0	Nil

B. Choice Based Credit System (CBCS)

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

The following is the course module designed for the M.TECH program:

Core competency: Students will acquire core competency in computer application studies and in allied subject areas.

Program/Discipline Specific Elective Course (DSEC):

Skilled communicator: The course curriculum incorporates basics and advanced training in order to make a graduate student capable of expressing the subject through technical writing as well as through oral presentation.

Critical thinker and problem solver: The course curriculum also includes components that can be helpful to post graduate students to develop critical thinking ability by way of solving problems/numerical using basic & advance knowledge and concepts of Computer Applications.

Sense of inquiry: It is expected that the course curriculum will develop an inquisitive characteristic among the students through appropriate questions, planning and reporting experimental investigation.

Skilled project manager: The course curriculum has been designed in such a manner as to enabling a post graduate student to become a skilled project manager by acquiring knowledge about computer application project management, planning, study of ethical standards and rules and regulations pertaining to scientific project operation.

Ethical awareness/reasoning: A post graduate student requires understanding and developing ethical awareness/reasoning which the course curriculums adequately provide.

Lifelong learner: The course curriculum is designed to inculcate a habit of learning continuously through use of advanced ICT technique and other available techniques/books/journals for personal academic growth as well as for increasing employability opportunity.

Value Added Course (VAC): A value added audit course is a non-credit course which is basically meant to enhance general ability of students in areas like soft skills, quantitative aptitude and reasoning ability - required for the overall development of a student and at the same time crucial for industry/corporate demands and requirements. The student possessing these skills will definitely develop acumen to perform well during the recruitment process of any premier organization and will have the desired confidence to face the interview. Moreover, these skills are also essential in day-to-day life of the corporate world. The aim is to nurture every student for making effective communication, developing aptitude and a general reasoning ability for a better performance, as desired in corporate world. There shall be four courses of Aptitude in Semester I, II, III & IV semesters and two courses of Soft Skills in III & IV Semesters and will carry no credit, however, it will be compulsory for every student to pass these courses with minimum

45% marks to be eligible for the certificate. These marks will not be included in the calculation of CGPI. Students have to specifically be registered in the specific course of the respective semesters.

Skill Enhancement Course: This course may be chosen from a pool of courses designed to provide value-based and/or skill-based knowledge.

Generic/Open Elective Course (OEC): Open Elective is an interdisciplinary additional subject that is compulsory in a program. The score of Open Elective is counted in the overall aggregate marks under Choice Based Credit System (CBCS). Each Open Elective paper will be of 3 Credits in III, IV and VI semesters. Each student has to take Open/Generic Electives from department other than the parent department. Core / Discipline Specific Electives will not be offered as Open Electives.

Non-Credit CGPA : This is a compulsory course but audit that does not have any choice and will be of 3 credits. Each student of M.TECH program has to compulsorily pass the Environmental Studies and Human values & professional Ethics and NSS.

C. Program Outcomes of M.TECH:

- PO1. **Engineering Knowledge:** Exhibit in-depth knowledge in computer engineering specialization.
- PO2. **Problem Analysis:** Think critically and analyze complex engineering problems to make creative advances in theory and practice..
- PO3. **Design/Development of Solutions:** An ability to design solutions for engineering problems and to design a component, system, or process that meet the specified needs with appropriate consideration for the public health and safety, along with the cultural, societal, and environmental considerations.
- PO4. **Conduct Investigations of Complex Problems:** Use research methodologies, techniques and tools, and will contribute to the development of technological knowledge.
- PO5. **Modern tool usage**: Apply appropriate techniques, modern engineering tools to perform modeling of complex engineering problems with knowing the limitations.
- PO6. **The Engineer and Society:** Achieve professional success with an understanding and appreciation of ethical behavior, social responsibility, and diversity, both as individuals and in team environments.
- PO7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge for sustainable development to articulate a comprehensive world view that integrates diverse approaches to sustainability
- PO8. **Communication:** Communicate complex engineering problems with the engineering community and society, write and present technical reports effectively
- PO9 **Ethics: Exhibit professional and intellectual integrity, ethics of research and scholarship and will realize the responsibility towards the community**
- PO10. **Individual and Team work:** An ability to analyze the local and global impact of computing on individuals, organizations, and society.
- PO11. **Project Management and Finance**: Demonstrate knowledge and understanding of engineering and management principles and apply the same with due consideration to economical and financial factors.
- PO12 **Life-long learning:** Engage in life-long learning with a high level of enthusiasm and commitment to improve knowledge and competence continuously

D. Program Specific Outcomes:

PSO1: Apply knowledge of engineering fundamentals to analyze and solve complex Computer Science and Engineering problems.

PSO2: Provide engineering solutions to meet the specified needs with appropriate consideration for comfort, safety, social and environmental aspects.

Program Educational Objectives (PEO's)

PEO 1: Analyze and solve Computer Science and Engineering problems using modern engineering tools in industry or in research establishments.

PEO 2: Play key role in collaborative multidisciplinary scientific research with due consideration to economical and financial factors for leading a successful career in industry or to pursue higher education or being an entrepreneur.

PEO 3: Engage in life-long learning with professional code of conduct.

E. Pedagogy & Unique practices adopted:

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

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

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

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

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

MOOCs: Students may earn credits by passing MOOCs as decided by the college. Graduate level programs may award Honors degree provided students earn pre-requisite credits through MOOCs. University allows students to undertake additional subjects/course(s) (In-house offered by the university through collaborative efforts or courses in the open domain by various internationally recognized universities) and to earn additional credits on successful completion of the same. Each course will be approved in advance by the University following the standard procedure of approval and will be granted credits as per the approval. Keeping this in mind, University proposed and allowed a maximum of two credits to be allocated for each MOOC courses. In the pilot phase it is proposed that a student undertaking and successfully completing a MOOC course through only NPTEL could be given 2 credits for each MOOC course.

For smooth functioning and monitoring of the scheme the following shall be the guidelines for MOOC courses, Add-on courses carried out by the College from time to time.

a) It will necessary for every student to take at least one MOOC Course throughout the programme.

b) There shall be a MOOC co-ordination committee in the College with a faculty at the level of Professor heading the committee and all Heads of the Department being members of the Committee.

c) The Committee will list out courses to be offered during the semester, which could be requested by the department or the students and after deliberating on all courses finalize a list of courses to be offered with 2 credits defined for each course and the mode of credit consideration of the student. The complete process shall be obtained by the College before end of June and end of December for Odd and Even semester respectively of the year in which the course is being offered. In case of MOOC course, the approval will be valid only for the semester on offer.

d) Students will register for the course and the details of the students enrolling under the course along with the approval of the Vice Chancellor will be forwarded to the Examination department within fifteen days of start of the semester by the Coordinator MOOC through the Principal of the College.

e) After completion of MOOC course, Student will submit the photo copy of Completion certificate of MOOC Course to the Examination cell as proof.

f) Marks will be considered which is mentioned on Completion certificate of MOOC Course.

g) College will consider the credits only in case a student fails to secure minimum required credits then the additional subject(s) shall be counted for calculating the minimum credits required for the award of degree.

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

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

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

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

Induction program: Every year 3 weeks induction program is organized for 1st year students and senior students to make them familiarize with the entire academic environment of university including Curriculum, Classrooms, Labs, Faculty/ Staff members, Academic calendar and various activities.

Mentoring scheme: There is Mentor-Mentee system. One mentor lecture is provided per week in a class. Students can discuss their problems with mentor who is necessarily a teaching faculty. In this way, student's problems or issues can be identified and resolved.

Competitive exam preparation: Students are provided with one class in every week for GATE/ Competitive exams preparation.

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

Career & Personal Counseling: - Identifies the problem of student as early as possible and gives time to discuss their problems individually as well as with the parents. Counseling enables the students to focus on behavior and feelings with a goal to facilitate positive change. Its major role lies in giving: Advice, Help, Support, Tips, Assistance, and Guidance.

Participation in Flip Classes, Project based Learning (A2 Assignment), Workshops, Seminars & writing & Presenting Papers: Departments plan to organize the Flip Classes, Project based Learning (A2 Assignment), workshops, Seminars & Guest lecturers time to time on their respective topics as per academic calendar. Students must have to attend these programs. This participation would be count in the marks of general Discipline & General Proficiency which is the part of course scheme as non-credit course.

Formation of Student Clubs, Membership & Organizing & Participating events: Every department has the departmental clubs with the specific club's name. The entire student's activity would be performed by the club. One faculty would be the coordinator of the student clubs & students would be the members with different responsibility.

Capability Enhancement & Development Schemes: The Institute has these schemes to enhance the capability and holistic development of the students. Following measures/ initiatives are taken up from time to time for the same: Career Counseling, Soft skill development, Remedial Coaching, Bridge Course, Language Lab, Yoga and Meditation, Personal Counseling

Library Visit & Utilization of QLRC: Students may visit the library from morning 10 AM to evening 8 PM. Library created its resources Database and provided Online Public Access Catalogue (OPAC) through which users can be accessed from any of the computer connected in the LAN can know the status of the book. Now we are in process to move from OPAC to KOHA.

Detailed Syllabus (Semester wise /course wise)

SEMESTER 1 Year -1

CS4106	Title: Advanced Discrete Structure	L T P C 3 2 0 4
Version No.	1.0	
Course Prerequisites	Nil	
Objective	Demonstrate the ability to write and evaluate a proof or outline the basic structure of and give examples of each proof technique described.Understand the basic principles of sets and operations in sets	
Expected Outcome	A number of recurring themes, and a set of general principles that have broad application to the field of computer science and discrete mathematics. The social, legal, ethical, and cultural issues inherent in the discipline of computing.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit 1	Set. Relation and Functions	7
Set, relations, equivalence relations; mappings-one-one and on to; - Definition of an algebraic structure; - Introduction to groups, subgroups, normal subgroups, isomorphism, homeomorphism; automorphism of groups; semigroups, monoids, rings, vector space.		
Unit 2	Logic	8
Logic operators, Truth table, Normal forms - Theory of inference and deduction. - Mathematical induction. - Predicate calculus; predicates and quantifiers. - Boolean algebra. - Lattice.		
Unit 3	Combinatorics	6
Basic counting techniques. - Recurrence relations and their solutions. - Generating functions.		
Unit 4	Modular Arithmetic	7
Congruence modulo, Fermat s Theorem, Euler s Theorem, Multiplicative Inverse, Reminder Theorem, FFT, Discrete Logarithm		
Unit 5	Number Theory	8
Introduction to Number theory, Divisibility, modular arithmetic (addition modulo and multiplication modulo); Statements and applications of Euler and Fermat Theorems, Primitive Roots, Discrete Logarithms, Primality Test, Finding Large primes, Definition of Elliptic Curves and their applications to Cryptography.		
Text Books	1. Liu, C. L. : Introduction to Discrete Mathematics. 2. Trembley, Manohar : Discrete Mathematical Structures.	
Reference Books	1. Somasundaram, “Discrete Mathematical structures”, PHI 2. Kolman, Busby & Ross, “Discrete Mathematical structures, PHI	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	03-03-2018	
Date of Approval by the Academic Council on	11-06-2018	

Course Outcome for CS4106

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Ability to apply mathematical logic to solve problems	2	Emp
CO2	Understand sets, relations, functions and discrete structures	2	S
CO3	Able to use logical notations to define and reason about fundamental mathematical concepts such as sets relations and functions	2	S
CO4	Able to formulate problems and solve recurrence relations	2	En
CO5	Able to model and solve real world problems using graphs and trees	1	None

CO-PO Mapping for CS4106

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	1	2	2	1	2	2	2	2	2	2	1	2
CO 2	2	3	2	2	3	2	3	2	2	2	2	2	3	2
CO 3	3	2	1	3	1	2	1	2	2	2	2	2	2	3
CO 4	3	3	3	2	2	2	2	2	2	2	2	2	2	2
CO 5	2	3	3	2	2	3	2	3	3	3	3	3	2	1
Avg	2.6	2.6	2	2.2	2	2	2	2.2	2.2	2.2	2.2	2.2	2	2

CS4107	Title: Advanced Design and Analysis of Algorithm	L T P C 3 2 0 4
Version No.	1.0	
Course Prerequisites	Nil	
Objective	To introduce the concepts of Algorithm Analysis, Time Complexity, Space Complexity. To discuss various Algorithm Design Strategies with proper illustrative examples. To introduce Complexity Theory.	
Expected Outcome	After the completion of this course, the students will be able to design and analysis the optimal programs.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit 1	Algorithm Fundamentals	8
Basic Concept, Analysis of Algorithm, Growth of Functions, Master's Theorem. Sorting Algorithms: Overview, Merge sort, Quick sort, Heap sort, radix sort.		
Unit 2	Advance Data Structure	7
Red-Black Trees, B/B+ Trees. Binomial Heap , Fibonacci Heap		
Unit 3	Advance Design and Analysis Techniques	7
Dynamic Programming: LCS MCM, ,Branch and Bound, Back Tracking, TSP		
Unit 4	Graph Algorithms	7
Graph Algorithm: DFS and BFS algorithm. Minimum Spanning Tree Prim Kruskal Shortest Paths: Single source and All pair Shortest path		
Unit 5	String Matching and NP Completeness	7
String Matching and NP Completeness		
Text Books	1. Ellis Horowitz, SartajSahni, Sanguthevar Rajasekaran, Computer Algorithms, Universities Press, 2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Introduction to Algorithms, MIT Press,	
Reference Books	1. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, The Design and Analysis of Computer Algorithms, Pearson Education 2. Anany Levitin, Introduction to the Design and Analysis of Algorithms, Pearson	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	03-03-2018	
Date of Approval by the Academic Council on	11-06-2018	

Course Outcome for CS4107

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Express combinatorial problems as maximum flow/minimum cut problems, as linear programs, or as integer linear programs.	3	**s**
CO2	Perform reductions to prove NP-completeness.	3	**Emp**
CO3	Explain what NP-completeness means and does not mean.	2	**Emp**
CO4	Devise algorithms that solve NP-complete problems on restricted classes of graphs.	2	**Emp**
CO5	Use linear programming to obtain approximation algorithms for certain optimization problems.	2	**Emp**

CO-PO Mapping for CS4107

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	2	2	1	2	3	2	3	2	2	2	2	2
CO 2	3	3	3	3	2	2	3	3	3	3	2	1	2	2
CO 3	2	3	3	3	2	2	3	1	3	3	2	3	3	2
CO 4	3	2	3	2	3	2	3	2	3	2	2	2	2	3
CO 5	3	2	3	3	2	2	3	2	3	3	2	2	2	2
Avg	2.8	2.6	2.8	2.6	2	2	3	2	3	2.6	2	2	2.2	2.2

CS4108	Title: Computer Network and Distributed Systems	L T P C 3 2 0 4
Version No.	1.0	
Course Prerequisites	CS3405	
Objective	The course is designed to give students a clear overview of the problems and issues that must be dealt with in constructing robust and flexible distributed applications as well as the underlying network protocols needed to support them. The emphasis is on the conceptual basis for distributed and networked systems rather than a detailed study of particular systems and standards.	
Expected Outcome	After the completion of this course, the students will get sound understanding of the principles and concepts involved in designing distributed systems and Internet applications & Ability to understand and evaluate network and security solutions.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit 1	Computer Network Fundamentals	7
Introduction to Computer Network, Types of Networks, OSI Reference Model, TCP/IP Model, Physical Transmission Medias, Network Performance Indicators & Delay Analysis, Network Topologies, Network Interfaces, Protocols & Services.		
Unit 2	MAC & Data link Protocols	7
Media Access Control - Deterministic and Probabilistic, IEEE 802.x Standards for Wired & Wireless Networking, Data Framing Techniques, Error Handling(Detection & Correction) Techniques, Flow Control & Physical Addressing.		
Unit 3	Interconnecting Network & Internet Protocols	8
Brief introduction to Bridges, Switches & Routers, Connection Oriented & Connectionless Services, Routing Concept & Routing Protocols, Port Addressing , IP(Logical) Addressing, NAT, Sub Netting & Super Netting, ARP & RARP, IP & ICMP, UDP & TCP Header Formats, DNS, Introduction to Cellular Network(GSM,CDMA,WCDMA,OFDM), Wireless Network Planning & KPI.		
Unit 4	Distributed System Design Concept	7
Distributed System Architecture, Design Issues, System Structures, ODP Reference Model and distribution Transparencies, Logical and Global Clock Concept, Interaction Primitives & Implementation (Message Passing, Remote Procedure Call, and Remote Object Invocation), Concurrency Control Techniques, Thread Management.		
Unit 5	Security in Network & Distributed System	7
Network Threat Analysis, Security Policies - Military (Bell Lapadula) Vs Commercial Models, Access Control Concepts - Identification, Authentication, Authorization and Delegation, Authorization Policy- Access Matrix, Access Rules and Domains, Access Control Lists, Secret and public Key Encryption, Digital Signatures, Authentication, IPSec, Kerberos.		
Text Books	1. Coulouris ,Distributed System Concept & Design, , Wesley. 2. Tanenbaum, Andrew S ,Computer Networks, , Pearson Education.	
Reference Books	1. Tanenbaum, Andrew S, Distributed System Principles & Paradigms, , Prentice Hall. 2. Stallings, William, Network Security Essentials, Pearson Education.	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	03-03-2018	
Date of Approval by the Academic Council on	11-06-2018	

Course Outcome for CS4108

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Explain in a concise manner how the Internet is constructed and functions.	2	s
CO2	Reason about design choices at different layers in the TCP/IP protocol stack.	3	Emp
CO3	Use standard tools to debug a network path and work in a distributed manner.	3	Emp
CO4	Explain basic data and net security.	3	Emp
CO5	Theorize about different types of limitations in an Internet based distributed system.	3	Emp

CO-PO Mapping for CS4108

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
CO 1	3	2	2	2	2	2	1	1	3	3	3	2	2	2
CO 2	1	1	3	2	1	2	2	2	1	2	2	2	1	2
CO 3	2	2	2	2	2	3	3	3	3	1	2	3	2	2
CO 4	2	3	2	2	2	3	3	2	2	2	3	1	2	3
CO 5	3	2	1	3	3	2	2	2	1	2	1	2	3	2
Avg	2.2	2	2	2.2	2	2.4	2.2	2	2	2	2.2	2	2	2.2

CS4109	Title: Advanced Operating System	L 2	T 2	P 0	C 3
Version No.	1.0				
Course Prerequisites	Nil				
Objective	A study of modern operating systems general concepts and distributed operating systems				
Expected Outcome	This module is focused on developing web and mobile applications in the cloud. By the end of this module the student will have a detailed overview of the distributed operating system.				

Unit No.	Unit Title	No. of hours (per Unit)
Unit 1	Distributed Operating System	5
Architectures, Issues in Distributed operating systems, Limitations of Distributed Systems, Lamport's logical clock, Global states, Chandy-Lampert's global state recording algorithm, Basic concepts of Distributed Mutual Exclusion, Lamport's Algorithm, Ricart-Agrawala Algorithm		
Unit 2	Distributed Resource Management	4
Distributed File systems, Architecture, Mechanisms, Design Issues, Distributed Shared Memory, Architecture, Algorithm and Protocols - Design Issues. Distributed Scheduling, Issues, Components, Algorithms.		
Unit 3	Distributed OS Implementation	6
Models, Naming, Process migration, Remote Procedure Calls. Failure Recovery and Fault Tolerance: Basic Concepts-Classification of Failures, Basic Approaches to Recovery; Recovery in Concurrent System; Synchronous and Asynchronous Check pointing and Recovery; Check pointing in Distributed Database Systems; Fault Tolerance; Issues - Two-phase and No blocking Commit Protocols; Voting Protocols; Dynamic Voting Protocols		
Unit 4	Multiprocessor System	4
Definition, Classification, Multiprocessor Interconnections, Types, Multiprocessor OS functions & requirements; Design & Implementation Issue; Introduction to parallel programming; Multiprocessor Synchronization.		
Unit 5	Real Time Operating System	6
Fundamentals of real time operating systems, real time multitasking, embedded application, preemptive task scheduling, inter-task communication and synchronization. Analytic Modeling: Introductions, Queuing Theory, Markov Process		

Text Books	1. Milan Milen kovic ,Operating Systems Concepts & Design-,TMH 2. H.M. Deitel ,Operating System-, Pearsons.
Reference Books	1. Mukesh Singhal and N. G. Shivaratri, "Advanced Concepts in Operating Systems", McGraw- Hill 2. Abraham Silberschatz, Peter B. Galvin, G. Gagne, "Operating System Concepts", Addison Wesley Publishing
Mode of Evaluation	Internal and External Examinations
Recommended by Board of Studied on	03-03-2018
Date of Approval by the Academic Council on	11-06-2018

Course Outcome for CS4109

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Hands-on experience with the development of a specific system on an operating system. By analyzing a research problem with scientific methods, the students will focus on system development, including system design, implementation, performance analysis and evaluation	2	s
CO2	Designing the evaluation plan to test the developed system in a comprehensive way	2	S
CO3	Learning the recent development of Operating Systems and understanding the new techniques that advance the start-of-the-art of Operating Systems.	2	Emp
CO4	Identifying the major research challenges in current research of Operating Systems; Accomplishing a project and write the project results with high standard.	3	Emp
CO5	Working in a team and presenting the results by oral presentation.	3	Emp

CO-PO Mapping for CS4109

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	1	3	2	1	3	3	2	2	2	3	2	2	3
CO 2	1	2	2	2	2	1	2	2	3	1	1	2	2	3
CO 3	2	2	3	3	3	2	2	2	2	3	3	2	3	2
CO 4	2	2	2	3	2	3	3	3	3	2	2	2	3	2
CO 5	3	3	2	3	2	2	2	2	2	3	3	2	3	3
Avg	2.2	2	2.4	2.6	2	2.2	2.4	2.2	2.4	2.2	2.4	2	2.6	2.6

CS4110	Title: Advanced Computer Architecture	L T P C 2 2 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	The syllabus includes: Principles of computer design; Instruction set design concepts; Performance enhancements- advanced pipelining, dynamic scheduling, branch prediction, vector processors; Memory hierarchy design- caches and virtual memory; Modern architectures: RISC, Super Scalar, VLIW; Thread-level parallelism; , Multi-core and Multi-CPU systems; Interconnection networks, Clusters and Grid computing.	
Expected Outcome	Technical competence in computer architecture and high performance computing. Ability to describe the operation of modern and high performance computers. Ability to undertake performance comparisons of modern and high performance computers. Ability to improve the performance of applications on modern and high performance computers.	

Unit No.	Unit Title	No. of hours (per Unit)
Unit 1	Fundamentals of Computer Design	5
Review of Fundamentals of CPU, Memory and IO – Trends in technology, power, energy and cost, Dependability - Performance Evaluation, Introduction; Pipeline hazards; Implementation of pipeline		
Unit 2	Instruction Level Parallelism	5
Review of Fundamentals of CPU, Memory and IO – Trends in technology, power, energy and cost, Dependability - Performance Evaluation.		
Unit 3	Data Level Parallelism	4
DATA-LEVEL PARALLELISM: Vector architecture – SIMD extensions – Graphics Processing units – Loop level parallelism.		
Unit 4	Thread Level Parallelism	5
Symmetric and Distributed Shared Memory Architectures – Performance Issues –Synchronization – Models of Memory Consistency – Case studies: Intel i7 Processor, SMT & CMP Processors.		
Unit 5	Memory And I/O	5
Cache Performance – Reducing Cache Miss Penalty and Miss Rate – Reducing Hit Time – Main Memory and Performance – Memory Technology. Types of Storage Devices – Buses – RAID – Reliability, Availability and Dependability – I/O Performance Measures.		

Text Books	1.John L Hennessy and David A Patterson “Computer Architecture: A Quantitative Approach” Elsevier
Reference Books	1.Kai Hwang.“Advanced Computer Architecture: Parallelism, Scalability, Programmability” McGraw-Hill Education
Mode of Evaluation	Internal and External Examinations
Recommended by Board of Studied on	03-03-2018
Date of Approval by the Academic Council on	11-06-2018

Course Outcome for CS4110

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	To make students know about the Parallelism concepts in Programming	2	s
CO2	To give the students an elaborate idea about the different memory systems and buses.	2	S
CO3	To introduce the advanced processor architectures to the students.	2	Emp
CO4	To make the students know about the importance of multiprocessor and multicomputers.	3	Emp
CO5	To study about data flow computer architectures	3	Emp

CO-PO Mapping for CS4110

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	1	3	2	3	1	2	2	3	1	3	2	2	2
CO 2	3	3	2	2	3	3	2	3	2	3	2	2	2	2
CO 3	2	2	2	3	2	2	2	3	2	3	2	2	3	2
CO 4	2	3	2	3	2	3	2	3	2	3	3	2	1	3
CO 5	3	2	2	3	2	3	2	3	3	2	2	2	2	3
Avg	2.2	2.2	2.2	2.6	2.4	2.4	2	2.8	2.4	2.4	2.4	2	2	2.4

CS4141	Title: Advanced Operating System Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To make students able to learn different types of operating systems along with concept of file systems and CPU scheduling algorithms used in operating system. To provide students knowledge of memory management and deadlock handling algorithms.	
Expected Outcome	At the end of the course, students will be able to implement various algorithms required for management, scheduling, allocation and communication used in operating system.	

List of Experiments

1. Design, develop and execute a program using any thread library to create number of threads specified by the user ,each thread independently generate a random integer as an upper limit and then computes and prints the number of primes less than or equal to that upper limit along with that upper limit.

2. Rewrite above program such that the processes instead of threads are created and the number of child processes created is fixed as two. The program should make use of kernel timer to measure and print the real time, processor time user space time and kernel space for each process

3. Design, develop and implement a process with a producer thread and a consumer thread which make use of bounded buffer (size can be prefixed at a suitable value) for communication. Use any suitable synchronization construct.

4. Design and execute a program to solve a system of n linear equations using Successive Over relaxation method and n processes which use Shared Memory API.

5. Design, develop, and execute a program to demonstrate the use of RPC.

Mode of Evaluation	Internal and External Examinations
Recommended by Board of Studied on	03-03-2018
Date of Approval by the Academic Council on	11-06-2018

Course Outcome for CS4141

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	To understand the challenges of the system software in modern era computing like cloud computing, Big-data analytics and IoT.	3	Emp
CO2	To promote research activities to uphold in the theory and practice.	3	Emp
CO3	To develop scientific writing skills through a series of laboratory reports	3	Emp

CO-PO Mapping for CS4141

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	1	2	2	1	3	2	2	3	2	2	2	3	3
CO 2	1	3	2	2	3	1	2	2	2	2	2	2	1	3
CO 3	2	2	2	3	2	2	2	3	2	3	3	3	3	2
Avg	2.00	2.00	2.00	2.33	2.00	2.00	2.00	2.33	2.33	2.33	2.33	2.33	2.33	2.67

SEMESTER 2

CS4208	Title: Advanced Data Base Management System	L T P C 3 1 0 4
Version No.	1.0	
Course Prerequisites	Nil	
Objective	To evaluate emerging architectures for database management systems ,To develop an understanding of the manner in which relational systems are implemented and the implications of the techniques of implementation for database performance	
Expected Outcome	At the end of the course students should be able to: critically assess new developments in database technology, Interpret and explain the impact of emerging database standards	
Unit No.	Unit Title	No. of hours (per Unit)
Unit 1	The Relational Model of Data and RDBMS Implementation Techniques	7
Theoretical concepts, Relational model conformity and Integrity, Advanced SQL programming, Query optimization, Concurrency control and Transaction management, Database performance tuning, Distributed relational systems and Data Replication, Security considerations.		
Unit 2	The Extended Entity Relationship Model and Object Model	7
The ER model revisited, Motivation for complex data types, User defined abstract data types and structured types, Subclasses, Super classes, Inheritance, Specialization and Generalization, Constraints and Characteristics of specialization and Generalization, Relationship types of degree higher than two		
Unit 3	Emerging Database Management System Technologies	8
Object Oriented Database concepts: object identity, structure, and type constructors; encapsulation of operations, methods, and persistence; type and class hierarchies and inheritance; structures and unstructured complex objects and type extensibility; polymorphism, multiple inheritance and selective inheritance, versions and configurations; Object Relational Database concepts: overview of SQL and its object- relational features (the SQL standard and its components.		
Unit 4	New database applications and environments	7
Data Mining: Overview of data mining technology (associated rules, classification, clustering), applications of data mining; Data Warehousing: Overview of data warehousing, typical functionality of a data warehouse		
Unit 5	Database Related Standards	7
SQL standards, SQL 1999, SQL 2003, Object Data Management Group (ODMG) version 3.0 standards (ODL, OQL), Standards for interoperability and integration e.g. Web Services, SOAP, XML related specifications, e.g. XML Documents, DTD, XML Schema, X-Query, X- Path.		
Text Books	1. Elmasri and Navathe, Fundamentals of Database Systems, Pearson Education	
Reference Books	1. Korth, Silberchatz, Sudarshan, Database Systems, Design, Implementation and Management, Thomson Learning 2. C.J. Date & Longman, Introduction to Database Systems, Pearson Education	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	03-03-2018	
Date of Approval by the Academic Council on	11-06-2018	

Course Outcome for CS4208

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Explain and evaluate the fundamental theories for advanced database architectures and query operators.	3	s
CO2	Design and implement parallel database systems with evaluating different methods of storing, managing of parallel database.	3	S
CO3	Assess and apply database functions of distributed database.	3	Emp
CO4	Evaluate different database designs and architecture.	2	Emp
CO5	Administer and analyze database with query optimization techniques and develop Web interface with database.	2	Emp

CO-PO Mapping for CS4208

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	2	2	3	2	1	1	2	2	2	2	1	1
CO 2	3	2	3	3	3	2	3	3	3	3	3	2	2	2
CO 3	3	2	3	3	2	2	2	3	3	2	2	3	3	3
CO 4	2	2	3	2	2	3	3	2	2	2	2	3	2	2
CO 5	2	2	2	3	3	3	3	3	2	2	2	2	2	2
Avg	2.75	2.25	2.75	2.5	2.5	2.25	2.25	2.25	2.5	2.25	2.25	2.5	2	2

CS4241	Title: Advanced Database Management System Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	to provide a sound introduction to the discipline of database management asa subject in its own right, rather than as a compendium of techniques and product-specific tools., to familiarize the participant with the nuances of database environments towards an information-oriented data-processing oriented framework, to give a good formal foundation on the relational model of data, to present SQL and procedural interfaces to SQL comprehensively	
Expected Outcome	Understand, appreciate and effectively explain the underlying concepts of database technologies, Design and implement a database schema for a given problem-domain, Normalize a database, Populate and query a database using SQL DML/DDL commands.Declare and enforce integrity constraints on a database using a state-of-the-artRDBMS	

List of Experiments

1. Study of DBMS, RDBMS and ORDBMS.
2. 2. To study Data Definition language Statatements.
3. 3. To study Data Manipulation Statatements.
4. 4. Study of SELECT command with different clauses.
5. 5. Study of SINGLE ROW functions (character, numeric, Data functions).
6. 6. Study of GROUP functions (avg, count, max, min, Sum).
7. 7. Study of various type of SET OPERATORS (Union, Intersect, Minus).
8. 8. Study of various type of Integrity Constraints.
9. 9. Study of Various type of JOINS.
10. 0. To study Views and Indices.

Mode of Evaluation	Internal and External Examinations
Recommended by Board of Studied on	03-03-2018
Date of Approval by the Academic Council on	11-06-2018

Course Outcome for CS4241

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Understand, appreciate and effectively explain the underlying concepts of database technologies	2	s
CO2	Design and implement a database schema for a given problem-domain	2	Emp
CO3	Normalize a database	2	Emp

CO-PO Mapping for CS4241

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	2	3	2	2	2	3	2	3	2	2	2	2	2
CO 2	2	3	3	3	3	2	3	3	3	3	2	2	3	2
CO 3	3	3	3	3	2	2	3	2	3	3	3	3	1	3
Avg	2.33	2.67	3.00	2.67	2.33	2.00	3.00	2.33	3.00	2.67	2.33	2.33	2.00	2.33

Program Elective (PE) :

CS4209	Title: Web Technology	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	Write syntactically correct HTTP messages and describe the semantics of common HTTP methods and header fields,Discuss differences between URIs, URNs, and URLs, and demonstrate a detailed understanding of http-scheme URLs, both relative and absolute	
Expected Outcome	Web Design & Development will be able to Employ fundamental computer theory to basic programming techniques.Use fundamental skills to maintain web server services required to host a website.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit 1	Introduction	7
Review of web technology, Review of HTML and JAVA Script		
Unit 2	Issues of Web Technology	7
Architectural issues of web layer, HTTP & FTP Protocols, Tier Technology: 2-Tier, 3-Tier and n-Tier		
Unit 3	The Client Tier	7
Representing content, XML, DTD's, Schemas, Stylesheets and Transformation: CSS, XSL/XSLT, SAX, and DOM, Client-side Programming		
Unit 4	The Server Tier	8
Web Server Concept, Creating Dynamic Content, Using Control Flow to control Dynamic Control Generation, Sessions and State, Error handling, Authentication, Architecting web application, Using tag libraries, Writing tag libraries		
Unit 5	Introduction to Advanced Server Side Issues	7
Server Side scripting, Static Sites, Dynamic Scripting, Difference between Server Side and Client side, delivery information		
Text Books	1. A.A Puntambekar ,Web Technologies , Technical Publications	
Reference Books	1. Web Technologies: HTML, JAVASCRIPT, PHP, JAVA, JSP, ASP.NET, XML and Ajax, Black Book: HTML, Javascript, PHP, Java, Jsp, XML and Ajax, Black Book 2. Modern Web Development: Understanding domains, technologies, and user experience	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	03-03-2018	
Date of Approval by the Academic Council on	11-06-2018	

Course Outcome for CS4209

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Describe the concepts of World Wide Web, and the requirements of effective web design.	2	S
CO2	Develop web pages using the HTML and CSS features with different layouts as per need of applications.	3	S
CO3	Use the JavaScript to develop the dynamic web pages.	3	Emp
CO4	Construct simple web pages in PHP and to represent data in XML format.	2	Emp
CO5	Use server side scripting with PHP to generate the web pages dynamically using the database connectivity.	3	Emp

CO-PO Mapping for CS4209

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	3	2	3	1	1	2	1	2	2	1	2	2	3
CO 2	2	3	2	3	3	1	2	1	2	2	2	2	3	3
CO 3	2	3	2	3	3	3	2	3	2	2	2	2	3	3
CO 4	2	2	2	2	3	3	2	3	2	2	2	2	3	1
CO 5	3	3	3	2	2	3	3	3	3	3	3	3	3	2
Avg	2.2	2.8	2.2	2.6	2.4	2.2	2.2	2.2	2.2	2.2	2	2.2	2.8	2.4

CS4210	Title: Advanced Theory of Computation	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	The course gives overview about structures of Languages, Grammars and Automata	
Expected Outcome	Computational and complexity-theoretic aspects of learning. Investigation of formal models of learning. Other learning paradigms. Neural networks and learning., Complexity approach to learning to design of learning system.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit 1	Introduction	8
Alphabets, Strings and Languages; Automata and Grammars, Finite automata, NFA/DFA: Definition, Language, Notation, State transition graph, Transition table, Equivalence of NFA and DFA, Myhill-Nerode Theorem		
Unit 2	Regular Expressions	8
Regular Expression, RE to FA, FA to RE, Pumping Lemma for regular Languages, Closure properties of Regular Languages, Decision properties of Regular Language & their Proofs		
Unit 3	Context Free Grammars	6
Definition, Derivation trees, Ambiguity, Normal forms for CFG, Closure & Decision Properties of CFL, Emptiness Testing, and Pumping Lemma		
Unit 4	Push Down Automata	7
PUSH DOWN AUTOMATA: Language, definition, Instantaneous Description and Acceptance of PDA, Equivalence and Conversion of PDA and CFG.		
Unit 5	Code Generation	7
Definition, Language acceptance by TM, Variants of Turing Machine, Universal Turing Machine, Turing Church Thesis, Recursive and recursively enumerable languages, Undecidable problems, Halting problem of TM, NP Completeness, P, NP and NP Hard problems		
Text Books	1. Hopcroft, Ullman, "Introduction to Automata Theory, Language and Computation", Nerosa Publishing House 2. Linz, Peter. An introduction to formal languages and automata	
Reference Books	1. Martin J. C., "Introduction to Languages and Theory of Computations", TMH	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	03-03-2018	
Date of Approval by the Academic Council on	11-06-2018	

Course Outcome for CS4210

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Interpret the mathematical foundations of computation including automata theory; the theory of formal languages and grammars; the notions of algorithm, decidability, complexity, and computability	2	S
CO2	Construct the abstract machines including finite automata, pushdown automata, and Turing machines from their associated languages and grammar	3	S
CO3	Make use of pumping lemma to show that a language is not regular / not context-free	3	Emp
CO4	Construct the grammar for any given finite automata, pushdown automata or Turing machines	2	Emp
CO5	Outline the characteristics of P, NP and NP Complete problems	3	Emp

CO-PO Mapping for CS4210

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	2	3	3	3	2	3	2	2	3	2	2	2
CO 2	2	1	2	3	1	3	2	3	2	2	2	2	3	3
CO 3	2	2	2	1	2	1	2	1	2	2	3	2	2	3
CO 4	2	2	2	2	3	3	2	3	2	2	2	2	3	1
CO 5	3	3	3	2	3	2	3	2	3	3	3	3	3	3
Avg	2.4	2.2	2.2	2.2	2.4	2.4	2.2	2.4	2.2	2.2	2.6	2.2	2.6	2.4

CS4211	Title: Data Mining and Data Warehousing	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	This course provides a complete overview of Data mining and warehousing techniques.	
Expected Outcome	To understand the concepts of Data Mining, To perform different data mining tasks, To understand the fundamental concepts of data warehousing technology, To learn step-by-step approach to designing and building a data warehouse.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit 1	Introduction	7
Introduction to Data Mining – Kind of Data – Functionalities – Interesting Patterns – Task Primitives – Issues In Data Mining - Data Preprocessing: Why Preprocessing		
Unit 2	Introduction To Data Warehousing	8
Introduction to data warehousing-data Warehouse: Defining features-Architecture of data warehouse-Gathering the business requirements. Planning and project management, Data Warehouse schema- Dimensional modeling-ETL Process-Testing, Growth and Maintenance-OLAP in the Data warehouse.		
Unit 3	Association Rules	7
Mining Frequent Patterns: Associations And Correlations - Basic Concepts – Frequent Item Set Mining Methods – Mining Various Kinds Of Association Rules		
Unit 4	Classification And Prediction	7
Classification & Prediction: Decision Tree Techniques, Back-Propagation Method, Bayesian Method, Rule Based Classification – Support Vector Machine		
Unit 5	Cluster Analysis	7
What Is Cluster Analysis? Types Of Data In Cluster Analysis – A Categorization Of Major Clustering Methods – Hierarchical Methods		
Text Books	1. M. H. Dunham, "Data Mining: Introductory and Advanced Topics", Pearson Education..	
Reference Books	1. Jiawei Han and Micheline Kamber, 'Data Mining: Concepts and Techniques, Morgan Kaufmann, India 2. A K Pujari, 'Data Mining Techniques, University Press, India 3. Han, Manilla and Smyth, 'Principles of Data Mining', PHI, India	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	03-03-2018	
Date of Approval by the Academic Council on	11-06-2018	

Course Outcome for CS4211

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Understand warehousing architectures and tools for systematically organizing large databaseand use their data to make strategic decisions.	2	S
CO2	Understand KDD process for finding interesting pattern from warehouse.	3	S
CO3	Remove redundancy and incomplete data from the dataset using data preprocessing methods.	3	Emp
CO4	Characterize the kinds of patterns that can be discovered by association rule mining.	2	Emp
CO5	Discover interesting patterns from large amounts of data to analyze for predictions and classification.	3	Emp

CO-PO Mapping for CS4211

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	2	2	1	2	2	2	1	2	2	2	2	2	2
CO 2	2	3	2	1	3	3	2	2	2	2	3	2	1	2
CO 3	2	2	2	1	2	2	2	3	2	3	2	3	2	2
CO 4	2	2	2	2	2	2	2	2	2	2	2	2	3	3
CO 5	3	3	3	2	2	2	3	2	3	3	3	3	2	2
Avg	2.2	2.4	2.2	1.4	2.2	2.2	2.2	2	2.2	2.4	2.4	2.4	2	2.2

CS4212	Title: Modeling and Simulation	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	The course is designed to provide complete knowledge to estimated costing, behavior and working of any final product.	
Expected Outcome	After the completion of this course, the students will be able to know how any model can behave or act before testing it in real word.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit 1	Introduction	8
Systems, models, discrete event simulation and continuous simulation. Time-advance mechanisms, event modeling of discrete dynamic systems, single-server single queue model, event graphs, Monte Carlo simulation.		
Unit 2	GPSS	7
Model structure, entities and transactions, blocks in GPSS, process oriented programming, user defined functions, SNA, logic switches, save locations, user chains, tabulation of result, programming examples.		
Unit 3	Random Number Generation:	6
Congruence generators, long period generators, uniformity and independence testing		
Unit 4	Random Variate Generation	7
Location, scale and shape parameters, discrete and continuous probability distributions; Inverse transform method, composition and acceptance rejection methods		
Unit 5	Queuing Models	7
Little's theorem, analytical results for M/M/1, M/M/1/N, M/M/c, M/G/1 and other queuing models.		
Text Books	1. Karian, Z.A. and Dudewicz, E.J., "Modern Statistical Systems and GPSS Simulation", CRC Press. 2. Banks, J., Carson, L.S., Nelson, B.L. and Nicol, D.M., "Discrete Event System Simulation", Pearson Education	
Reference Books	1. Law, A.M. and Kelton, W.D., "Simulation, Modeling and Analysis", Tata McGraw-Hill	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	03-03-2018	
Date of Approval by the Academic Council on	11-06-2018	

Course Outcome for CS4212

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students will understand the techniques of modeling in the context of hierarchy of	2	S
CO2	knowledge about a system and develop the capability to apply the same to study systems through available software.	3	S
CO3	Students will learn different types of simulation techniques.	3	Emp
CO4	Students will learn to simulate the models for the purpose of optimum control by using software.	2	Emp
CO5	Students will understand the techniques Turing Machine	3	Emp

CO-PO Mapping for CS4212

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	3	2	3	3	3	2	1	2	2	2	2	2	2
CO 2	2	3	2	3	1	1	2	2	2	2	3	2	2	2
CO 3	2	2	2	2	3	3	2	3	2	2	3	2	3	2
CO 4	2	2	2	3	2	2	2	3	3	2	2	2	3	3
CO 5	3	3	3	3	2	2	3	2	3	3	3	3	3	3
Avg	2.2	2.6	2.2	2.8	2.2	2.2	2.2	2.2	2.4	2.2	2.6	2.2	2.6	2.4

CS4213	Title: Soft Computing	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	The student should be made to Learn the various soft computing frame works, Be familiar with design of various neural networks, Be exposed to fuzzy logic, Learn genetic programming	
Expected Outcome	Upon completion of the course, the student should be able to Apply various soft computing frame works .Design of various neural networks. Use fuzzy logic. Apply genetic programming. Discuss hybrid soft computing.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit 1	Introduction	8
Artificial neural network: Introduction, characteristics- learning methods – taxonomy – Evolution of neural networks- basic models - important technologies - applications. Fuzzy logic: Introduction - crisp sets- fuzzy sets - crisp relations and fuzzy relations: cartesian product of relation - classical relation, fuzzy relations, tolerance and equivalence relations, non-iterative fuzzy sets. Genetic algorithm		
Unit 2	Neural Network	7
McCulloch-Pitts neuron - linear separability - hebb network - supervised learning network: perceptron networks - adaptive linear neuron, multiple adaptive linear neuron, BPN, RBF, TDNN- associative memory network: auto-associative memory network, hetero-associative memory network, BAM, hopfield networks, iterative auto associative memory network		
Unit 3	Fuzzy Logic	8
Membership functions: features, fuzzification, methods of membership value assignments- Defuzzification: lambda cuts - methods - fuzzy arithmetic and fuzzy measures: fuzzy arithmetic - extension principle - fuzzy measures - measures of fuzziness -fuzzy integrals - fuzzy rule base and approximate reasoning : truth values and tables, fuzzy propositions, formation of rules-decomposition of rules, aggregation of fuzzy rules, fuzzy reasoning		
Unit 4	Genetic Algorithms	6
Genetic algorithm and search space - general genetic algorithm – operators - Generational cycle - stopping condition – constraints - classification - genetic programming – multilevel optimization – real life problem-advances in GA		
Unit 5	Hybrid Soft Computing Techniques & Applications	7
Neuro-fuzzy hybrid systems - genetic neuro hybrid systems - genetic fuzzy hybrid and fuzzy genetic hybrid systems - simplified fuzzy ARTMAP - Applications: A fusion approach of multispectral images with SAR, optimization of traveling salesman problem using genetic algorithm approach, soft computing based hybrid fuzzy controllers.		
Text Books	1. J.S.R.Jang, C.T. Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI / Pearson Education. 2. S.N.Sivanandam and S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt Ltd,.	
Reference Books	1.S.Rajasekaran and G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis & Applications", Prentice-Hall of India Pvt. Ltd..	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	03-03-2018	
Date of Approval by the Academic Council on	11-06-2018	

Course Outcome for CS4213

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Develop intelligent systems leveraging the paradigm of soft computing techniques.	2	S
CO2	Implement, evaluate and compare solutions by various soft computing approaches for finding the optimal solutions.	3	S
CO3	Recognize the feasibility of applying a soft computing methodology for a particular problem	3	Emp
CO4	Design the methodology to solve optimization problems using fuzzy logic, genetic algorithms and neural networks.	2	Emp
CO5	Design hybrid system to revise the principles of soft computing in various applications	3	Emp

CO-PO Mapping for CS4213

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
CO 1	2	3	2	1	3	1	2	3	2	3	3	2	2	2
CO 2	2	3	2	1	3	1	3	3	3	3	3	2	3	2
CO 3	2	3	2	3	2	1	3	3	3	3	3	3	3	3
CO 4	2	2	2	3	3	2	3	2	3	2	2	3	2	3
CO 5	3	3	3	3	3	2	3	2	3	3	3	3	3	3
Avg	2.2	2.8	2.2	2.2	2.8	1.4	2.8	2.6	2.8	2.8	2.8	2.6	2.6	2.6

CS4214	Title: Artificial Intelligence	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	Basics of AI and ANN, Neuro fuzzy systems and its applications, Genetic algorithms and its applications	
Expected Outcome	After the completion of this course, the students will be able to develop applications.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit 1	Artificial Intelligence	8
Some Applications of AI-Production Systems and AI-Different types of Production Systems-Search Strategies for AI-Backtracking-Graph-search, Un-uniformed and Heuristic Graph-Search Procedures- Related Algorithms-Applications.		
Unit 2	Introduction to Neural Computing	8
Differences between Human Brain and ANN - Knowledge Based Information Processing-Neural Information Processing - Hybrid Intelligence - Basic Concepts of Neural Networks - Inference and Learning - Classification, Association, Optimization and Self-Organization.		
Unit 3	Fuzzy Systems	7
Crisp sets and Fuzzy sets-Notion of Fuzzy Sets - Basic Concepts - Operations on Fuzzy sets-Uncertainty and Information – Types of Uncertainty –Principles of Uncertainty and Information -Applications		
Unit 4	Neuro-Fuzzy Systems	7
Introduction to Neuro - Fuzzy Systems -Fuzzy System Design Procedures – Fuzzy Sets and Logic Background - Fuzzy / ANN Design and Implementation		
Unit 5	Genetic Algorithms	6
Introduction-Robustness of Traditional Optimization and Search Techniques-The goals of optimization- Computer Implementation-Applications		
Text Books	1. Limin Fu , “Neural Network in computer intelligence”, McGraw-Hill International Editions. 2. Timoothy J. Ross , “Fuzzy Logic with Engineering Applications”, McGraw-Hill International Editions	
Reference Books	1. Elaine Rich and Kelvin knight, “Artificial Intelligence”, McGraw-Hill Edition. 2. David E. Goldberg , “Genetic Algorithms-In Search, optimization and Machine Learning”, Pearson Education.	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	03-03-2018	
Date of Approval by the Academic Council on	11-06-2018	

Course Outcome for CS4214

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Understand the informed and uninformed problem types and apply search strategies to solve them.	2	S
CO2	Apply difficult real-life problems in a state space representation so as to solve them using AI techniques like searching and game playing.	3	S
CO3	Design and evaluate intelligent expert models for perception and prediction from intelligent environment.	3	Emp
CO4	Formulate valid solutions for problems involving uncertain inputs or outcomes by using decision making techniques.	2	Emp
CO5	Demonstrate and enrich knowledge to select and apply AI tools to synthesize information and develop models within constraints of application area.	3	Emp

CO-PO Mapping for CS4214

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	1	2	3	3	1	2	1	2	3	1	2	2	2
CO 2	3	3	2	3	3	3	2	3	2	3	2	2	1	2
CO 3	3	3	2	3	3	3	2	3	2	3	2	2	3	3
CO 4	3	3	2	2	2	3	2	3	2	2	2	2	3	3
CO 5	3	3	3	2	2	2	3	2	3	3	3	3	3	3
Avg	2.8	2.6	2.2	2.6	2.6	2.4	2.2	2.4	2.2	2.8	2	2.2	2.4	2.6

SEMESTER 3

Program Elective (PE):

CS 4304	Title: Pattern Recognition	L 3	T 0	P 0	C 3
Version No.	1.0				
Course Prerequisites	Basic knowledge of Data Mining				
Objective	To study the mathematical morphology necessary for Pattern recognition .To introduces the student to various Pattern recognition techniques. To study the Representation and description and feature extraction. To study the principles of decision trees and clustering in pattern recognition.				
Expected Outcome	Upon Completion of the course, the students will be able to Develop and analyze decision tress. Design the nearest neighbor classifier. Develop algorithms for Pattern Recognition.				
Unit No.	Unit Title	No. of Hrs (Per Unit)			
Unit I	Introduction	7			
Definition of PR, Applications, Datasets for PR, Different paradigms for PR, Introduction to probability, events, random variables, Joint distributions and densities, moments. Estimation minimum risk estimators, problems.					
Unit II	Representation	7			
Data structures for PR, Representation of clusters, proximity measures, size of patterns, Abstraction of Data set, Feature extraction, Feature selection, Evaluation.					
Unit III	Nearest Neighbor based classifiers & Bayes classifier	8			
Nearest neighbor algorithm, variants of NN algorithms, use of NN for transaction databases, efficient algorithms, Data reduction, prototype selection, Bayes theorem, minimum error rate classifier, estimation of probabilities, estimation of probabilities, comparison with NNC, Naive Bayes classifier,					
Unit IV	Decision Trees	7			
Introduction, DT for PR, Construction of DT, Splitting at the nodes, Over-fitting & Pruning, Examples.					
Unit V	Clustering	7			
Hierarchical (Agglomerative, single/complete/average linkage, wards, Partitional (Forgy's, k-means, Isodata), clustering large data sets, examples.					
Text Books	1. V Susheela Devi, M Narsimha Murthy, "Pattern Recognition (An Introduction)", Universities Press. 2. Earl Gose, Richard Johnsonbaugh, Steve Jost., "Pattern Recognition & Image Analysis", PHI.				
Reference Books	1. Duda R. O., P.E. Hart, D.G. Stork., "Pattern Classification",Wiley and sons Publication.				
Mode of Evaluation	Internal and External Examinations				
Recommended by Board of Studied on	03-03-2018				
Date of Approval by the Academic Council on	11-06-2018				

Course Outcome for CS 4304

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Explain and compare a variety of pattern classification, structural pattern recognition, and pattern classifier combination techniques.	2	S
CO2	Summarize, analyze, and relate research in the pattern recognition area verbally and in writing.	3	S
CO3	Apply performance evaluation methods for pattern recognition, and critique comparisons of techniques made in the research literature.	3	Emp
CO4	Apply pattern recognition techniques to real-world problems such as document analysis and recognition.	2	Emp
CO5	Implement simple pattern classifiers, classifier combinations, and structural pattern recognizers	3	Emp

CO-PO Mapping for CS 4304

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	2	1	2	3	2	3	2	3	2	2	2	3
CO 2	2	2	2	1	3	2	3	2	2	2	3	3	3	2
CO 3	2	3	2	1	2	3	2	3	2	3	2	3	2	3
CO 4	2	2	2	2	3	2	2	2	3	2	2	2	3	2
CO 5	3	3	3	2	2	2	3	2	2	3	3	3	3	2
Avg	2.4	2.6	2.2	1.4	2.4	2.4	2.4	2.4	2.2	2.6	2.4	2.6	2.6	2.4

CS 4305	Title: Information System & Audit	L	T	P	C
		3	0	0	3

Version No.	**1.0**	
Course Prerequisites	Introduction to Information system Business Information System Communication and Networking Essential Data management and IT for Business	
Objective	An overview of information systems security, audit and control function. Threats, attacks and security technology measures. Legal, ethical and professional issues. Planning for security.	
Expected Outcome	As a result of taking this course the student, should be able to: Examine the multiple layers of IS security in organizations.,Analyze the risk management approach to information assets' security with respect to operational and organizational goals.,Evaluate physical and logical security controls, and the automated approaches in IS security.	
Unit No.	**Unit Title**	**No. of Hrs (Per Unit)**
Unit I	**Information Systems Audit Standards and Practices and Information**	**6**
System Security and Control Practices, Standards and Guidelines for IS Auditing, The Control Objectives, Other Laws and Regulations		
Unit II	**Auditing Information Systems Organization and Management**	**8**
Information Systems Strategies to achieve business management, objectives, Policies and Procedures, Information Systems Management Practices, Organizational Structure, Audit and Evaluation Techniques		
Unit III	**Auditing the Information Systems Process**	**8**
Information Systems Hardware Platform, Information Systems Software Platform, Information Systems Network and Telecommunication, Infrastructure, Information System Operational Practices		
Unit IV	**Information Systems Integrity, Confidentiality and Availability**	**7**
Logical Access Controls, Physical Access Controls, Environmental Controls, Data validation, processing and balancing controls, Business Continuity Planning and testing		
Unit V	**Auditing Information Systems Software Development, Acquisition and maintenance**	**7**
System Integration Concepts, SDAM Methodologies, SDAM Practices, Information Systems Maintenance Practices		
Text Books	1.Richard E. Cascarino, "Auditor's Guide to Information Systems Auditing", Wiley and sons Publication.	
Reference Books	1. Chris Davis, Mike Schiller, Kevin Wheeler, "IT Auditing Using Controls to Protect Information Assets 2e", McGraw-Hill. 2. Weber & Jamieson, "Information Systems Control and Audit", Pearson Education.	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	03-03-2018	
Date of Approval by the Academic Council on	11-06-2018	

Course Outcome for CS 4305

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Understanding of Governance and Management of Information Technologies	2	S
CO2	Understanding of IS acquisition, development and implementation	3	S
CO3	Understanding of IS operations, maintenance and support audit	3	Emp
CO4	Understanding of a protection of information assets audit	2	Emp
CO5	Understanding of a BC and DR audit	3	Emp

CO-PO Mapping for CS 4305

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	2	2	2	1	2	2	2	2	2	2	2	2	2
CO 2	3	3	2	3	1	3	2	3	3	2	3	3	2	2
CO 3	2	3	2	2	2	2	2	3	2	2	2	2	3	2
CO 4	2	2	2	3	2	3	2	3	2	2	2	2	3	3
CO 5	3	3	3	2	2	2	3	3	3	3	3	3	3	3
Avg	2.4	2.6	2.2	2.4	1.6	2.4	2.2	2.8	2.4	2.2	2.4	2.4	2.6	2.4

CS4306	Title: Multimedia and Graphics	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	Develop an understanding and awareness of how issues such as content, information architecture, motion, sound, design, and technology merge to form effective and compelling interactive experiences for a wide range of audiences and end users.	
Expected Outcome	Upon completion of the course, the student should be able to Effectively and creatively solve a wide range of graphic design problems,Form effective and compelling interactive experiences for a wide range of audiences.	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Output Primitives	7
Basic – Line – Curve and ellipse drawing algorithms – Examples – Applications - Attributes – Two- Dimensional geometric transformations – Two-Dimensional clipping and viewing – Input techniques.		
Unit II	Three-Dimensional Concepts	7
Three-Dimensional object representations – Three-Dimensional geometric and modeling transformations – Three-Dimensional viewing – Hidden surface elimination Color models – Virtual reality - Animation.		
Unit III	Multimedia Systems Design	8
Multimedia basics – Multimedia applications – Multimedia system architecture – Evolving technologies for multimedia – Defining objects for multimedia systems – Multimedia data interface standards – Multimedia databases.		
Unit IV	Multimedia File Handling	6
Compression and decompression – Data and file format standards – Multimedia I/O technologies – Digital voice and audio – Video image and animation – Full motion video – Storage and retrieval technologies.		
Unit V	Hypermedia	8
Multimedia authoring and user interface – Hypermedia messaging – Mobile messaging – Hypermedia message component – Creating hypermedia message – Integrated multimedia message standards – Integrated document management – Distributed multimedia systems.		
Text Books	1. Donald Hearn and M. Pauline Baker, “Computer Graphics C Version”, Pearson Education. 2. Andleigh, P. K and Kiran Thakrar, “Multimedia Systems and Design”, PHI.	
Reference Books	1. Judith Jeffcoate, “Multimedia in practice: Technology and Applications”, PHI. 2. Foley, Vandam, Feiner and Huges, “Computer Graphics: Principles and Practice”, 2ndEdition, Pearson Education.	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	03-03-2018	
Date of Approval by the Academic Council on	11-06-2018	

Course Outcome for CS4306

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Utilize and optimize graphic file formats and their individual characteristics to various modes of delivery.	2	S
CO2	Relate the primary features of pixel resolution and color depth issues of graphics development to multiple modes of delivery	3	S
CO3	Utilize industry standard development tools for design and lay out of digital media.	3	Emp
CO4	Create, edit, and optimize graphic images for use in various multimedia applications and the various delivery possibilities;	2	Emp
CO5	Understand the use of user interfaces	3	Emp

CO-PO Mapping for CS4306

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	1	2	1	1	3	2	3	2	2	3	2	2	2
CO 2	2	1	3	3	3	3	3	3	3	3	3	2	3	2
CO 3	3	2	3	3	3	3	3	3	3	3	3	2	3	3
CO 4	3	2	3	3	3	2	3	2	3	3	2	2	3	3
CO 5	3	3	3	2	2	2	3	2	3	3	3	3	3	3
Avg	2.6	1.8	2.8	2.4	2.4	2.6	2.8	2.6	2.8	2.8	2.8	2.2	2.8	2.6

CS4303	Title: Cyber Laws	L T P C 3 0 0 3
Version No.	1.0	

Course Prerequisites	Nil	
Objective	To recognize the developing trends in Cyber law and the legislation impacting cyberspace in the current situation. To generate better awareness to battle the latest kinds of cybercrimes impacting all investors in the digital and mobile network. To recognize the areas for stakeholders of digital and mobile network where Cyber law needs to be further evolved.	
Expected Outcome	Make Learner Conversant With the Social and Intellectual, Property Issues Emerging From 'Cyberspace. Explore the Legal And Policy Developments In Various Countries To Regulate Cyberspace. Make Study On Various Case Studies On Real Time Crimes.	
Unit No.	**Unit Title**	**No. of Hrs (Per Unit)**
Unit I	**Introduction to Computer Security**	**8**
Definition, Threats to security, Government requirements, Information Protection and Access Controls, Computer security efforts, Standards, Computer Security mandates and legislation, Privacy considerations, International security activity.		
Unit II	**Secure System Planning and Administration**	**7**
Introduction to the orange book, Security policy requirements, accountability, assurance and documentation requirements, Network Security, The Red book and Government network evaluations.		
Unit III	**Information Security Policies and Procedures**	**7**
Corporate policies- Tier 1, Tier 2 and Tier3 policies - process management-planning and preparation- developing policies-asset classification policy-developing standards.		
Unit IV	**Information Security**	**7**
fundamentals-Employee responsibilities information classification Information handling- Tools of information security- Information processing-secure program administration.		
Unit V	**Organizational and Human Security**	**7**
Adoption of Information Security Management Standards, Human Factors in Security- Role of information security professionals.		
Text Books	1. Debby Russell and Sr. G.T Gangemi, "Computer Security Basicsn (Paperback)", 2nd Edition, O' Reilly Media. 2. Thomas R. Peltier, "Information Security policies and procedures: A Practitioner's Reference", 2nd Edition Prentice Hall.	
Reference Books	1. Kenneth J. Knapp, "Cyber Security and Global Information Assurance: Threat Analysis and Response Solutions", IGI Global. 2. Jonathan Rosenoer, "Cyber law: the Law of the Internet", Springerverlag.	
Mode of Evaluation	Internal and External Examination	
Recommended by Board of Studied on	03-03-2018	
Date of Approval by the Academic Council on	11-06-2018	

Course Outcome for CS4303

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Make Learner Conversant With The Social And Intellectual Property Issues Emerging From 'Cyberspace.	2	S
CO2	Explore The Legal And Policy Developments In Various Countries To Regulate Cyberspace	3	S
CO3	Develop The Understanding Of Relationship Between Commerce And Cyberspace; And	3	Emp
CO4	Give Learners In Depth Knowledge Of Information Technology Act And Legal Frame Work Of Right To Privacy, Data Security And Data Protection.	2	Emp
CO5	Make Study On Various Case Studies On Real Time Crimes.	3	Emp

CO-PO Mapping for CS4303

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	3	2	1	3	3	2	3	2	2	3	2	2	2
CO 2	2	3	3	3	3	3	3	3	3	3	3	2	3	2
CO 3	3	3	3	2	3	3	3	3	3	3	3	3	3	3
CO 4	2	2	3	3	3	2	2	2	3	3	2	3	3	3
CO 5	3	3	3	2	2	2	3	2	3	3	3	3	3	2
Avg	2.4	2.8	2.8	2.2	2.8	2.6	2.6	2.6	2.8	2.8	2.8	2.6	2.8	2.4

ME4307	Title: Research Methodology	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	Understand some basic concepts of research and its methodologies Select and define appropriate research problem and parameters, Write a research report and thesis	
Expected Outcome	To know about the types of research and also how to write a report and thesis.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction	6
Objectives of Research – Limitations in Research – Qualities of a Good Research Worker – Criteria of Good Research – Limitations of Research Concept of Applied and Basic research – Quantitative and Qualitative Research Techniques – Need for theoretical frame work – Hypothesis development – Hypothesis testing with quantitative data. Research design – Purpose of the study: Exploratory, Descriptive, Hypothesis Testing.		
Unit II	Experimental design	7
Laboratory and the Field Experiment – Internal and External Validity – Factors affecting Internal validity. Measurement of variables – Scales and measurements of variables. Developing scales – Rating scale and attitudinal scales – Validity testing of scales – Reliability concept in scales being developed – Stability Measures.		
Unit III	Data collection	7
Interviewing, Questionnaires, etc. Secondary sources of data collection. Guidelines for Questionnaire Design – Electronic Questionnaire Design and Surveys. Special Data Sources: Focus Groups, Static and Dynamic panels. Review of Advantages and Disadvantages of various Data-Collection Methods and their utility. Sampling Techniques – Probabilistic and non-probabilistic samples. Issues of Precision and Confidence in determining Sample Size. Hypothesis testing, Determination of Optimal sample size.		
Unit IV	Multivariate statistical techniques	8
Data Analysis – Factor Analysis – Culster Analysis -Discriminant Analysis – Multiple Regression and Correlation – Canonical Correlation – Application of Statistical(SPSS) Software Package in Research		
Unit V	Research report	8
Purpose of the written report – Concept of audience – Basics of written reports. Integral parts of a report – Title of a report, Table of contents, Abstract, Synopsis, Introduction, Body of a report – Experimental, Results and Discussion – Recommendations and Implementation section – Conclusions and Scope for future work		
Text Books	1. Kothari, "Research Methodology", John Wiley & Sons (Asia) Pte Ltd. 2. C. Murthy, " Research Methodology",Vindra Publications (P) Ltd.	
Reference Books	1. Donald Cooper & Pamela Schindler, "Business Research Methods", TMGH. 2. Alan Bryman & Emma Bell, "Business Research Methods", Oxford University Press. 3. Ranjit Kumar, "Research Methodology", Sage Publications, London.	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	03-03-2018	
Date of Approval by the Academic Council on	11-06-2018	

Course Outcome for ME4307

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Understand research problem formulation.	2	S
CO2	Analyze research related information	3	S
CO3	Follow research ethics	3	Emp
CO4	Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruledby ideas, concept, and creativity.	2	Emp
CO5	Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular. Field	3	Emp

CO-PO Mapping for ME4307

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	2	2	1	3	3	2	3	2	2	3	2	2	2
CO 2	2	2	3	3	3	3	3	2	3	3	2	2	3	2
CO 3	3	2	3	2	3	3	3	2	3	3	2	3	3	2
CO 4	2	2	3	3	3	2	2	2	3	3	2	3	3	2
CO 5	3	3	3	2	2	2	3	2	3	3	3	3	3	2
Avg	2.4	2.2	2.8	2.2	2.8	2.6	2.6	2.2	2.8	2.8	2.4	2.6	2.8	2

ME4340	Title: Research Methodology Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To learn to prepare reports and charts	
Expected Outcome	On successful completion of this course the student will have knowledge to analyse and prepare reports	
List of Experiments		
1. Basics of Excel- data entry, editing and saving, establishing and copying a formula. 2. Functions in excel, copy and paste and exporting to MS word document 3. Graphical presentation of data -Histogram, frequency polygon, pie-charts and bar diagrams. 4. SPSS, opening SPSS, layout, menu and icons analyzing the data using different statistical techniques.		
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	03-03-2018	
Date of Approval by the Academic Council on	11-06-2018	

Course Outcome for ME4340

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	demonstrate knowledge of research processes (reading, evaluating, and developing);	2	S
CO2	demonstrate knowledge of research processes (reading, evaluating, and developing);	3	S
CO3	employ American Psychological Association (APA) formats for citations of print and electronic materials;	3	Emp

CO-PO Mapping for ME4340

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	2	2	3	3	2	2	2	2	2	2	3	3
CO 2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
CO 3	3	3	2	3	3	3	2	2	2	2	2	2	3	3
Avg	2.67	2.67	2.00	2.33	2.67	2.67	2.00	2.00	2.00	2.00	2.00	2.00	2.67	2.67