SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE
(An Autonomous Institution)
(Approved by AICTE, New Delhi & Affiliated to Pondicherry University)
(Accredited by NBA-AICTE, New Delhi, ISO 9001:2000 Certified Institution &
Accredited by NAAC with "A" Grade)
Madagadipet, Puducherry - 605 107

DEPARTMENT OF COMPUTER SCIENCE AND BUSINESS SYSTEMS

MINUTES OF BOARD OF STUDIES

FOURTH MEETING

Venue

Lecture Hall, Department of CSBS
Sri Manakula Vinayagar Engineering College
Madagadipet, Puducherry – 605 107

Date &Time

25.2.22 & 10 A.M.

Department of Computer Science and Business Systems

Minutes of Board of Studies

The Board of Studies Fourth meeting of Department of Computer Science and Business Systems (CSBS) was held on 25th Feb 2022 at 10:00 A.M in the Lecture Hall, Department of CSBS, Sri Manakula Vinayagar Engineering College with the Head of the Department in the Chair.

The following members were present for the BoS meeting

Sl.No	Name of the Member with Designation and official Address	Members as Per UGC Norms
1	**Dr. G. Shanmugasundaram** Associate Professor and Head, Department of CSBS, SMVEC, Puducherry	Chairman
2	**Dr.T. Chithralekha, M.Tech., Ph.D** Professor, School of Engineering and Technology, Pondicherry University, R.V.Nagar, Kalapet, Puducherry	Subject Expert (University Nominee)
3	**Dr. K.Devaki, M.E., Ph.D.,** Professor, Department of Computer Science and Engineering, Rajalakshmi Engineering College, Chennai.	Subject Expert (Academic Council Nominee)
4	**Dr. M.Chinnadurai, M.E., Ph.D.,** Professor, Department of Computer Science and Engineering, Controller of Examination, E.G.S Pillay Engineering College, Nagapattinam, Tamil Nadu	Subject Expert (Academic Council Nominee)

5	**Mr. Asoke Das Sarma** BPO Transformation Lead, Tata Consultancy Services, Kolkata.	Representative from Industry
6	**Dr. P. Victer Paul, M.Tech., Ph.D.,** Assistant Professor, Department of Computer Science and Engineering, Indian Institute of Information Technology, Kottayam - 686635, Kerala.	Postgraduate Alumnus (nominated by the Principal)
7	**Dr. N.S.N. Cailassame, M.B.A,Ph.D.,** Professor and Head, Department of Management Studies, SMVEC.	Internal Member
8	**Dr. G. Bala Sendhil Kumar,** Professor, Department of Management Studies, SMVEC.	Internal Member
9	**Dr.R. Saravanan , M.E., Ph.D,** Associate Professor, Department of Information Technology, SMVEC.	Internal Member
10	**Mrs.K. Devika , M.E., ,** Assistant Professor, Department of Computer Science and Business Systems, SMVEC.	Internal Member
11	**Dr.T. Gayathri** Professor and Head, Dept of Mathematics, SMVEC	Internal Member
12	**Dr.D. Jaichithra** Professor and Head, Dept. of English, SMVEC	Internal Member
13	**Dr. T. Jayavarthanan** Professor, Dept. of Physics, SMVEC	Internal Member

Agenda of the Meeting

1) Confirmation of BOS third meeting minutes was held on 18th August 2021
2) To review of Curriculum (I to VIII Semesters) and Syllabi (I to VI Semesters) of Autonomous R-2020 Regulations
3) To discuss and recommend the syllabi for VII Semester under R2020 Regulations for UG Programme: B.Tech. CSBS
4) To discuss about Certification and Skill Development Courses
5) To discuss about online platforms used for teaching, Extra-Curricular and Co – Curricular activities
6) Any other item with the permission of chair

Minutes of the Meeting

Dr.G.Shanmugasundaram, Chairman, BoS officially announced the opening of the meeting, and welcomed the external, internal and co-opted members and also thanked them for accepting the invite and their presence as member of the Board of Studies and the meeting thereafter deliberated on agenda items that had been approved by the Chairman.

BOS/2022/CSBS/UG/ 4.1	**Confirmation of BOS third meeting Minutes was held on 18th August 2021.**
	• Chairman, BoS, briefed the minutes of 3rd BoS, its implementation and then it is confirmed with the approval, for the incorporation of minor revisions in curriculum (III to VIII) and syllabi (IV, V and IV semesters) of R2020 regulations. The changes in Curriculum and syllabi are mentioned below. **Revisions in Curriculum** • U20CBT509 - Design and Analysis of Algorithms course shall be changed from semester 5 to 4 • U20CBT305 - Software Engineering course shall be moved from semester 3 to 4 • U20CBT408 - Software Design using UML course shall be altered from semester 4 to 5 • U20CBT407 - Database Management Systems course shall be moved from semester 4 to 3 • Change of evaluation Pattern from External to Internal o Business communication & value science III (Semester 4) o Business communication & value science IV (Semester 6) • Revision of credits for BCVS IV Course in Semester 6 from 3 to 2 • Revision of credits for Software Design using UML Course from 2 to 3 credits

- Revision of Course completion hours based on course credits (Semester I, II, IV – 2 credit course was allotted maximum of 45 hours which are reduced to 30 hrs.)
- No of skill development courses in semester V and VI are reduced

Syllabus Revisions

Sl. No	Regulation	Sem	Subject Name with Code	Unit	Particulars
1	R-2020	IV	Design and Analysis of Algorithms /	III & IV	Changing the unit order - Unit III and Unit IV are interchanged.
2	R-2020	V	Business Intelligence/ U20CBE504	II & III	Unit II data mining topics specific to Business Intelligence are included Unit III classification and clustering techniques specific to Business Intelligence are included
3	R-2020	V	Machine Learning/ U20CBE503	II,III, IV,V	Naive Bayes classification; Bayesian networks; Decision Tree and Random Forests; k-Nearest neighbor classification; Support Vector Machines are moved to Unit II Hidden Markov Models and Regression techniques are moved to Unit III Unit IV topics are deals with Unsupervised algorithms and Unit IV deals with only Mining algorithms

	4	R-2020	VI	Robotics and Embedded Systems/ U20CBE606	V	Unit V - Recent trends and open challenges topics are included.
	5	R-2020	VI	Data Mining and Analytics/ U20CBE608	IV	Non Linear Regression contents in Unit IV are removed
	6	R-2020	VI	Financial and Cost Accounting/ U20HST611	II & III	Unit II - Practical's using Tally and in Unit III Application of Tally in Financial Statement Analysis topics are included

The above corrections were made and was approved by Academic Council and confirmed by the BoS members. **(Annexure- I)**

BOS/2022/CSBS/UG/ 4.2	**To Review of Curriculum (I to VIII Semesters) and Syllabi (I to VI Semesters) of Autonomous R-2020 Regulations**
	The Curriculum (I to VIII Semesters) and Syllabi (I to VI Semesters) of Autonomous R-2020 Regulations was reviewed by the BoS members and recommended the following suggestions • U20CBW601 Internship / Industrial Projects to be shifted from semester 6 to semester 7 • Change of Elective courses in Professional Elective III and V o Digital marketing is introduced in Elective III by replacing Cyber Security o IT Infrastructure Management is introduced in Elective V by replacing Data Science The changes were made as per the suggestions and it is approved by the BoS members. **(Annexure- II)**

BOS/2022/CSBS/UG/ 4.3	To discuss and recommend the syllabi for VII Semesters under R2020 Regulations for UG Programme: B.Tech. CSBS

The BoS members recommended the following changes in the VII semester syllabus and submitted to Academic council for approval

Syllabus revision

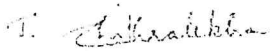
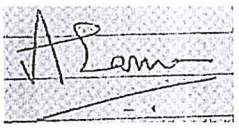
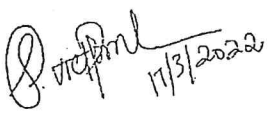
Sl.	Regulation	Sem	Subject Name with Code	Unit	Particulars
1	R-2020	VII	Usability Design of Software Applications /U20CBT714	II,III & V	The units were reordered Unit II has been changed as Unit V Unit III has been changed as Unit II Unit V has been changed as Unit III
2	R-2020	VII	Financial Management / U20HST712	II & III	In Unit II Practical Applications using MS Excel is added In Unit III topics such as Project estimation and other Financial influential factors are added and topics such as Tax Increments, Combining Liability Structures and Current Asset Decisions I Operating Cash Flows are removed
3	R-2020	VII	Human Resource Management /U20HST713	I,II & III	Some topics that fall out of scope like Measuring HR from Unit I and organizational design from Unit II are removed Essential topic such as Practical Applications using SPSS software is added in unit III

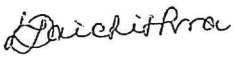
	4	R-2020	VII	Mobile Computing/U 20CBE718	II,IV & V	Topics such as Terminal paging in unit II, Cognitive radio networks in Unit IV are removed Topics such as D2D Communication and 5G in unit V are moved to Unit IV, and replaced by Mobile Computing models.
	5	R-2020	VII	Advanced Social, Text And Media Analytics Laboratory/ U20CBEP72		Link and user influential analysis exercises are included
	6	R-2020	VII	Mobile Computing Laboratory/ U20CBEP73		Mobile app development exercises are introduced
	The above corrections are incorporated and the syllabi of semester VII are approved by the BoS members **(Annexure- III)**.					
BOS/2022/CSBS/UG/ 4.4	**To discuss about certification and Skill Development Courses**					
	The chairman briefed the various certification and skill development Courses. BoS Members appreciated the • Conduction of certification courses and international certification exams • Conduction of skill development courses and its assessment process					

BOS/2022/CSBS/UG/ 4.5	**To discuss about online platforms used for teaching, Extra-Curricular and Co – Curricular activities**
	The chairman briefed the Learning Management Systems, Extra-Curricular and Co – Curricular activities to the BoS members. The BoS Members appreciated • Great learning platform used for online class • Certification Courses completed by the Students and Staff through edx platform • "Train the Trainer Program" for the Faculties, for the current Semester IV Courses to transit the knowledge and teach TCS designed courses as per their objective • Guest lectures and workshops conducted • Student participation on various events such as hackathon and virtual internships • Various induction orientation activities for students admitted in 2021-2022
BOS/2022/CSBS/UG/ 4.6	**Any other item with the permission of chair**
	BOS members were suggested to revise the structure of course syllabi might be 4 units as theoretical and 1 unit as practical.

The meeting was concluded at 12:00 PM with vote of thanks by **Dr. G. Shanmugasundaram**, Chairman, Board of Studies, Department of Computer Science and Business Systems.

Members Present:

Sl.No	Name of the Member with Designation and official Address	Responsibility in the BoS	Signature
1	**Dr. G. Shanmugasundaram** Associate Professor and Head, Department of CSBS, SMVEC, Puducherry	Chairman	
2	**Dr.T. Chithralekha, M.Tech., Ph.D** Professor, School of Engineering and Technology, Pondicherry University, R.V.Nagar, Kalapet, Puducherry	Subject Expert (University Nominee)	
3	**Dr. K.Devaki, M.E., Ph.D.,** Professor, Department of Computer Science and Engineering, Rajalakshmi Engineering College, Chennai.	Subject Expert (Academic Council Nominee)	
4	**Dr. M.Chinnadurai, M.E., Ph.D.,** Professor, Department of Computer Science and Engineering, Controller of Examination, E.G.S Pillay Engineering College, Nagapattinam, Tamil Nadu	Subject Expert (Academic Council Nominee)	
5	**Mr. Asoke Das Sarma** BPO Transformation Lead, Tata Consultancy Services, Kolkata.	Representative from Industry	
6	**Dr. P. Victer Paul, M.Tech., Ph.D.,** Assistant Professor, Department of Computer Science and Engineering, Indian Institute of Information Technology, Kottayam - 686635, Kerala.	Postgraduate Alumnus (nominated by the Principal)	

7	**Dr. N.S.N. Cailassame, M.B.A,Ph.D.,** Professor and Head, Department of Management Studies, SMVEC.	Internal Member	
8	**Dr. G. Bala Sendhil Kumar,** Professor, Department of Management Studies, SMVEC.	Internal Member	
9	**Dr.R. Saravanan , M.E., Ph.D,** Associate Professor, Department of Information Technology, SMVEC.	Internal Member	
10	**Mrs.K. Devika , M.E., ,** Assistant Professor, Department of Computer Science and Business Systems, SMVEC.	Internal Member	
11	**Dr.T. Gayathri** Professor and Head, Dept of Mathematics, SMVEC	Internal Member	
12	**Dr.D. Jaichithra** Professor and Head, Dept. of English, SMVEC	Internal Member	
13	**Dr. T. Jayavarthanan** Professor, Dept. of Physics, SMVEC	Internal Member	

ANNEXURE – I

STRUCTURE FOR UNDERGRADUATE ENGINEERING PROGRAMME

Sl.No	Course Category	Breakdown of Credits
1.	Humanities and Social Sciences (HS)	36
2.	Basic Sciences (BS)	25
3.	Engineering Sciences (ES)	10
4.	Professional core (PC)	57
5.	Professional Electives (PE)	22
6.	Open Electives (PE)	-
7.	Project work/ Internship	12
8.	Employability Enhancement Courses (EEC)*	-
9.	Mandatory Courses (MC)*	-
	Total	**162**

SCHEME OF CREDIT DISTRIBUTION – SUMMARY

Sl.No	Course Category	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	Humanities and Social Sciences (HS)	2	4	-	5	7	4	4	10	36
2	Basic Sciences(BS)	10	8	4	3	-	-	-	-	25
3	Engineering Sciences (ES)	7	3	-	-	-	-	-	-	10
4	Professional Core (PC)	-	4	14	12	9	12	6	-	57
5	Professional Electives (PE)	-	-	-	-	4	4	7	7	22
6	Open Electives (OE)	-	-	-	-	-	-	-	-	-
7	Project Work (PW)	-	-	-	-	-	-	2	8	10
8	Internship(PW)	-	-	-	-	-	2	0	-	02
9	Employability Enhancement Courses (EEC)*	-	-	-	-	-	-	-	-	-
10	Mandatory courses (MC)*	-	-	-	-	-	-	-	-	-
Total		**19**	**19**	**18**	**20**	**20**	**22**	**19**	**25**	**162**

**** EEC and MC are not included for CGPA calculation***

SEMESTER – I										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U20HST101	Business Communication & Value Science - I	HS	2	0	0	2	25	75	100
2	U20BST102	Discrete Mathematics	BS	2	1	0	3	25	75	100
3	U20BST103	Introductory Topics in Statistics and Probability	BS	3	0	0	3	25	75	100
4	U20BST113	Physics for Computing Science	BS	3	0	0	3	25	75	100
5	U20EST134	Fundamentals of Computer Science	ES	3	0	0	3	25	75	100
6	U20EST136	Principles of Electrical Engineering	ES	2	0	0	2	25	75	100
Practical										
7	U20BSP114	Physics for Computing Science Laboratory	BS	0	0	2	1	50	50	100
8	U20ESP135	Fundamentals of Computer Science Laboratory	ES	0	0	2	1	50	50	100
9	U20ESP137	Principles of Electrical Engineering Laboratory	ES	0	0	2	1	50	50	100
Employability Enhancement Course										
10	U20CBC1XX	Certification Course-I **	EEC	0	0	4	-	100	-	100
Mandatory Course										
11	U20CBM101	Induction Program	MC	3Weeks			-	-	-	-
							19	400	600	1000

SEMESTER – II										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U20HST202	Business Communication & Value Science – II	HS	2	0	0	2	25	75	100
2	U20HST203	Fundamentals of Economics	HS	2	0	0	2	25	75	100
3	U20BST216	Linear Algebra	BS	3	1	0	4	25	75	100
4	U20BST217	Statistical Methods	BS	3	0	0	3	25	75	100
5	U20EST251	Principles of Electronics	ES	2	0	0	2	25	75	100
6	U20CBT201	Data Structures & Algorithms	PC	3	0	0	3	25	75	100
Practical										
7	U20BSP218	Statistical Methods Laboratory	BS	0	0	2	1	50	50	100
8	U20ESP252	Principles of Electronics Laboratory	ES	0	0	2	1	50	50	100
9	U20CBP201	Data Structures & Algorithms Laboratory	PC	0	0	2	1	50	50	100
Employability Enhancement Course										
10	U20CBC2XX	Certification Course - II**	EEC	0	0	4	-	100	-	100
11	U20CBS201	Skill Development Course 1 – Python Programming	EEC	0	0	2	-	100	-	100
Mandatory Course										
12	U20CBM202	Environmental Sciences	MC	2	0	0	-	100	-	100
							19	600	600	1200

SEMESTER – III										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U20BST328	Computational Statistics	BS	3	0	0	3	25	75	100
2	U20CBT302	Formal Language and Automata Theory	PC	3	0	0	3	25	75	100
3	U20CBT303	Computer Organization & Architecture	PC	3	0	0	3	25	75	100
4	U20CBT304	Object Oriented Programming	PC	3	0	0	3	25	75	100
5	U20CBT305	Database Management Systems	PC	3	0	0	3	25	75	100
Practical										
6	U20BSP329	Computational Statistics Laboratory	BS	0	0	2	1	50	50	100
7	U20CBP302	Object Oriented Programming Laboratory	PC	0	0	2	1	50	50	100
8	U20CBP303	Database Management Systems Laboratory	PC	0	0	2	1	50	50	100
Employability Enhancement Course										
9	U20CBC3XX	Certification Course - III**	EEC	0	0	4	-	100	-	100
10	U20CBS302	Skill Development Course 2 — R Programming	EEC	0	0	2	-	100	-	100
Mandatory Course										
11	U20CBM303	Physical Education	MC	0	0	2	-	100	-	100
							18	575	525	1100

SEMESTER – IV										
Sl. No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U20HST404	Business Communication & Value Science – III	HS	1	0	2	2	100	-	100
2	U20HST405	Introduction to Innovation, IP Management & Entrepreneurship	HS	3	0	0	3	25	75	100
3	U20BST440	Operations Research	BS	2	0	0	2	25	75	100
4	U20CBT406	Operating Systems	PC	3	0	0	3	25	75	100
5	U20CBT407	Software Engineering	PC	3	0	0	3	25	75	100
6	U20CBT408	Design And Analysis of Algorithms	PC	3	0	0	3	25	75	100
Practical										
7	U20BSP441	Operations Research Laboratory	BS	0	0	2	1	50	50	100
8	U20CBP404	Operating Systems(Unix) Laboratory	PC	0	0	2	1	50	50	100
9	U20CBP405	Software Engineering Laboratory	PC	0	0	2	1	50	50	100
10	U20CBP406	Design And Analysis of Algorithms	PC	0	0	2	1	50	50	100
Employability Enhancement Course										
11	U20CBC4XX	Certification Course - IV**	EEC	0	0	4	-	100	-	100
12	U20CBS403	Skill Development Course 3*	EEC	0	0	2	-	100	-	100
Mandatory Course										
13	U20CBM404	NSS	MC	0	0	2	-	100	-	100
							20	650	650	1300

SEMESTER – V										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U20HST507	Fundamentals of Management	HS	2	0	0	2	25	75	100
2	U20HST508	Business Strategy	HS	2	0	0	2	25	75	100
3	U20HST509	Design Thinking	HS	2	0	2	3	25	75	100
4	U20CBT509	Software Design with UML	PC	3	0	0	3	25	75	100
5	U20CBT510	Compiler Design	PC	3	0	0	3	25	75	100
6	U20CBE5XX	Professional Elective I#	PE	2	1	0	3	25	75	100
Practical										
7	U20CBP507	Software Design with UML Laboratory	PC	0	0	2	1	50	50	100
8	U20CBP508	Compiler Design Laboratory	PC	0	0	2	1	50	50	100
9	U20CBP509	Mini Project	PC	0	0	2	1	50	50	100
10	U20CBEP5X	Professional Elective I# Laboratory	PE	0	0	2	1	50	50	100
Employability Enhancement Course										
11	U20CBC5XX	Certification Course-V**	EEC	0	0	4	-	100	-	100
12	U20CBS504	Skill Development Course 4: Foreign Language/ IELTS-I	EEC	0	0	2	-	100	-	100
Mandatory Course										
13	U20CBM505	Indian Constitution	MC	2	0	0	-	100	-	100
							20	750	650	1400

 # Professional Electives are to be selected from the list given in Annexure I

**** Certification courses are to be selected from the list given in Annexure II**

*** Skill Development Course 3 is to be selected from the list given in Annexure III**

SEMESTER – VI										
Sl. No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U20HST610	Business Communication & Value Science – IV	HS	1	0	2	2	100	-	100
2	U20HST611	Financial and Cost Accounting	HS	2	0	0	2	25	75	100
3	U20CBT611	Computer Networks	PC	3	0	0	3	25	75	100
4	U20CBT612	Information Security	PC	3	0	0	3	25	75	100
5	U20CBT613	Artificial Intelligence	PC	3	0	0	3	25	75	100
6	U20CBE6XX	Professional Elective II#	PE	2	2	0	3	25	75	100
Practical										
7	U20CBP610	Computer Networks Laboratory	PC	0	0	2	1	50	50	100
8	U20CBP611	Information Security Laboratory	PC	0	0	2	1	50	50	100
9	U20CBP612	Artificial Intelligence Laboratory	PC	0	0	2	1	50	50	100
10	U20CBEP6X	Professional Elective II# Laboratory	PE	0	0	2	1	50	50	100
Project Work										
11	U20CBW601	Internship/ Industrial Projects	PC	0	0	0	2	100	-	100
Employability Enhancement Course										
12	U20CBC6XX	Certification Course - VI**	EEC	0	0	4	-	100	-	100
13	U20CBS605	Skill Development Course 5: NPTEL/MOOC-I	EEC	0	0	0	-	100	-	100
Mandatory Course										
14	U20CBM606	Essence of Indian Traditional Knowledge	MC	2	0	0	-	100	-	100
							22	950	650	1600

SEMESTER – VII										
Sl. No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U20HST712	Financial Management	HS	2	0	0	2	25	75	100
2	U20HST713	Human Resource Management	HS	2	0	0	2	25	75	100
3	U20CBT714	Usability Design of Software Applications	PC	2	0	0	2	25	75	100
4	U20CBT715	IT Workshop Skylab / Matlab	PC	2	0	0	2	25	75	100
5	U20CBE7XX	Professional Elective III#	PE	2	1	0	3	25	75	100
6	U20CBE7XX	Professional Elective IV#	PE	3	0	0	3	25	75	100
Practical										
7	U20CBP713	Usability Design of Software Applications Laboratory	PC	0	0	2	1	50	50	100
8	U20CBP714	IT Workshop Skylab / Matlab Laboratory	PC	0	0	2	1	50	50	100
9	U20CBEP7X	Professional Elective IV# Laboratory	PE	0	0	2	1	50	50	100
Project Work										
10	U20CBW702	Project Evaluation I	PC	0	0	4	2	100	-	100
Mandatory Course										
11	U20CBM707	Professional Ethics	MC	2	0	0	-	100	-	100
							19	500	600	1100

SEMESTER – VIII										
Sl. No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U20HST814	Services Science & Service Operational Management	HS	3	0	0	3	25	75	100
2	U20HST815	IT Project Management	HS	3	0	0	3	25	75	100
3	U20HST816	Marketing Research & Marketing Management	HS	2	0	0	2	25	75	100
4	U20CBE8XX	Professional Elective V#	PE	2	1	0	3	25	75	100
5	U20CBE8XX	Professional Elective VI#	PE	3	0	0	3	25	75	100
Practical										
6	U20HSP801	Services Science & Service Operational Management Laboratory	HS	0	0	2	1	50	50	100
7	U20HSP802	IT Project Management Laboratory	HS	0	0	2	1	50	50	100
8	U20CBEP8X	Professional Elective VI# Laboratory	PE	0	0	2	1	50	50	100
Project Work										
9	U20CBW803	Project Evaluation II	PC	0	0	16	8	40	60	100
Employability Enhancement Course										
10	U20CBS806	Skill Development Course 6: NPTEL / MOOC-II	EEC	0	0	0	-	100	-	100
							25	415	585	1000

ANNEXURE I

PROFESSIONAL ELECTIVE COURSES (18 CREDITS)

Professional Elective – I (Offered in Semester V)		
Sl. No.	**Course Code**	**Course Title**
1	U20CBE501	Conversational Systems
2	U20CBE502	Cloud, Microservices & Application
3	U20CBE503	Machine Learning
4	U20CBE504	Business Intelligence
5	U20CBE505	Business Process
Professional Elective – II (Offered in Semester VI)		
Sl. No.	**Course Code**	**Course Title**
1	U20CBE606	Robotics and Embedded Systems
2	U20CBE607	Modern Web Applications
3	U20CBE608	Data Mining and Analytics
4	U20CBE609	E- Commerce and E- Payment Systems
5	U20CBE610	Big Databases
Professional Elective – III (Offered in Semester VII)		
Sl. No.	**Course Code**	**Course Title**
1	U20CBE711	Cognitive Science & Analytics
2	U20CBE712	Introduction to IoT
3	U20CBE713	Cryptology
4	U20CBE714	Robotic Process Automation
5	U20CBE715	Cyber Security
Professional Elective – IV (Offered in Semester VII)		
Sl. No.	**Course Code**	**Course Title**
1	U20CBE716	Quantum Computation & Quantum Information
2	U20CBE717	Advanced Social, Text and Media Analytics
3	U20CBE718	Mobile Computing
4	U20CBE719	Block chain
5	U20CBE720	Virtual Reality

Professional Elective – V (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	U20CBE821	Behavioral Economics
2	U20CBE822	Computational Finance & Modeling
3	U20CBE823	Psychology
4	U20CBE824	Data Sciences
5	U20CBE825	Smart Systems
Professional Elective – VI (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	U20CBE826	Enterprise Systems
2	U20CBE827	Advance Finance
3	U20CBE828	Image Processing and Pattern Recognition
4	U20CBE829	Automation Tools and Technique - Devops
5	U20CBE830	Augmented Reality

PROFESSIONAL ELECTIVE PRACTICAL COURSES (4 CREDITS)

Professional Elective – I (Offered in Semester V)		
Sl. No.	**Course Code**	**Course Title**
1	U20CBEP51	Conversational Systems Laboratory
2	U20CBEP52	Cloud, Microservices & Application Laboratory
3	U20CBEP53	Machine Learning Laboratory
4	U20CBEP54	Business Intelligence Laboratory
5	U20CBEP55	Business Process Laboratory
Professional Elective – II (Offered in Semester VI)		
Sl. No.	**Course Code**	**Course Title**
1	U20CBEP61	Robotics and Embedded Systems Laboratory
2	U20CBEP62	Modern Web Applications Laboratory
3	U20CBEP63	Data Mining and Analytics Laboratory
4	U20CBEP64	E- Commerce and E- Payment Systems Laboratory
5	U20CBEP65	Big Databases Laboratory
Professional Elective – IV (Offered in Semester VII)		
Sl. No.	**Course Code**	**Course Title**
1	U20CBEP71	Quantum Computation & Quantum Information Laboratory
2	U20CBEP72	Advanced Social, Text and Media Analytics Laboratory
3	U20CBEP73	Mobile Computing Laboratory
4	U20CBEP74	Block chain Laboratory
5	U20CBEP75	Virtual Reality Laboratory
Professional Elective – VI (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	U20CBEP81	Enterprise Systems Laboratory
2	U20CBEP82	Advance Finance Laboratory
3	U20CBEP83	Image Processing and Pattern Recognition Laboratory
4	U20CBEP84	Automation Tools and Technique – Devops Laboratory
5	U20CBEP85	Augmented Reality Laboratory

ANNEXURE-II

EMPLOYABILITY ENHANCEMENT COURSES – (A). CERTIFICATION COURSES

Sl.No.	Course Code	Course Title
1	U20CBCX01	3ds Max
2	U20CBCX02	Advance Structural Analysis of Building using ETABS
3	U20CBCX03	Advanced Java Programming
4	U20CBCX04	Advanced Python Programming
5	U20CBCX05	Analog System Lab Kit
6	U20CBCX06	Android Medical App Development
7	U20CBCX07	Android Programming
8	U20CBCX08	ANSYS -Multiphysics
9	U20CBCX09	Artificial Intelligence
10	U20CBCX10	Artificial Intelligence and Edge Computing
11	U20CBCX11	Artificial Intelligence in Medicines
12	U20CBCX12	AutoCAD for Architecture
13	U20CBCX13	AutoCAD for Civil
14	U20CBCX14	AutoCAD for Electrical
15	U20CBCX15	AutoCAD for Mechanical
16	U20CBCX16	Azure DevOps
17	U20CBCX17	Basic Course on ePLAN
18	U20CBCX18	Basic Electro Pneumatics
19	U20CBCX19	Basic Hydraulics
20	U20CBCX20	Bio Signal and Image Processing Development System
21	U20CBCX21	Blockchain
22	U20CBCX22	Bridge Analysis
23	U20CBCX23	Building Analysis and Construction Management

24	U20CBCX24	Building Design and Analysis Using AECO Sim Building Designer
25	U20CBCX25	CATIA
26	U20CBCX26	CCNA (Routing and Switching)
27	U20CBCX27	CCNA (Wireless)
28	U20CBCX28	Cloud Computing
29	U20CBCX29	Computer Programming for Medical Equipments
30	U20CBCX30	Corel Draw
31	U20CBCX31	Creo (Modeling and Simulation)
32	U20CBCX32	Cyber Security
33	U20CBCX33	Data Science and Data Analytics
34	U20CBCX34	Data Science using Python
35	U20CBCX35	Data Science using R
36	U20CBCX36	Deep Learning
37	U20CBCX37	Design and Documentation using ePLAN Electric P8
38	U20CBCX38	Design of Biomedical Devices and Systems
39	U20CBCX39	Digital Marketing
40	U20CBCX40	Digital Signal Processing Development System
41	U20CBCX41	DigSILENT Power Factory
42	U20CBCX42	Electro Hydraulic Automation with PLC
43	U20CBCX43	Embedded System using Arduino
44	U20CBCX44	Embedded System using C
45	U20CBCX45	Embedded System with IoT
46	U20CBCX46	ePLAN Data Portal
47	U20CBCX47	ePLAN Electric P8
48	U20CBCX48	ePLAN Fluid
49	U20CBCX49	ePLAN PPE
50	U20CBCX50	Fusion 360
51	U20CBCX51	Fuzzy Logic and Neural Networks
52	U20CBCX52	Google Analytics

53	U20CBCX53	Hydraulic Automation
54	U20CBCX54	Industrial Automation
55	U20CBCX55	Industry 4.0
56	U20CBCX56	Internet of Things
57	U20CBCX57	Introduction to C Programming
58	U20CBCX58	Introduction to C++ Programming
59	U20CBCX59	IoT using Python
60	U20CBCX60	Java Programming
61	U20CBCX61	Machine Learning
62	U20CBCX62	Machine Learning and Deep Learning
63	U20CBCX63	Machine Learning for Medical Diagnosis
64	U20CBCX64	Mechatronics
65	U20CBCX65	Medical Robotics
66	U20CBCX66	Microsoft Dynamics 365 ERP for HR , Marketing and Finance
67	U20CBCX67	Mobile Edge Computing
68	U20CBCX68	Modeling and Visualization using Micro station
69	U20CBCX69	MX Road
70	U20CBCX70	Photoshop
71	U20CBCX71	PLC
72	U20CBCX72	Pneumatics Automation
73	U20CBCX73	Project Management
74	U20CBCX74	Python Programming
75	U20CBCX75	Revit Architecture
76	U20CBCX76	Revit Inventor
77	U20CBCX77	Revit MEP
78	U20CBCX78	Robotics
79	U20CBCX79	Search Engine Optimization
80	U20CBCX80	Software Testing
81	U20CBCX81	Solar and Smart Energy System with IoT

82	U20CBCX82	Solid Works
83	U20CBCX83	Solid Works with Electrical Schematics
84	U20CBCX84	Speech Processing
85	U20CBCX85	STAAD PRO V8i
86	U20CBCX86	Structural Design and Analysis using Bentley
87	U20CBCX87	Total Station
88	U20CBCX88	Video and Image Processing Development System
89	U20CBCX89	VLSI Design
90	U20CBCX90	Web Programming - I
91	U20CBCX91	Web Programming - II

ANNEXURE-III

EMPLOYABILITY ENHANCEMENT COURSES-(B) SKILL DEVELOPMENT COURSES

Sl. No.	Course Code	Course Title
1.	U20CBS201	Skill Development Course 1 : Python Programming
2.	U20CBS302	Skill Development Course 2 : R Programming
3.	U20CBS403	Skill Development Course 3 *
		1) Graphic Design
		2) Exploring GITHUB Platform
		3) Aptitude Basics
4.	U20CBS504	Skill Development Course 4 : Foreign Language/ IELTS -I
5.	U20CBS605	Skill Development Course 5 : NPTEL / MOOC - I
6.	U20CBS806	Skill Development Course 6 : NPTEL / MOOC-II

**** Choose any one skill development course in the list for SDC 3***

U20CBT408	DESIGN AND ANALYSIS OF ALGORITHMS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- Learn and understand the algorithm analysis techniques and complexity notations
- Become familiar with the different algorithm design techniques for effective problem solving in computing.
- Learn to apply the design techniques in solving various kinds of problems in an efficient way.
- Become familiar with various Computability classes of problem.
- Understand the Randomized algorithms and Approximation algorithms to deal optimization problems in polynomial time

Course Outcomes

After completion of the course, the students will be able to

CO1 - Analyze the best, worst and average behavior of an algorithm based on time and space **(K2)**

CO2 - Understand various algorithm design strategies to synthesize algorithms for solving various problems. **(K2)**

CO3 - Choose and apply appropriate algorithm design strategies to design algorithms based on the nature of problems **(K3)**

CO4 - Apply Backtracking and Branch and Bound techniques to develop algorithms to solve various problems **(K3)**

CO5 – Understand various computability classes of problem **(K2)**

UNITI ALGORITHM ANALYSIS **(9 Hrs)**

Introduction: Characteristics of Algorithm. Analysis of Algorithm: Asymptotic analysis of Complexity Bounds – Best, Average and Worst-Case behavior; Performance Measurements of Algorithm, Time and Space Trade-Offs, Analysis of Recursive Algorithms through Recurrence Relations: Substitution Method, Recursion Tree Method and Masters' Theorem.

UNIT II FUNDAMENTAL ALGORITHMIC STRATEGIES **(9 Hrs)**

Brute-Force, Heuristics, Greedy, Divide and Conquer, Dynamic Programming

UNIT III GRAPH AND TREE ALGORITHMS **(9 Hrs)**

Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.

UNIT IV ALGORITHMIC STRATEGIES **(9 Hrs)**

Branch and Bound and Backtracking methodologies; Illustrations of these techniques for Problem-Solving , n-Queens Problem , Graph Coloring , Knapsack, Travelling Salesman Problem.

UNIT V TRACTABLE AND INTRACTABLE PROBLEMS **(9 Hrs)**

Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques.

Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE, Introduction to Quantum Algorithm.

Text Books

1. E. Horowitz and S. Sahni., "Fundamental of Computer Algorithms", Second Edition, Computer Science Press, 2008.
2. A. Aho, J. Hopcroft and J. Ullman, "The Design and Analysis of Computer Algorithms", Fourth edition, Pearson India, 2009.
3. T. H. Cormen, C. E. Leiserson and R. L. Rivest, "Introduction to Algorithms", Third Edition, MIT Press, 2009.

Reference Books

1. S. Baase, "Computer Algorithms: Introduction to Design and Analysis", Third Edition, Pearson, 2000.
2. D. E. Knuth ,"The Art of Computer Programming, Vol. 1, Vol. 2 and Vol. 3", Third Edition, Mathematical Science Publishers,1997.
3. Michael A. Nielsen and Isaac L. Chuang ,Quantum Computation and Quantum Information: 10th Anniversary Edition.Cambridge University Press, 2010

Web References

1. https://www.tutorialspoint.com/design_and_analysis_of_algorithms/index.htm
2. https://www.javatpoint.com/daa-tutorial
3. https://www.guru99.com/design-analysis-algorithms-tutorial.html
4. https://nptel.ac.in/courses/106/106/106106131/
5. https://online.stanford.edu/courses/soe-ycsalgorithms1-algorithms-design-and-analysis-part-1

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	-	-	-	-	-	-	-	-	2	1	1
2	2	1	-	-	-	-	-	-	-	-	-	-	2	1	1
3	3	2	1	1	-	-	-	-	-	-	-	1	2	1	-
4	3	2	1	1	-	-	-	-	-	-	-	1	2	-	1
5	2	1	-	-	-	-	-	-	-	-	-	1	2	1	1

Correlation Level: 1-Low, 2-Medium, 3- High

U20CBE503	MACHINE LEARNING	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- Have a thorough understanding of the existing machine learning techniques
- Know the basic concepts of supervised learning techniques.
- Study the working of neural networks and similar models.
- Familiarize with unsupervised learning algorithms.
- Understand the concepts of mining and applications based on it.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Distinguish between, supervised, unsupervised and semi-supervised learning. **(K2)**
CO2 - Modify existing machine learning algorithms to improve classification efficiency. **(K2)**
CO3 - Build a basic neural network for real-time data. **(K3)**
CO4 -. Use of temporal models for classification **(K3)**
CO5 - Use unsupervised models for clustering data and design a system that uses the information mining models of machine learning. **(K3)**

UNITI INTRODUCTION TO MACHINE LEARNING (9 Hrs)

Introduction to Machine Learning (ML); Relationship between ML and human learning; A quick survey of major models of how machines learn; Example applications of ML..

UNIT II SUPERVISED LEARNING ALGORITHMS (9 Hrs)

Supervised Learning; The problem of classification; Feature engineering; Training and testing classifier models; Cross-validation; Model evaluation (precision, recall, F1-mesure, accuracy, area under curve); Statistical decision theory including discriminant functions and decision surfaces;

UNIT III CLASSIFICATION TECHNIQUES (9 Hrs)

Naive Bayes classification; Bayesian networks; Decision Tree and Random Forests; k-Nearest neighbor classification; Support Vector Machines

Artificial neural networks including back propagation; Applications of classifications; Ensembles of classifiers including bagging and boosting

UNIT IV HIDDEN MARKOV MODELS AND REGRESSION TECHNIQUES (9 Hrs)

Hidden Markov Models (HMM) with forward-backward and Vierbi algorithms; Sequence classification using HMM; Conditional random fields; Applications of sequence classification such as part-of-speech tagging

Regression: Multi-variable regression; Model evaluation; Least squares regression; Regularization; LASSO; Applications of regression.

UNIT IV UNSUPERVISED LEARNING AND MINING LGORITHMS (9 Hrs)

Clustering: Average linkage; Ward's algorithm; Minimum spanning tree clustering; K-nearest neighbours clustering; BIRCH; CURE; DBSCAN..

Association rule mining algorithms including apriori - Expectation-Maximization (EM) Algorithm for unsupervised learning anomaly and outlier detection methods.

Text Books

1. E. Alpaydin, "Introduction to Machine Learning", Third Edition, Prentice-Hall, 2014.
2. A. Rostamizadeh, A. Talwalkar, M. Mohri, "Foundations of Machine Learning", MIT Press.
3. Andriy Burkov,The Hundred-Page Machine Learning Book, first edition

Reference Books

1. R.O. Duda, P.E. Hart, D.G. Stork, "Pattern Classification", Second Edition, Wiley, 2001.
2. C. Bishop,"Pattern Recognition and Machine Learning", Springer, 2007.
3. Webb, "Statistical Pattern Recognition", Third Edition, Wiley, 2011..

Web References

1. https://nptel.ac.in/courses/106/106/106106139/
2. https://www.javatpoint.com/machine-learning
3. https://www.geeksforgeeks.org/machine-learning/
4. https://www.kaggle.com/learn/intro-to-machine-learning
5. https://machinelearningmastery.com/start-here/
6. https://intellipaat.com/blog/tutorial/machine-learning-tutorial/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	-	-	-	-	-	-	-	-	2	1	1
2	2	1	-	-	-	-	-	-	-	-	-	-	2	1	1
3	3	2	1	1	-	-	-	-	-	-	-	1	2	1	-
4	3	2	1	1	-	-	-	-	-	-	-	1	2	-	1
5	2	1	-	-	-	-	-	-	-	-	-	1	2	1	1

Correlation Level: 1-Low, 2-Medium, 3- High

U20CBE504	BUSINESS INTELLIGENCE	L	T	P	C	HRS
		3	0	0	3	45

Course Objectives

- Be familiar with the concepts of business intelligence and Decision support systems.
- Be acquainted with mathematical models for decision making and data mining process
- To understand classification and clustering techniques.
- To know about the various business intelligence applications
- To understand the knowledge management process

Course Outcomes

After completion of the course, the students will be able to

CO1 - Describe business intelligence and decision support systems **(K2)**
CO2 – Use the mathematical models for decision making process **(K3)**
CO3 – Implement the techniques involving classification and clustering **(K3)**
CO4 – Summarize the various business intelligence applications **(K2)**
CO5 - Explain the context of knowledge management systems **(K2)**

UNIT I INTRODUCTION TO BUSINESS INTELLIGENCE (9 Hrs)

Effective and timely decisions-Data, information and knowledge-The role of mathematical models-Business intelligence architectures-Ethics and business intelligence-Definition of system-Representation of the decision making process-Evolution of information systems-Definition of decision support system-Development of a decision support system

UNIT II DATA MINING & DATA PREPARATION (9 Hrs)

Structure of mathematical models-Development of model-Classes of models–Definition of data mining-Representation of input data-Data mining process-Analysis methodologies-Data validation-Data transformation-Data reduction

UNIT III CLASSIFICATION & CLUSTERING (9 Hrs)

Classification problems-Evaluation of classification models-Bayesian methods-Logistic regression-Neural networks-Support vector machines-Clustering methods-Partition methods-Hierarchical methods-Evaluation of clustering models

UNIT IV BI APPLICATIONS, LOGISTIC & PRODUCTION MODELS (9 Hrs)

Marketing models: Relational marketing-Sales force management-Supply chain optimization-Optimization models for logistics planning-Revenue management systems. –Efficiency measures-Efficient frontier-The CCR model-Identification of good operating practices

UNIT V KNOWLEDGE MANAGEMENT (9 Hrs)

Introduction to Knowledge Management-Organizational Learning and Transformation-Knowledge Management Activities-Approaches to Knowledge Management-Information Technology (IT) In Knowledge Management-Knowledge Management Systems Implementation-Roles of People in Knowledge Management.

Text Books

1. Carlo Vercellis, "Business Intelligence: Data Mining and Optimization for decision making", 1st Edition, Wiley, 2009..
2. Efraim Turban, Ramesh Sharda, Dursun Delen "Decision Support and Business Intelligence Systems", Pearson, 9th Edition 2011.
3. Ramesh Sharda, Dursun Delen, Efraim Turban, & David King, "Business Intelligence: A Managerial Approach", Global Edition, November 2017

Reference Books

1. Grossmann W, Rinderle-Ma "Fundamental of Business Intelligence" Springer, 1st Edition, 2015.
2. Galit Shmueli, Nitin R. Patel, Peter C. Bruce,"Data Mining for Business Intelligence: Concepts, Techniques, and Applications in Microsoft Office Excel with XLMiner",Wiley, November 2010

Web References

1. www.cio.com/article/2439504/business-intelligence-definition-and-solutions.html
2. https://data-flair.training/blogs/business-intelligence/
3. https://www.javatpoint.com/power-bi
4. https://www.datapine.com/blog/business-intelligence-concepts-and-bi-basics/
5. https://nptel.ac.in/courses/110/107/110107092/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	-	-	-	-	-	-	3	1	-	3	1
2	3	2	1	-	3	-	-	-	-	-	3	1	-	3	1
3	3	2	1	-	3	-	-	-	-	-	3	1	-	3	1
4	2	1	-	-	3	-	-	-	-	-	3	1	-	3	1
5	2	1	-	-	-	-	-	-	-	-	3	1	-	3	1

Correlation Level: 1-Low, 2-Medium, 3- High

U20CBE606	ROBOTICS AND EMBEDDED SYSTEMS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To acquire knowledge about microcontrollers embedded processors and their applications.
- To understand the internal architecture and interfacing of different peripheral devices with Microcontrollers.
- To understand the design concept of embedded systems.
- To gain knowledge about the real time operating systems
- To gain knowledge about the robotics and kinematics

Course Outcomes

After completion of the course, the students will be able to

CO1 – Understand the key concepts of microcontrollers embedded processors and their applications. **(K2)**

CO2 –Know about the internal architecture and interfacing of different peripheral devices with Microcontrollers. **(K2)**

CO3 – Design embedded systems using modeling concepts. **(K3)**

CO4 - Use of real time operating system for various application. **(K3)**

CO5 - Design and engineer autonomous robots using various sensors. **(K3)**

UNITI INTRODUCTION TO EMBEDDED SYSTEM (9 Hrs)

Embedded system Vs General computing systems, History of Embedded systems, Purpose of Embedded systems, Microprocessor and Microcontroller, Hardware architecture of the real time systems..

UNIT II DEVICES AND COMMUNICATION BUSES (9 Hrs)

I/O types, serial and parallel communication devices, wireless communication devices, timer and counting devices, watchdog timer, real time clock, serial bus communication protocols, parallel communication network using ISA, PCI, PCT-X, Intrnet embedded system network protocols, USB, Bluetooth

UNIT III PROGRAM MODELLING CONCEPTS (9 Hrs)

Fundamental issues in Hardware software co-design, Unified Modelling Language(UML), Hardware Software trade-offs DFG model, state machine programming model, model for multiprocessor system.

UNIT IV REAL TIME OPERATING SYSTEMS & EXAMPLES OF EMBEDDED SYSTEM (9 Hrs)

Operating system basics, Tasks, Process and Threads, Multiprocessing and multitasking, task communication, task synchronization, qualities of good RTOS.

Examples of Embedded System: Mobile phones, RFID, WISENET, Robotics, Biomedical Applications, Brain machine interface etc. Popular microcontrollers used in embedded systems, sensors, actuators

UNIT V ROBOTICS AND KINEMATICS (9 Hrs)

Introduction to robotics, Elements of robots -- joints, links, actuators, and sensors ,Kinematics of serial robots, Kinematics of parallel robots, Motion planning and control, Sensing distance and direction, Line Following Algorithms, Feedback Systems, Recent trends and open challenges

Text Books

1. Shibu K. V , "Introduction to Embedded Systems", 2nd Edition, McGraw Hill, 2017
2. Ashitava Ghosal, "Robotics: Fundamental Concepts and Analysis", Oxford University Press, 2006
3. MAZIDI,"The 8051 Microcontroller and Embedded Systems: Using Assembly and C"Pearson,second Edition, January 2007

Reference Books

1. L. B. Das, "Embedded Systems: An Integrated Approach",1st edition, Pearson Education India, 2012.
2. Raj Kamal, "Embedded Systems- Architecture, Programming and Design", 3rd Edition, McGraw Hill Education, 2017.
3. Frank Vahid and Tony Givargis,"Embedded System Design: A Unified Hardware/Software Introduction"ohn Wiley & Sons,2002.

Web References

1. https://nptel.ac.in/courses/108/102/108102045/
2. https://www.embeddedrelated.com/tutorials.php
3. https://www.tutorialspoint.com/embedded_systems/index.htm
4. https://www.javatpoint.com/robotics-tutorial
5. http://www.robotictutorials.com/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	-	-	-	-	-	-	-	-	2	1	1
2	2	1	-	-	-	-	-	-	-	-	-	-	2	1	1
3	3	2	1	1	-	-	-	-	-	-	-	1	2	1	-
4	3	2	1	1	-	-	-	-	-	-	-	1	2	-	1
5	2	1	-	-	-	-	-	-	-	-	-	1	2	1	1

Correlation Level: 1-Low, 2-Medium, 3- High

U20CBE608	DATA MINING AND ANALYTICS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To introduce the fundamental concepts of data mining and data representation.
- To learn the data preprocessing task and attribute oriented analysis
- To understand the association rules, classification and prediction algorithms
- To learn and apply the linear models of data analysis
- To understand the time series analysis and aspects of prescriptive analysis.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Understand the fundamentals of data mining and data representation. **(K2)**
CO2 - Perform preprocessing tasks for the data set. **(K2)**
CO3 - Apply association rules and predictive methods for data mining. **(K3)**
CO4 - Build data models using linear regression techniques. **(K3)**
CO5 - Gain knowledge on time series analysis and prescriptive analysis. **(K2)**

UNITI INTRODUCTION AND KNOWLEDGE REPRESENTATION (9 Hrs)

Introduction - Related technologies - Machine Learning, DBMS, OLAP, Statistics, Stages of the Data Mining Process, Data Mining Techniques, Knowledge Representation Methods, Task relevant data, Background knowledge, Representing input data and output knowledge, Visualization techniques, Applications..

UNIT II DATA PREPROCESSING (9 Hrs)

Data preprocessing: Data cleaning, Data transformation, Data reduction, Discretization and generating concept hierarchies.

Attribute-oriented analysis: Attribute generalization, Attribute relevance, Class comparison, Statistical measures

UNIT III ASSOCIATION AND MINING METHODS (9 Hrs)

Association rules: Motivation and terminology, Basic idea: item sets, Generating item sets and rules efficiently, Correlation analysis. Classification: Basic learning/mining tasks, Inferring rudimentary rules: 1R, algorithm, Decision trees, covering rules.

Prediction: The prediction task, Statistical (Bayesian) classification, Bayesian networks, Instance based methods (nearest neighbor), linear models

UNIT IV LINEAR MODELS (9 Hrs)

Descriptive analytics: Data Modeling, Trend Analysis, Simple Linear Regression Analysis
Forecasting models: Heuristic methods, predictive modeling and pattern discovery,
Logistic Regression: Logit transform, ML estimation, Tests of hypotheses, Wald test, LR test, score test, test for overall regression, multiple logistic regression, forward, backward method, interpretation of parameters, relation with categorical data analysis. Interpreting Regression Models, Implementing Predictive Models.
Generalized Linear model: Link functions such as Poisson, binomial, inverse binomial, inverse Gaussian, Gamma.

UNIT V TIME SERIES ANALYSIS (9 Hrs)

Time Series Analysis: Auto - Covariance, Auto-correlation and their properties. Exploratory time series analysis, Test for trend and seasonality, Exponential and moving average smoothing, Holt – Winter smoothing, forecasting based on smoothing.

Linear time series models: Autoregressive, Moving Average, Autoregressive Moving Average and Autoregressive Integrated Moving Average models; Estimation of ARIMA models such as Yule-Walker estimation for AR Processes, Maximum likelihood and least squares estimation for ARIMA Processes, Forecasting using ARIMA models.

Prescriptive Analytics: Mathematical optimization, Networks modeling-Multi-objective optimization-Stochastic modeling, Decision and Risk analysis, Decision trees.

Content beyond Syllabus

Non Linear Regression Models

Text Books

1. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", Third Edition, Elsevier, 2012.
2. Lior Rokach and Oded Maimon, "Data Mining and Knowledge Discovery Handbook", Springer, 2nd edition, 2010.
3. Ian H. Witten, Eibe Frank and Mark A. Hall "Data Mining: Practical Machine Learning Tools and Techniques",Fourth Edition, Elsevier, 2017..

Reference Books

1. Box, G.E.P and Jenkins G.M. (1970) Time Series Analysis, Forecasting and Control, Holden-Day.
2. Draper, N. R. and Smith, H., "Applied Regression Analysis", Third Edition, John Wiley, 1998.
3. Hosmer, D. W. and Lemeshow, S., "Applied Logistic Regression", Third Edition, Wiley, 2003..

Web References

1. https://nptel.ac.in/courses/106/105/106105174/
2. https://nptel.ac.in/courses/110/106/110106072/
3. https://www.tutorialspoint.com/data_mining/index.htm
4. https://www.javatpoint.com/data-mining
5. https://www.guru99.com/data-mining-tutorial.html

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	-	-	-	-	-	-	-	-	2	1	1
2	2	1	-	-	-	-	-	-	-	-	-	-	2	1	1
3	3	2	1	1	-	-	-	-	-	-	-	1	2	1	-
4	3	2	1	1	-	-	-	-	-	-	-	1	2	-	1
5	2	1	-	-	-	-	-	-	-	-	-	1	2	1	1

Correlation Level: 1-Low, 2-Medium, 3- High

U20HST611	FINANCIAL & COST ACCOUNTING	L	T	P	C	Hrs
		2	0	0	2	30

Course Objectives

- To make the student conversant with Fundamentals of Accounting and its process.
- To make the student familiar with the preparation of final Accounts.
- To empower them with deeper understanding on Fund flow and Cash flow Statement.
- To familiarise the student with the key analyses for cost and their applications in real case studies.
- To provide them with the understanding on the role of Financial Statements given in an annual report of a corporate entity.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Understand the Fundamentals of Accounting and its processes. **(K2)**
CO2 –Understand accounting cycle and gain knowledge about final accounts preparation (K2)
CO3 - Construct funds and cash flow statements and interpret them meaningfully. **(K3)**
CO4- Understand the cost concepts and their application in costing estimates. **(K2)**
CO5 –Evaluate the financial statements given in an annual report of a corporate entity. **(K5)**

UNIT-I ACCOUNTING CONCEPTS AND PROCESS **(6 Hrs)**

Definition of Accounting – Accounting Principles- Accounting concepts and conventions – Accounting standards- Branches of Accounting - Book Keeping - Double Entry System- Accounting equation- Types of Accounts – Groups interested in Accounting information.

UNIT- II ACCOUNTING CYCLE AND FINAL ACCOUNTS **(6 Hrs)**

Asset and Liability –Types - Accounting Cycle – Journal – Ledger - Trial Balance – Final Accounts - Trading, P & L - Balance sheet - (Simple Problem)- Annual Reports - Rectification of Errors - Subsidary Books – Practical's using Tally

UNIT- III FINANCIAL STATEMENT ANALYSIS **(6 Hrs)**

Financial Statements- Meaning- Types and Techniques- Comparative statement- Common size statement - Trend analysis – Ratio Analysis. Funds Flow Analysis – Concept of Funds and Flow – Statement of Changes in Working Capital – Funds From Operations – Funds Flow Statement – Uses and Limitations of Funds Flow Statements. Cash Flow Analysis – Meaning and Significance of Cash Flow Statements. Preparation of Cash Flow Statement as per Accounting Standard 3 – Format. Uses and Limitations of cash flow analysis (Practical Problems) – Application of Tally in Financial Statement Analysis

UNIT- IV COST ACCOUNTING **(6 Hrs)**

Definition and Meaning of Cost Accounting- Elements of Cost - Cost behaviour- Cost allocation- Over Head allocation- Types - Unit Costing- Job Costing- Process Costing-Marginal Costing- absorption Costing-Preparation of Cost Sheet (Simple Problems) - Application of Costing Concept in the Service Sector (Case Study) - ABC analysis.

UNIT-V BUDGETS AND ANNUAL REPORTS **(6 Hrs)**

Definition of Budget - Need for Business Budgeting - Forecast and a Budget- Budgeting and budgetary Control- Meaning of Annual Reports- Statutory Requirements- Directors Report - Auditors Report - Notes to Accounts - Pitfalls in accounts.

Text Books

1. T.S. Reddy and Y. Harim Prasad Reddy, Financial and Management Accounting- Margham Publications
2. S.P. Iyengar , Cost and Management Accounting , S. Chand
3. The Case Study Handbook, Revised Edition: A Student's Guide Paperback –Wiiliam Ellate

Reference Books

1. Robert Libby , patrica Libby and Daniel short ,Financial Accounting with Annual report- Mcgraw Hill Education.
2. Charles T. Horngren, Gary L. Sundem, Jeff O. Schatzberg & Dave Burgstahler. Introduction to Management Accounting. Prentice Hall India. (Latest available edition)
3. Drury Colin. Management and Cost Accounting. International Thomson Business Press, London. (Latest available edition)
4. Jan Williams, Financial and Managerial Accounting – The basis for business Decisions. Tata McGraw Hill Publishers. (Latest available edition)
5. Stice & Stice, Financial Accounting Reporting and Analysis. Cengage Learning (Latest available edition)
6. Ravi M. Kishore. Cost and Managerial Accounting. Taxmann Publishers, New Delhi. (2018 or later edition)

Web Resources

1. https://icmai.in/icmai/contact_us.php
2. https://home.kpmg/in/en/home/services/advisory/management-consulting/financial-management/cost-accounting-management.html
3. https://www.accounting.com/
4. https://www.erpgreat.com/general/case-study-financial-and-cost-accounting.htm
5. https://www.hzu.edu.in/uploads/Case_Studies_of_Cost_and_Works_Accounting.pdf

COs/POs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	1	-	-	-	-	-	-	-	-	-	-	1	-	-
2	1	2	1	-	-	-	1	-	-	-	-	-	1	1	-
3	1	2	1	1	-	-	1	-	-	-	1	-	1	1	-
4	1	2	2	1	-	-	1	-	-	1	-	-	1	1	-
5	1	2	1	1	-	-	1	-	-	1	-	-	1	1	-

ANNEXURE – II

U20CBT712	FINANCIAL MANAGEMENT	L	T	P	C	Hrs
		2	0	0	2	30

Course Objectives

- To understand the fundamental concepts of financial management.
- To gain knowledge of the valuation of securities.
- To appreciate basic concepts such as time value of money, cost of capital, risk, and return.
- To know about capital budgeting and working capital management.
- To Leverage the concept for deciding the financial angle of IT projects.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Enables the budding Technocrat Managers to understand the Financial Management concepts and to appreciate the concepts of "time value of money" in the decision-making process. **(K2)**

CO2- Evaluates the Securities and know the concept of Risk and return. **(K3)**

CO3 - Evaluates the "Leverage" "cost of capital" & the projects using the Capital budgeting concepts. **(K3)**

CO4 - Understands the concepts of Capital components, their implications and Working Capital requirements. **(K2)**

CO5 - Analyze the Components of Working Capital. **(K4)**

UNIT – I INTRODUCTION **(6 Hrs)**

Introduction: Introduction to Financial Management - Goals of the firm - Financial Environments.

Time Value of Money: Simple and Compound Interest Rates, Amortization, Computing more than once a year, Annuity Factor

UNIT – II VALUATION OF SECURITIES / RISK & RETURN **(6 Hrs)**

Valuation of Securities: Bond Valuation, Preferred Stock Valuation, Common Stock Valuation, Concept of Yield and YTM.

Risk & Return: Defining Risk and Return, Using Probability Distributions to Measure Risk, Attitudes Toward Risk, Risk and Return in a Portfolio Context, Diversification, The Capital Asset Pricing Model (CAPM), Practical Applications using MS Excel

UNIT-III LEVERAGE / COST OF CAPITAL **(6 Hrs)**

Operating & Financial Leverage: Operating Leverage, Financial Leverage, Total Leverage, Indifference Analysis in leverage study

Cost of Capital: Concept, Computation of Specific Cost of Capital for Equity - Preference – Debt, Weighted Average Cost of Capital – Factors affecting Cost of Capital 4L

UNIT – IV CAPITAL BUDGETING AND WORKING CAPITAL MANAGEMENT **(6 Hrs)**

Capital Budgeting: The Capital Budgeting Concept & Process - An Overview, Generating Investment Project Proposals, Capital Budgeting Techniques, Project Evaluation, and Selection - Alternative Methods

Working Capital Management: Overview, Working Capital Issues, Financing Current Assets (Short Term and Long Term- Mix), Estimation of Working Capital.

UNIT – V CASH MANAGEMENT AND ACCOUNTS RECEIVABLE MANAGEMENT **(6 Hrs)**

Cash Management: Motives for Holding cash, Speeding Up Cash Receipts, Slowing Down Cash Payouts, Electronic Commerce, Outsourcing, Cash Balances to maintain, Factoring.

Accounts Receivable Management: Credit & Collection Policies, Analyzing the Credit Applicant, Credit References, Selecting optimum Credit period.

Text Books

1. Chandra, Prasanna - Financial Management - Theory & Practice, Prentice Hall/Pearson Education.2019.
2. I.M. Pandey, Financial Management, Vikas Publishing House, 2016.
3. James C. Van Horne and John M. Wachowicz, Jr. Fundamentals of Financial Management. Prentice Hall – Financial Times, New York. (Latest available edition).

Reference Books

1. Eugene F. Brigham and Joel F. Houston. Fundamentals of Financial Management. Cengage Learning, New York. (Latest available edition).
2. Eugene F. Brigham and Michael C. Ehrhardt. Financial Management: Theory & Practice. Thomson Western Learning, New York. (Latest available edition).
3. Vishwanath. S.R. Corporate Finance: Theory and Practice. Sage Response, New Delhi. (2015 or later edition).
4. Bhabatosh Banerjee. Fundamentals of Financial Management. Prentice-Hall of India, New Delhi. (2015 or later edition).

Web References

1. https://www.khanacademy.org/economics-finance-domain/core-finance/interest-tutorial
2. https://efinancemanagement.com/financial-management/capital-budgeting-techniques-with-an-example
3. https://static.careers360.mobi/media/uploads/froala_editor/files/Dividend-Decisions.pdf
4. https://efinancemanagement.com/costing-terms/inventory-management-techniques
5. https://booksc.org/book/71927964/4e63e6
6. https://silo.tips/queue/working-capital-management-of-bajaj-auto-ltd-with-special-reference-to-automobil?&queue_id=-1&v=1626159679&u=MTA2LjIwMy41MC4xMzk=

COs Mapping with POs and PSOs

COS	Program Outcomes (POs)											Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	-	-	-	1	-	1	-	1	1	1
CO2	2	1	1	1	1	-	-	-	1	-	2	1	1	2	2
CO3	1	1	1	2	1	-	-	-	2	-	2	1	1	1	1
CO4	1	2	1	1	1	-	-	-	2	-	2	1	1	2	1
CO5	1	2	1	2	1	-	-	-	2	-	2	1	1	1	1

Correlation Level: 1-Low, 2-Medium, 3- High

U20CBT713	HUMAN RESOURCE MANAGEMENT	L	T	P	C	Hrs
		2	0	0	2	30

Course Objectives

- Familiarize the basic concepts functional areas and activities of Human Resource Management.
- Understand the Functional areas of HRM concepts in an organizational context.
- Understand how to measure the Human Resources Forecasting.
- To develop relevant SHRM related issues in an organizational environment.
- Understand the components of HRM pertinent to the Service Sector.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Understand the basic concepts of HRM. **(K2)**

CO2 - Understand the HR functions and activities in organizations. **(K2)**

CO3 - Align HRM activities with a real-time organizational environment. **(K1)**

CO4 - Comprehend Strategic Management of Human Resources and HR activities. **(K2)**

CO5 - Understand the impact of HR activities on the Service Sector. **(K2)**

UNIT – I HUMAN RESOURCE MANAGEMENT **(6 Hrs)**

Concept and Challenges, HR Philosophy, Policies, Procedures and Practices. Human Resource System Design: HR Profession, and HR Department, Line Management Responsibility in HRM, Human resources accounting and audit

UNIT – II FUNCTIONAL AREAS OF HRM **(6 Hrs)**

recruitment and staffing, benefits, compensation, employee relations, HR compliance, training and development, human resource information systems (H.R.I.S.), and payroll.

UNIT – III HUMAN RESOURCE PLANNING **(6 Hrs)**

Demand Forecasting, Practical Applications using SPSS software, Action Plans– Retention, Training, Redeployment & Staffing, Succession Planning

UNIT-IV STRATEGIC MANAGEMENT OF HUMAN RESOURCES **(6 Hrs)**

SHRM, the relationship between HR strategy and overall corporate strategy, HR as a Factor of Competitive Advantage, Managing Diversity in the Workplace

UNIT – V HUMAN RESOURCE MANAGEMENT IN SERVICE SECTOR **(6 Hrs)**

Special considerations for Service Sector including

- Managing the Customer – Employee Interaction
- Employee Empowerment and Customer Satisfaction
- Service Failure and Customer Recovery – the Role of Communication and Training
- Similarities and Differences in Nature of Work for the Frontline Workers and the Backend
- Support Services - Impact on HR Practices Stressing Mainly on Performance
- Flexible Working Practices – Implications for HR

Text Books

1. Dessler G, Varkey B. Human Resource Management, 16th edition. Pearson Education India, 2020.
2. Joseph J. Martocchio, Human Resource Management, 15th edition, Pearson Education Champaign, 2019.
3. Mathis RL, Jackson JH. Human resource management, 15th edition, Jakarta: Salemba Empat, 2021.

Reference Books

1. Armstrong, M., & Taylor, S. Armstrong's handbook of human resource management practice. 15th Edition, Kogan Page Publishers, 2020.
2. Raymond A. Noe, John R. Hollenbeck, Gerhart, B., & Patrick M. Wright. Fundamentals of human resource management. 6th Edition, McGraw-Hill Higher Education, 2015.
3. Gary Dessler, Human Resource Management,15th edition, Pearson, 2017.

Web References

1. https://www.journals.elsevier.com/human-resource-management-review
2. https://swayam.gov.in/nd1_noc20_mg15/preview
3. http://www.sciencepublishinggroup.com/j/jhrm
4. https://journals.sagepub.com/home/hrm
5. https://www.hrdguru.com/
6. https://www.citehr.com/

COs Mapping with POs and PSOs

COS	Program Outcomes (POs)											Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	-	-	-	-	-	2	3	-	1	-	1	1	-
CO2	1	1	-	-	-	-	-	2	3	-	1	-	1	1	-
CO3	1	1	1	-	1	-	1	2	3	1	1	-	1	1	-
CO4	1	1	-	-	-	-	1	2	3	1	1	-	1	1	-
CO5	1	1	-	-	-	-	1	2	3	1	1	-	1	1	-

Correlation Level: 1-Low, 2-Medium, 3- High

U20CBT714	USABILITY DESIGN OF SOFTWARE APPLICATIONS	L	T	P	C	Hrs
		2	0	0	2	30

Course Objectives

- To gain knowledge of the User Centered Design.
- To familiarize User Centric Design to the facets of User Experience (UX) Design.
- To design and develop applications with smart designs.
- To familiarize with the Research techniques of UX.
- To analyze and identify the methods to offer a better UI experience.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Gain knowledge of the User Centered Design. **(K2)**
CO2 - Familiarize User Centric Design to the facets of User Experience (UX) Design. **(K2)**
CO3 - Design and develop applications with smart designs. **(K3)**
CO4 – Familiarize with the research techniques of UX. **(K2)**
CO5 - Analyze and identify the methods to offer a better UI experience. **(K3)**

UNIT I INTRODUCTION **(6Hrs)**

Introduction to User Centered Design - Basics of User Centered Design
Aspects of User Centered Design - Product Appreciation Assignment – Evaluating the product from user centered design aspects such as functionality, ease of use, ergonomics, and aesthetics.

UNIT II PRODUCT DESIGN LIFECYCLE **(6Hrs)**

Redesign project through the design lifecycle – Discovery - Define – Design - Implement (Design Prototype) - Usability Testing.

UNIT III PERSONAS, SCENARIOS, DEVELOPMENT AND PROTOTYPING **(6Hrs)**

Scenarios and Persona Technique – Overview of Design Thinking Technique - Discovery and Brainstorming.
Concept Development - Task flow detailing for the Project – Prototyping Techniques - Paper, Electronic, and Prototyping Tools.

UNIT IV UX RESEARCH **(6Hrs)**

Understanding users, their goals, context of use, and environment of use.
Research Techniques: Contextual Enquiry, User Interviews, Competitive Analysis for UX.

UNIT V HEURISTIC EVALUATION **(6Hrs)**

10 Heuristic Principles, Examples Heuristic Evaluation: Group Assignment initiation (Website and App)Evaluation for key tasks of the app or website for heuristic principles, severity, recommendations.

Text Books

1. Jennifer Preece, Helen Sharp, Yvonne Rogers, "Interaction Design: Beyond Human-Computer Interaction", 4th Edition, Wiley publications, 2015
2. Alan Cooper and Robert Riemann, "About Face The Essentials of Interaction Design", 4th Edition, Wiley Publications,2014.
3. Elizabeth Goodman, Mike Kuniavsky, Andrea Moed, "Observing the User Experience - A Practitioner's Guide to User Research", Second Edition, Morgan Kaufmann Publications,2012.

Reference Books

1. Jesse James Garrett, "The Elements of User Experience: User-Centered Design for the Web and Beyond - Voices That Matter" New Riders; 2nd edition, 2010
2. Jonny Schneide, Understanding Design Thinking, Lean, and Agile, O'Reilly Media, Inc. 2017
3. Everett N McKay, UI is Communication: How to Design Intuitive, User Centered Interfaces by Focusing on Effective Communication, 1st Edition, 2013

Web References

1. https://nptel.ac.in/courses/124/107/124107008/
2. https://www.tutorialspoint.com/
3. cs.stir.ac.uk/courses/ITNP023/lectures/03-web.pdf

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	1	1	1	-	-	-	-	-	-	-	-	1	1	-
2	1	1	1	2	-	-	-	-	-	-	-	-	2	1	-
3	1	1	2	2	2	-	-	-	-	-	-	-	2	1	1
4	1	1	1	2	3	-	-	-	-	-	-	-	2	1	1
5	1	1	2	1	-	-	-	-	-	-	-	-	2	1	1

Correlation Level: 1-Low, 2-Medium, 3- High

U20CBE718	MOBILE COMPUTING	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To learn about various wireless & cellular communication networks and various telephone and satellite networks.
- To study about the location and handoff management
- To know about wireless Transmission fundamentals
- To build knowledge on various wireless sensor network routing protocols, energy-efficient protocols and D2D Communication in cellular networks.
- To explore the suitability of mobile computing models

Course Outcomes

After completion of the course, the students will be able to

CO1 - Understand the working principles of mobile networks and Contrast different types of telecommunication networks. **(K2)**

CO2 - Gain knowledge about the location and handoff management. **(K2)**

CO3 - Comprehend the fundamentals of wireless transmission. **(K2)**

CO4 – Explore the concepts of wireless sensor networks and D2D Communication. **(K3)**

CO5 – Use of Mobile computing models for different applications. **(K3)**

UNIT I INTRODUCTION **(9 Hrs)**

Overview of wireless and mobile infrastructure; Preliminary concepts on cellular architecture; Design objectives and performance issues; Radio resource management and interface; Propagation and path loss models; Channel interference and frequency reuse; Cell splitting; Channel assignment strategies; Overview of generations:- 1G to 5G.

UNIT II LOCATION AND HANDOFF MANAGEMENT **(9 Hrs)**

Introduction to location management (HLR and VLR); Mobility models characterizing individual node movement (Random walk, Fluid flow, Markovian, Activity-based); Mobility models characterizing the movement of groups of nodes (Reference point-based group mobility model, Community based group mobility model); Static and Dynamic location management schemes

Location management and Mobile IP; Overview of handoff process; Factors affecting handoffs and performance evaluation metrics; Handoff strategies; Different types of handoffs (soft, hard, horizontal, vertical).

UNIT III WIRELESS TRANSMISSION FUNDAMENTALS **(9 Hrs)**

Introduction to narrow and wideband systems; Spread spectrum; Frequency hopping; Introduction to MIMO; MIMO Channel Capacity and diversity gain; Introduction to OFDM; MIMO-OFDM system; Multiple access control (FDMA, TDMA, CDMA, SDMA); Wireless local area network; Wireless personal area network (Bluetooth and Zigbee).

Mobile Ad-hoc networks

Characteristics and applications; Coverage and connectivity problems; Routing in MANETs.

UNIT IV WIRELESS SENSOR NETWORKS & D2D COMMUNICATION **(9 Hrs)**

Concepts, basic architecture, design objectives and applications; Sensing and communication range; Coverage and connectivity; Sensor placement; Data relaying and aggregation; Energy consumption; Clustering of sensors; Energy-efficient Routing (LEACH).

D2D Communications in 5G Cellular Networks

Introduction to D2D communications; high-level requirements for 5G architecture; Millimeter-wave communication in 5G.

UNIT V MOBILE COMPUTING MODELS (9 Hrs)

Mobile Computing Models: Client-Server model – Client/Proxy/Server Model – Disconnected Operation Model – Mobile Agent Model – Thin Client Model – Tools: Java, Brew, Windows CE, WAP, Sybian, and EPOC

Content Beyond Syllabus

Cognitive radio networks and their applications

Text Books

1. Jochen Schiller, Mobile Communications. Pearson Education, 2009.
2. Andrea Goldsmith, Wireless Communications. Cambridge University Press, 2012.
3. Prasant KumPattnaik and Rajiib Mall, Fundamentals Of Mobile Computing, Prentice-Hall of India Pvt.Ltd

Reference Books

1. Ivan Stojmenovic, Handbook of Wireless Networking and Mobile Computing, Wiley, 2002.
2. Ezio Biglieri, Andrea J. Goldsmith, Larry J. Greenstein, Narayan Mandayam and H. Vincent Poor, Principles of Cognitive Radio. Cambridge University Press, 2012.
3. Raj Kamal, Mobile Computing, 2nd edition, 2011

Web Resources

1. https://nptel.ac.in/courses/106/106/106106147/
2. https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs13/
3. http://www.digimat.in/nptel/courses/video/106106147/L15.html

COs/POs/PSOs Mapping

Co's	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	-	-	-	-	-	-	-	-	2	1	1
2	2	2	1	1	-	-	-	-	-	-	-	-	2	1	1
3	3	2	2	2	-	-	-	-	-	-	-	-	2	2	2
4	3	2	2	2	2	-	-	-	-	-	-	-	2	3	2
5	3	2	2	2	2	-	-	-	-	-	-	-	2	3	2

Correlation Level: 1-Low, 2-Medium, 3- High

U20CBEP72	ADVANCED SOCIAL, TEXT AND MEDIA ANALYTICS LABORATORY	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

- To interpret knowledge from natural language text.
- To extract useful information from the textual data.
- To analyze social media data using web mining techniques.
- To discover interesting patterns from Social Media Networks.
- To analyze social media using sentiment analysis and opinion mining.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Interpret knowledge from natural language text. **(K3)**
CO2 - Extract useful information from the textual data. **(K2)**
CO3 - Analyse social media data using web mining techniques. **(K4)**
CO4 - Discover interesting patterns from Social Media Networks. **(K5)**
CO5 - Analyse social media using sentiment analysis and opinion mining. **(K4)**

List of Exercises

1. Text analysis - Facebook post comments/Youtube comments - using R/PYTHON.
2. scrape data from Facebook page posts for statistical analysis - using Python.
3. Mining Twitter Data with Python (Collecting data).
4. Perform link analysis on any social media platform.
5. Users Influential on Social media platforms
6. Implement an analytic application for Facebook/Twitter data to demonstrate Sentiment Analysis and Entity Recognition.

Text Books

1. Bing Liu, Web Data Mining-Exploring Hyperlinks, Contents, and Usage Data, Springer, Second Edition, 2011.
2. Reza Zafarani, Mohammad Ali Abbasi and Huan Liu, Social Media Mining-An Introduction, Cambridge University Press, 2014.
3. Bing Liu, Sentiment Analysis: Mining Opinions, Sentiments, and Emotions, Cambridge University Press, Second Edition, 2020.

Reference Books

1. Ronen Feldman and James Sanger, The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Data, Cambridge University Press, First Edition, 2009.
2. Marshall Sponder, Social Media Analytics: Effective Tools for Building, Interpreting, and Using Metrics,2011.
3. Alex Gonçalves, Social Media Analytics Strategy: Using Data to Optimize Business Performance,2017.

Web Resources

1. https://www.tutorialspoint.com/social_media_marketing/social_media_analysis.htm
2. https://onlinecourses.nptel.ac.in/noc21_cs74/preview
3. http://r-tutorials.com/social-media-analysis-in-r/

COs/POs/PSOs Mapping

Co's	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	3	-	-	-	-	-	-	-	2	1	1
2	3	2	1	1	3	-	-	-	-	-	-	-	2	1	1
3	3	2	1	1	3	-	-	-	-	-	-	1	2	2	1
4	3	2	1	1	3	-	-	-	-	-	-	1	2	2	2
5	3	2	1	1	3	-	-	-	-	-	-	1	2	2	2

Correlation Level: 1-Low, 2-Medium, 3- High

U20CBEP73	MOBILE COMPUTING LABORATORY	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

- To design and development of various network protocols using simulation tools.
- To develop communication protocol for device-to-device communication in sensor.
- To design and develop routing, congestion, application and security protocol.
- To implement application using WML
- To implement mobile application for gaming.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Design and develop various wireless network protocols using simulation tools **(k4)**
CO2 - Develop communication protocol for device-to-device communication in sensor **(k4)**
CO3 - Stimulate routing, congestion, application and security protocol **(k4)**
CO4 – Develop calculator and calendar application using WML. **(k4)**
CO5 - Develop gaming application using WML. **(k4)**

List of Exercises

1. Design and Development of different wireless network protocols using network simulators such as NS-3 / OMNET++.
- MAC Protocol
- Routing Protocol
- Transport Protocol
- Congestion Control Protocol
- Application Protocol
- Security Protocol
2. Design of simple Calculator having +,,,* and / using WML
3. Design of Calendar for any given month and year using WML
4. Design of simple game using WML
5. Animate an image using WML

Text Books

1. Jochen Schiller, Mobile Communications. Pearson Education, 2009.
2. Andrea Goldsmith, Wireless Communications. Cambridge University Press, 2012.
3. PrasantKumPattnaik and Rajib Mall, Fundamentals Of Mobile Computing, Prentice-Hall of India Pvt.Ltd

Reference Books

1. Ivan Stojmenovic, Handbook of Wireless Networking and Mobile Computing, Wiley, 2002.
2. EzioBiglieri, Andrea J. Goldsmith, Larry J. Greenstein, Narayan Mandayam and H. Vincent Poor, Principles of Cognitive Radio. Cambridge University Press, 2012.
3. Raj Kamal, Mobile Computing, 2nd edition, 2011

Web Resources

1. https://nptel.ac.in/courses/106/106/106106147/
2. https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs13/
3. http://www.digimat.in/nptel/courses/video/106106147/L15.html

COs/POs/PSOs Mapping

Co's	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	3	-	-	-	-	-	-	-	2	1	1
2	3	2	1	1	3	-	-	-	-	-	-	-	2	1	1
3	3	2	1	1	3	-	-	-	-	-	-	1	2	2	1
4	3	2	1	1	3	-	-	-	-	-	-	1	2	2	2
5	3	2	1	1	3	-	-	-	-	-	-	1	2	2	2

Correlation Level: 1-Low, 2-Medium, 3- High