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

FIFTH MEETING

Venue

Staff Room, Department of CSBS
Sri Manakula Vinayagar Engineering College
Madagadipet, Puducherry – 605 107

Date &Time

27.09.22 & 10 A.M.

Department of Computer Science and Business Systems

Minutes of Board of Studies

The Board of Studies Fifth meeting of Department of Computer Science and Business Systems (CSBS) was held on 27th Sep 2022 at 10:00 A.M in the Staff Room, 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. N.Danapaquiame** 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**	Representative from

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	BPO Transformation Lead, Tata Consultancy Services, Kolkata.	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

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1. Confirmation of BOS fifth meeting minutes was held on 27th Sep 2022.
2. To review of R2020 Curriculum (I to VIII Semesters) and Syllabi VIII Semester for 2020-24 batch under Autonomous R-2020 Regulations
   - ➢ Professional Core Courses
   - ➢ Professional Elective Courses
2. To discuss and recommend the syllabi for VIII Semesters under R2020 Regulations for UG Programme: B.Tech. CSBS in the AY 2020-21 for the students admitted in the year 2020-21, 2021-22, 2022-2023.
   - ➢ To discuss about Skill Development Course
3. To discuss about Extra-Curricular and Co – Curricular activities
   - ➢ To discuss about the End semester results for students admitted in the year 2020-2021 (Semester III) and 2021-2022 (Semester I)
4. Any other item with the permission of chair

Minutes of the Meeting

Dr.N.Danapaquiame, 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/5.1	**Confirmation of BOS fourth meeting Minutes was held on 25th Feb 2022.**

- Chairman, BoS, briefed the minutes of 4th BoS, its implementation and then it is confirmed with the approval, for the incorporation of minor revisions in curriculum (VII) and syllabi (VII semester) of R2020 regulations. The changes in Curriculum and syllabi are mentioned below.

Revisions in Curriculum

Syllabus Revisions

Sl. No	Regulation	Sem	Subject Name with Code	Unit	Particulars
1	R-2020	VII	Usability Design of Software Applications	II,III & V	The units were reordered Unit II has been changed as Unit V Unit III has been changed as Unit II

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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
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	Advanced Social, Text and Media Analytics Laboratory/ U20CBEP72 Link and user influential analysis exercises are included		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 were made and was approved by Academic Council and confirmed by the BoS members. (Annexure III).

BOS/2022/CSBS/UG/5.2	• **To review of R2020 Curriculum (I to VIII Semesters) and Syllabi I to VIII Semester for 2020-24 batch under Autonomous R-2020 Regulations** ➢ **Professional Core Courses** ➢ **Professional Elective Courses**

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	Revisions in Curriculum: VIII semester 1. BOS members are suggested to move any two HS courses to Professional elective v and vi. 2. Computational Finance and Modeling (U20CBE822) in Professional Elective v: and Advance Finance (U20CBE827) in Professional Elective vi are same. So, BoS members are suggested to remove advance finance course with Lab in professional Elective vi. 3. Advance finance Course (T+L). shall be replaced by Services Science & Service Operational Management (U20CBE827) (T+L) in Professional Elective vi. 4. IT Infrastructure Management (U20CBE824) (T) in professional elective v shall be replaced by Marketing Research and Marketing Management (U20HST816) (Core course). The changes were made as per the suggestions and it is approved by the BoS members. (Annexure- II)
BOS/2022/CSBS/UG/5.3	➢ **To discuss and recommend the syllabi for VIII Semesters under R2020 Regulations for UG Programme: B.Tech. CSBS in the AY 2020-21 for the students admitted in the year 2020-21, 2021-22, 2022-2023.** ➢ **To discuss about Skill Development Course**
	1. Bos members are suggested to move Services Science and service Operational Management (U20HST814) with its corresponding Laboratory (U20HSP802) to professional elective vi by replacing Advance Finance (U20CBE827) and its Laboratory (U20CBEP82). 2. Bos members are suggested to add SLA in UNIT III of Services Science and service Operational Management (U20HST814) course. In the same syllabus, they have suggested to remove second option of student project and prepare the report for two different services of organization. 3. In IT Project Management (U20HST815) course, suggested to include CMM in first unit. They suggested to use scrum tool (open source tools) for agile process. 4. Marketing Research & Marketing Management (U20HST816) course, BOS members are suggested to change the credit from 2 to 3 or reduce the syllabus content for 2 credit and also to update UNIT II in elaborate. In Unit V, process of how to do marketing for software products need to be included. Case studies, a comparison of tool usage, and two exercises from the software service business should be included in homework assignments. 5. IT Project Management laboratory (U20HSP802) course, suggested to include

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the risk management factors and how to manage project risk during pandemic situation.

6. Project Evaluation II (U20CBW803) require to refer business related project papers and business papers.
7. Enterprise Systems course (U20CBE826) in professional elective vi, suggested to refine UNIT V, required to identify some tools as open source. Needs to check the relevance of text book with the syllabus.
8. In the Image Processing and Pattern Recognition course (U20CBE828), it is required to check whether the students have Fourier Transform concepts or not. If not, the syllabus need to be improved.
9. Augmented Reality course (U20CBE715), suggested to include hands on training, AR assistance License tool.
10. Enterprise Systems Laboratory course (U20CBEP81), suggested to reframe the exercises based on the tools.
11. Image Processing and Pattern Recognition Laboratory course (U20CBEP83) suggested to include python programming language and MATLAB etc.
12. Augmented Reality Laboratory (U20CBEP85), suggested to specify the language and tools.

Syllabus Revisions

S.No	Regulation	Sem	Subject Name with Code	Unit	Particulars
1.	R-2020	VIII	Services Science and Service Operational Management (U20HST814)	III	Service Level Agreement (SLA) is included UNIT III.
2.	R-2020	VIII	Services Science and Service Operational Management (U20HST814)	V	After V unit , in Student Project second option has been removed and refined the first option
3.	R-2020	VIII	IT Project Management (U20HST815)	I	CMM has been inserted in unit I. some open source scrum tools are identified and inserted in this course.
4.	R-2020	VIII	Marketing Research & Marketing Management (U20HST816)	-	Credit is changed from 2 to 3 and total hours is changed from 30 to 45.

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5.	R-2020	VIII	Marketing Research & Marketing Management (U20HST816)	II	Unit II has been refined elaborately.
6.	R-2020	VIII	Marketing Research & Marketing Management (U20HST816)	V	Process for how to do marketing has been included.
7.	R-2020	VIII	Marketing Research & Marketing Management (U20HST816)	V	In Home Assignments, two exercises from the Software Services industry, a case study and a comparison of tool usage have been made.
8.	R-2020	VIII	IT Project Management laboratory (U20HSP802		The risk management factors and how to manage project risk during pandemic situation are included.
9.	R-2020	VIII	Project Evaluation II (U20CBW803)		In project phase II, the methodology of implementing projects is given and it is also suggested to refer only to business-related projects and business papers.
10.	R-2020	VIII	Enterprise Systems (U20CBE826)	IV, V	Unit IV and Unit V are reframed, some open source tools are identified, and the textbook list is refined based on the restructured syllabus.
11.	R-2020	VIII	Image Processing and Pattern Recognition (U20CBE828)	-	Students have studied linear algebra in the II semester, so that the students are able to work out the problems using integration based on the Fourier transform formula. So, a Mathematics Department BOS member suggested that it is not necessary to reframe the syllabus.
12.	R-2020	VIII	Augmented Reality (U20CBE715)	-	Hands on training, AR Assistance License tool has been specified in the syllabus in V.
13.	R-2020	VIII	Enterprise Systems Laboratory (U20CBEP81),	-	All the exercises are reframed based on the Theory syllabus.
14.	R-2020	VIII	Image Processing and Pattern Recognition Laboratory (U20CBEP83)	-	Name of the programming language and simulator is specified in the syllabus
15.	R-2020	VIII	Augmented Reality Laboratory (U20CBEP85)	-	Name of the programming language and tools is specified in the syllabus

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	The changes were made as per the suggestions and it is approved by the BoS members. **(Annexure- I)** The chairman briefed the skill development Courses. Conduction of skill development courses and its assessment process are discussed.
BOS/2022/CSBS/UG/5.4	**➢To discuss about Extra-Curricular and Co – Curricular activities** **➢To discuss about the End semester results for students admitted in the year 2020-2021 (Semester III) and 2021-2022 (Semester I)**
	The chairman briefed the Extra-Curricular and Co – Curricular activities to the BoS members. • "Train the Trainer Program" for the Faculties, for the current semesters (II and IV) to transit the knowledge and teach TCS designed courses as per their objectives • Guest lectures and workshops conducted • Student participation on various events such as hackathon and virtual internships • Various induction orientation activities for students admitted in 2022-2023 are scheduled.
BOS/2022/CSBS/UG/5.5	**Any other item with the permission of chair**
	BOS members were suggested to revise the curriculum of VIII semester under R-2020.

The meeting was concluded at 1:00 PM with vote of thanks by **Dr. N. Danapaquiame**, 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. N.Danapaquiame** Professor and Head, Department of CSBS, SMVEC, Puducherry	Chairman	
2	**Dr.T. Chithralekha, M.Tech., Ph.D** Professor,	Subject Expert (University	

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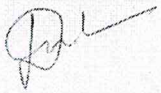
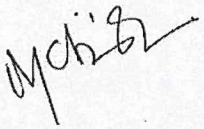
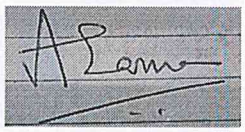
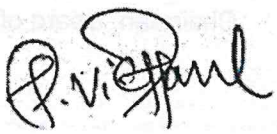
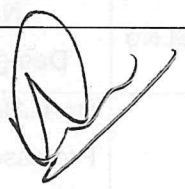
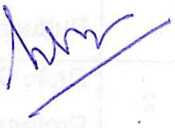
	School of Engineering and Technology, Pondicherry University, R.V.Nagar, Kalapet, Puducherry	Nominee)	
3	**Dr. K.Devaki, M.E., Ph.D.,** Professor, Department of Computer Science and Engineering, Rajalakshmi Engineering College, Chennai.	Subject Expert (Academic Council Nominee)	
4	**Dr. M.Chinnadurai, 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,	Internal Member	

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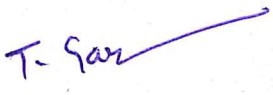
	SMVEC.		
10	**Mrs.K. Devika , M.E., ,** Assistant Professor, Department of Computer Science and Business Systems, SMVEC.	Internal Member	
11	**Dr.T. Gayathri** Professor and Head, Dept of Mathematics, SMVEC	Internal Member	
12	**Dr.D. Jaichithra** Professor and Head, Dept. of English, SMVEC	Internal Member	
13	**Dr. T. Jayavarthanan** Professor, Dept. of Physics, SMVEC	Internal Member	

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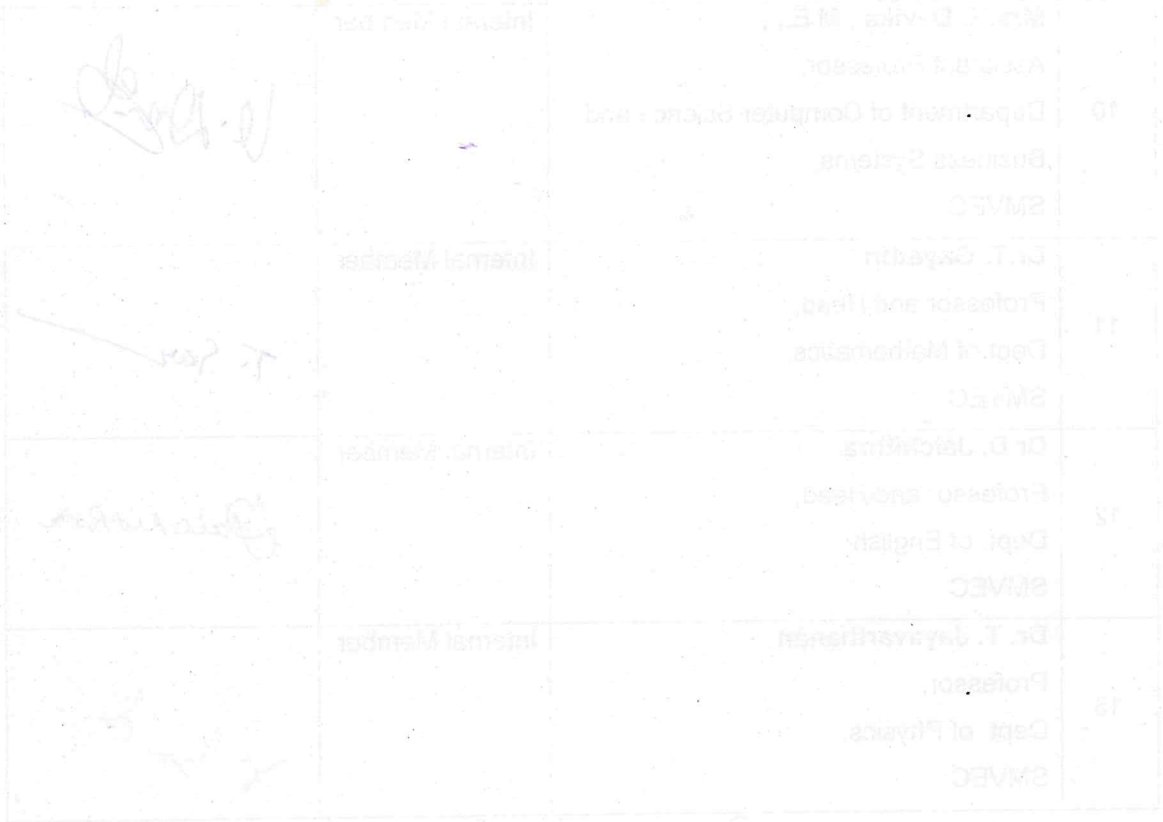

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Annexure I

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2.A.11:14

SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE
(An Autonomous Institution)

Puducherry

B.TECH.
COMPUTER SCIENCE AND BUSINESS SYSTEMS

ACADEMIC REGULATIONS 2020
(R-2020)

CURRICULUM AND SYLLABI

23 years of ACADEMIC EXCELLENCE

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COLLEGE VISION AND MISSION

Vision

To be globally recognized for excellence in quality education, innovation and research for the transformation of lives to serve the society

Mission

M1 :	**Quality Education**	:	To provide comprehensive academic system that amalgamates the cutting-edge technologies with best practices
M2 :	**Research and Innovation**	:	To foster value-based research and innovation in collaboration with industries and institutions globally for creating intellectuals with new avenues
M3:	**Employability and Entrepreneurship**	:	To inculcate the employability and entrepreneurial skills through value and skill-based training
M4 :	**Ethical Values**	:	To instill deep sense of human values by blending societal righteousness with academic professionalism for the growth of society

DEPARTMENT VISION AND MISSION

Vision

To envision the technology and business trends in this domain and to create technically competent professionals for meeting out the needs globally

Mission

M1: To foster knowledge sharing through contemporary curriculum and creative teaching learning process

M2: To impart strong computer and business skills to shine and sustain in the agile IT industry

M3: To promote technocrats with rich expertise in innovation and research

M4: To instill moral values and ethical responsibilities by empowering graduates to be socially responsible

PROGRAMME OUTCOMES (POs)

PO1:Engineering knowledge:

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

PO2:Problem analysis:

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

PO3:Design/development of solutions:

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

PO4:Conduct investigations of complex problems:

Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage:

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

PO6:The engineer and society:

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

PO7:Environment and sustainability:

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

PO8:Ethics:

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

PO9: Individual and team work:

Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10:Communication:

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

PO11:Project management and finance:

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

PO12: Life-long learning:

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

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PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1: To apply computer science and business concepts to solve the real world problems

PEO2: To develop professional skills in contemporary areas of computer science and business systems to obtain employability and pursue higher education

PEO3: To reconcile business demands with state-of-the art technologies by providing innovative solutions and insightful decisions

PEO4: To ensure ample growth with social and ethical responsibilities

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1: Ability to gain deep knowledge in Computer Science with equal appreciation in humanities, management, sciences and human values.

PSO2: Ability to demonstrate the technical and business skills and provide solutions for the societal needs

PSO3: Ability to engage lifelong learning and bestow innovative contributions toenhance research in the field of computer science and business system

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Sl.No	Course Category	Breakdown of Credits
1.	Humanities and Social Sciences (HS)	30
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	**156**

STRUCTURE FOR UNDERGRADUATE ENGINEERING PROGRAMME

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	4	30
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)	-	-	-	-	-	0	2	-	02
9	Employability Enhancement Courses (EEC)*	-	-	-	-	-	-	-	-	-
10	Mandatory courses (MC)*	-	-	-	-	-	-	-	-	-
Total		**19**	**19**	**18**	**20**	**20**	**20**	**21**	**25**	**156**

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

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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

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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

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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

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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 Laboratory	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

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

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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	1	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
Employability Enhancement Course										
11	U20CBC6XX	Certification Course - VI**	EEC	0	0	4	-	100	-	100
12	U20CBS605	Skill Development Course 5: NPTEL/MOOC-I	EEC	0	0	0	-	100	-	100
Mandatory Course										
13	U20CBM606	Essence of Indian Traditional Knowledge	MC	2	0	0	-	100	-	100
							20	950	650	1600

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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 Scilab / 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 Scilab / 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	U20CBW701	Internship/ Industrial Projects	PC	0	0	0	2	100	-	100
11	U20CBW702	Project Evaluation I	PC	0	0	4	2	100	-	100
Mandatory Course										
12	U20CBM707	Professional Ethics	MC	2	0	0	-	100	-	100
							21	500	600	1100

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

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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

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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***

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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

Annexure II

U20HST814 **IT Project Management**

L	T	P	C	H
3	0	0	3	45

Couse Objectives

1. Gain knowledge on fundamental concepts of project and project scheduling.
2. Understand Project Cost Control, Scheduling and Management Features.
3. Obtain knowledge on Agile Project Management.
4. Know about the Scrum framework in detail.
5. Obtain knowledge on DevOps and its related concepts

Course Outcomes

CO1 - Learn to effectively plan, and schedule projects within time and cost targets **(K2)**
CO2 - Have Knowledge in Cost Control, Scheduling and Management Features **(K2)**
CO3 - Be aware of different Agile Project Methodologies **(K3)**
CO4 - Know in detail about Scrum.**(K3)**
CO5 - Obtain good knowledge in DevOps **(K2)**

Unit – I Project Overview and Project Scheduling **(9 Hrs)**

Project Overview and Feasibility Studies- Identification, Market and Demand Analysis, Project Cost Estimate, Financial Appraisal. Project Scheduling concepts and methods, CMM, PERT and CPM, Critical Path Calculation, Precedence Relationship, Difference between PERT and CPM, Float Calculation and its importance, Cost reduction by Crashing of activity

UNIT – II Cost Control and Scheduling and Management Features **(9 Hrs)**

Project Cost Control (PERT/Cost), Resource Scheduling & Resource Leveling. Project Management Features: Risk Analysis, Project Control, Project Audit and Project Termination.

UNIT – III Agile Project Management **(9 Hrs)**

Agile Project Management: Introduction, Agile Principles, Agile methodologies, Relationship between Agile Scrum, Lean, DevOps and IT Service Management (ITIL). Other Agile Methodologies: Introduction to XP, FDD, DSDM, Crystal.

UNIT – IV Scrum **(9 Hrs)**

Scrum: Various terminologies used in Scrum (Sprint, product backlog, sprint backlog, sprint review, retro perspective), various roles (Roles in Scrum), Best practices of Scrum.

UNIT – V Devops **(9 Hrs)**

DevOps: Overview and its Components, Containerization Using Docker, Managing Source Code and Automating Builds, Automated Testing and Test Driven Development, Continuous Integration, Configuration Management, Continuous Deployment, Automated Monitoring, Case study.

Workshop

Workshops will be conducted as a part of this course which is mandatory for students to attend. The primary objective of the workshops is to teach the students the agile project management including Scrum and DevOps through group activities.

Assignment: To make the students to prepare the projects using scrum tools as open source for Agile process. Jitamin, KADOS open source scrum tools.

Text Books

1. Mike Cohn, *Succeeding with Agile: Software Development Using Scrum*

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	2	2	2	1	-	-	-	-	3	2	-	-	1	2	-
CO2	1	2	2	2	3	2	2	2	3	3	3	1	3	2	2
CO3	1	2	2	2	3	2	2	2	3	3	2	1	2	2	2
CO4	1	2	2	2	3	2	2	2	3	3	2	1	2	2	2
CO5	1	1	2	2	2	2	2	2	3	3	2	1	2	2	2

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

U20CBW803 **PROJECT EVALUATION II**

L	T	P	C	Hrs
0	0	16	8	240

Course Objectives

- To make a literature survey.
- To identify problem definition.
- To build a project design.
- To carry out project implementation.
- To perform project testing and documentation.

Course Outcomes

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

CO1 – Detailed literature survey related to the problem definition. **(K3)**

CO2 – Implementaion of Existing System **(K3)**

CO3 – Implementation of Proposed Work **(K3)**

CO4 – Comparion of Existing with the proposed system and quantification **(K3)**

CO5 – Future work. **(K3)**

List of Exercises

The project group is required to do the following

1. Detailed literature survey,
2. Problem Definition and Research model preparation (conceptual model)
3. Data Collection tool design
4. Data Collection
5. Data Analysis
6. Interpretation and Results
7. Scope for Future Work

Reference Books

- Papers published in reputed journals, conferences related to the project

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	3	2	1	1	-	-	-	-	-	-	3	3	2	2	3
2	3	2	1	1	3	-	-	-	-	-	3	3	2	2	3
3	3	2	1	1	3	-	-	-	-	-	3	3	2	2	3
4	3	2	1	1	3	-	-	-	-	-	3	3	2	2	3
5	3	2	1	1	3	-	-	-	-	-	3	3	2	2	3

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

Employability Enhancement Course

		L	T	P	C	Hrs
U20CBS806	**Skill Development Course 6: NPTEL/ MOOC-II**	**0**	**0**	**0**	**0**	**30**

Student should register online courses like MOOC / SWAYAM / NPTEL etc. approved by the Department committee comprising of HoD, Programme Academic Coordinator, Class advisor and Subject Experts. Students have to complete the relevant online courses successfully. The list of online courses is to be approved by Academic Council on the recommendation of HoD at the beginning of the semester if necessary, subject to ratification in the next Academic council meeting. The Committee will monitor the progress of the student and recommend the grade (100% Continuous Assessment pattern) based on the completion of course / marks secured in online examinations. The marks attained for this course is not considered for CGPA calculation.

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U20CBE821 **Behavioral Economics**

L	T	P	C	H
2	1	0	3	45

Course Objectives

1. To understand the concept and theory of economics.
2. To acquire knowledge on the choices and behavior of firms, households and other economics entities.
3. To learn the behavioral science perspective in economics.
4. To know the current ideas and concepts regarding decision making in economics.
5. To study the inter temporal choice in economics

Course Outcomes

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

CO1 - Understand and apply various concepts in traditional and modern Microeconomic **(K3).**
CO2 - Focus on decision making, and develop a holistic understanding of these concepts and their interconnections **(K3).**
CO3 - Explore the knowledge on behavioural science perspective in Economics **(K3).**
CO4 - Understand current ideas and concepts regarding decision making in Economics **(K2).**
CO5 - Students will be able to understand the inter temporal choice in Economics **(K2).**

Unit I Introduction **(9Hrs)**

The neoclassical/standard model and behavioral economics in contrast; historical background; behavioral economics and other social sciences; theory and evidence in the social sciences and in behavioral economics; applications – gains and losses, money illusion, charitable donation.

Unit II Basics of choice theory **(9Hrs)**

Revisiting the neoclassical model; utility in economics and psychology; models of rationality; connections with evolutionary biology and cognitive neuroscience; policy analysis – consumption and addiction, environmental protection, retail therapy; applications – pricing, valuation, public goods, choice anomalies

Unit III Beliefs, heuristics and biases **(9Hrs)**

Revisiting rationality; causal aspects of irrationality; different kinds of biases and beliefs; self-evaluation and self-projection; inconsistent and biased beliefs; probability estimation; trading applications – trade in counterfeit goods, financial trading behavior, trade in memorabilia, policy analysis – norms and markets, labor markets, market clearing, public goods; applications – logic and knowledge, voluntary contribution, compensation design.

Unit IV Choice under uncertainty **(9Hrs)**

Background and expected utility theory; prospect theory and other theories; reference points; loss aversion; marginal utility; decision and probability weighting; applications – ownership and trade, income and consumption, performance in sports. **Strategic choice:** . Review of game theory and Nash equilibrium – strategies, information, equilibrium in pure and mixed strategies, iterated games, bargaining, signaling, learning; applications – competitive sports, bargaining and negotiation, monopoly and market entry

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Unit V Intertemporal choice **(9Hrs)**

Geometric discounting; preferences over time; anomalies of inter-temporal decisions; hyperbolic discounting; instantaneous utility; alternative concepts – future projection, mental accounts, heterogeneous selves, procedural choice; policy analysis – mobile calls, credit cards, organization of government; applications – consumption and savings, clubs and membership, consumption planning. Individual preferences; choice anomalies and inconsistencies; social preferences; altruism; fairness; reciprocity; trust; learning; communication; intention; demographic and cultural aspects; social norms; compliance and punishment; inequity aversion;

Text Books

1. Philip Corr, Anke Plagnol, "Behavioral Economics: The Basic", Routledge; 1st edition, 2018.
2. N. Wilkinson and M. Klaes, "An Introduction to Behavioral Economics ", 2017.
3. Robert H. Frank, "Microeconomics and Behaviour", McGraw-Hill, 9th Edition, 2014.
4. Paul A. Samuelson, William D. Nordhaus, Sudip Chaudhuri and AnindyaSen, "Economics", 19th edition,Tata McGraw Hill, 2010.
5. M.L.Trivedi, "Managerial Economics:Theory & Applications", Tata McGraw-Hill Education, 4th Edition, 2002.

Reference Books

1. William Boyes and Michael Melvin, "Textbook of Economics", DTECH, 6th Edition, 2004.
2. N. Gregory Mankiw, "Principles of Economics", Thomson learning, 3rd Edition, 2003.
3. Richard Lipsey and Alec Charystal, "Economics", Oxford, University Press, 12th Edition, 2011.

Web References

1. https://www.behavioraleconomics.com/resources/introduction-behavioral-economics/
2. https://wglasser.com/quickstart-guide-to-choice-theory/
3. https://wglasser.com/quickstart-guide-to-choice-theory/
4. https://www.youtube.com/watch?v=kPQcZgjHYtU
5. https://www.investopedia.com/terms/i/intertemporalchoice.asp

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	2	1	3	2	3	1	3	3	2	2	2	3	-	1	2
CO2	2	1	2	2	2	1	2	1	2	2	3	3	-	1	2
CO3	1	2	1	2	2	2	3	3	3	3	2	3	-	1	2
CO4	2	2	3	3	3	2	3	3	1	1	2	2	-	1	2
CO5	1	2	3	3	3	3	2	3	2	2	2	2	-	1	2

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

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U20CBE822	Computational Finance & Modeling	L	T	P	C	H
		2	1	0	3	45

Course Objectives

1. Understand existing financial models in a quantitative and mathematical way.
2. Apply these quantitative tools to solve complex problems in the areas of portfolio management, risk management and financial engineering.
3. Explain the approaches required to calculate the price of options.
4. Identify the methods required to analyse information from financial data and trading systems.

Course Outcomes

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

CO1 - Understand existing financial models in a quantitative and mathematical way.**(K2)**
CO2 - Apply these quantitative tools to solve complex problems in the areas of portfolio management, risk management and financial engineering.**(K4)**
CO3 - Explain the approaches required to calculate the price of options.**(K3)**
CO4 - Identify the methods required to analyse information from financial data and trading systems.**(K3)**
CO5 - Understand the various statistical methods to analyse the financial data.**(K2)**

UNIT – I **(9Hrs)**

Numerical methods relevant to integration, differentiation and solving the partial differential equations of mathematical finance: examples of exact solutions including Black Scholes and its relatives, finite difference methods including algorithms and question of stability and convergence, treatment of near and far boundary conditions, the connection with binomial models, interest rate models, early exercise, and the corresponding free boundary problems, and a brief introduction to numerical methods for solving multi-factor models.

UNIT – II Black-Scholes framework: Black-Scholes PDE **(9Hrs)**

simple European calls and puts; put-call parity. The PDE for pricing commodity and currency options. Discontinuous payoffs - Binary and Digital options. The Greeks: theta, delta, gamma, vega & rho and their role in hedging. The mathematics of early exercise - American options: perpetual calls and puts; optimal exercise strategy and the smooth pasting condition. Volatility considerations - actual, historical, and implied volatility; local vol and volatility surfaces.
Simulation including random variable generation, variance reduction methods and statistical analysis of simulation output. Pseudo random numbers, Linear congruential generator, Mersenne twister RNG. The use of Monte Carlo simulation in solving applied problems on derivative pricing discussed in the current finance literature. The technical topics addressed include importance sampling, Monte Carlo integration, Simulation of Random walk and approximations to diffusion processes, martingale control variables, stratification, and the estimation of the "Greeks".

UNIT – III Financial Products and Markets **(9Hrs)**

Introduction to the financial markets and the products which are traded in them: Equities, indices, foreign exchange, and commodities. Options contracts and strategies for speculation and hedging.

UNIT – IV **(9Hrs)**

Application areas include the pricing of American options, pricing interest rate dependent claims, and credit risk. The use of importance sampling for Monte Carlo simulation of VaR for portfolios of options.

UNIT – V **Statistical Analysis of Financial Returns** **(9Hrs)**

Fat-tailed and skewed distributions, outliers, stylized facts of volatility, implied volatility surface, and volatility estimation using high frequency data. Copulas, Hedging in incomplete markets, American Options, Exotic options, Electronic trading, Jump Diffusion Processes, High-dimensional covariance matrices, Extreme value theory, Statistical Arbitrage.

Text Books

1. R. Seydel, "Tools for Computational Finance", 2nd edition, Springer-Verlag, New York, 2004
2. P. Glasserman, "Monte Carlo Methods in Financial Engineering", Springer-Verlag, New York, 2004.
3. A. Lewis, " Option Valuation under Stochastic Volatility", Finance Press, Newport Beach, California, 2000
4. A. Pelsser, "Efficient Methods for Valuing Interest Rate Derivatives", Springer-Verlag, New York, 2000.
5. W. Press, S. Teukolsky, W. Vetterling and B. Flannery, "Numerical Recipes in C: The Art of Scientific Computing", Cambridge University Press, Cambridge, UK. Available on-line at: http://www.nr.com/, 1997.

Reference Books

1. D. Ruppert and David S. Matteson, "Statistics and Data Analysis for Financial Engineering",2015
2. R. Carmona, "Statistical Analysis of Financial Data in S-Plus", 2014
3. N. H. Chan, "Time Series: Applications to Finance", 2018.
4. R. S. Tsay, "Analysis of Financial Time Series", 2002.
5. J. Franke, W. K. Härdle and C. M. Hafner, "Statistics of Financial Markets: An Introduction", 2004.

Web References

1. http://www.nr.com/
2. https://en.wikipedia.org/wiki/Computational_finance
3. https://www.investopedia.com/terms/f/financial-market.asp
4. https://www.investopedia.com/terms/b/blackscholes.asp

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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	3	1	2	3	2	-	2	2	-	-	-	-	-	-	-
CO2	3	3	3	3	2	1	2	3	-	-	-	-	-	-	-
CO3	2	3	2	3	2	2	1	3	-	-	-	-	-	-	-
CO4	3	2	2	3	1	2	2	3	-	-	-	-	-	-	-
CO5	1	2	1	2	3	3	2	3	-	-	-	-	-	-	-

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

U20CBE823	PSYCHOLOGY	L	T	P	C	H
		2	1	0	3	45

Course Objectives

1. Introduces students to the content areas of industrial psychology and the application of psychological theory to organizational issues.
2. Includes an employment law, job analysis, recruitment and selection, training, performance appraisal and discipline, employee motivation, and workplace safety.
3. Using an applied approach, this course will help prepare students for their roles as employees and managers.
4. Includes motivation of an employee and level of satisfaction measurements.
5. Introduces leadership, work behaviour and handling of stress.

Course Outcomes

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

CO1 - Become conversant about the major content areas of Industrial Psychology (i.e., job analysis, recruitment, selection, employment law, training, performance management, and health/well-being issues in the workplace**).(K2)**

CO2 - Gain further comfort with statistical concepts in the context of making personnel decisions to Reinforce content learned in PSY203 or an equivalent introductory statistics course**.(K3)**

CO3- Gain practical experience by completing a series of hands-on projects involving job analysis, selection decisions, training programs and employee well-being**.(K3)**

CO4 - Deepen your understanding of tests and measurements so that you can collect accurate information and make sound data-based decisions**.(K4)_**

CO5 - Prepare for other focused seminar courses in Industrial/Organizational Psychology or Human Resource Management. **(K2)**

UNIT – I **(9 Hrs)**

What is I/O Psychology? Research Methods, Statistics, and Evidence-based Practice, Introduction & Legal Context of Industrial Psychology, Job Analysis & Competency Modeling, Job Evaluation & Compensation, Job Design & Employee Well-Being, Recruitment

UNIT – II **(9 Hrs)**

Identifying Criteria & Validating Tests and Measures, Screening Methods, Intensive Methods,

UNIT – III **(9 Hrs)**

Performance Goals and Feedback, Performance Coaching and Evaluation, Evaluating Employee Performance,

UNIT – IV **(9 Hrs)**

Employee Motivation, Satisfaction and Commitment, Fairness and Diversity

UNIT – V **(9 Hrs)**

Leadership, Organizational Climate, Culture, and Development, Teams in Organizations, The Organization of Work Behavior, Stress Management: Demands of Life and Work

Text Books

1. Stephen Robbins, Tim Judge, Neharika Vohra, "Organizational Behaviour", Pearson, 18th Edition, 2019.

2. A. 11. 26

2. TV.Rao, "Performance Management towards Organizational Excellence", Sage, 2nd Edition, 2016.
3. Pratibha Goyal , Alok Chakrawal , "Stress Management", Studera Press, 1st Edition, 2016.
4. Landy, F. J. and Conte, J. M. " Work in the 21st Century" (4th Edition). Oxford: Blackwell Publishing, 2013.
5. Imes, D., Kantowitz, B., & Roediger, H, "Research methods in psychology", Cengage Learning, 9th Edition, 2011.

Reference Books

1. Breakwell, G.M., Smith, J.A., &Wright, D.B, "Research methods in psychology", Sage, 4th Edition, 2012.
2. Charles Stangor and Jennifer Walinga, "Introduction to Psychology" 1st Canadian Edition, 2014.
3. Dr. Dan Ariely , "Predictably Irrational, Revised and Expanded Edition: The Hidden Forces That Shape Our Decisions", kindle Edition, 2010.
4. Daniel Goleman, "Emotional Intelligence: Why It Can Matter More Than IQ ", kindle edition,2005.

Web References

1. https://en.wikipedia.org/wiki/Industrial_and_organizational_psychology
2. https://ip2012.blogspot.com/2012/02/job-analysis.html
3. https://opentextbc.ca/researchmethods/chapter/practical-strategies-for-psychological-measurement/
4. https://www.inc.com/encyclopedia/employee-motivation.html
5. https://positivepsychology.com/psychology-teamwork/

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	3	2	-	-		-	1	-
CO2	1	2	-	-	-	-	2	3	2	-	-	-	1	2	-
CO3	-	3	-	-	-	-	2	3	2	-	-	-	-	3	-
CO4	1	2	-	-	-	-	1	2	2	-	-	-	1	1	-
CO5	-	1	-	-	-	-	1	1	1	-	-	-	-	1	-

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

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U20CBE824	Marketing Research & Marketing Management	L	T	P	C	H
		3	0	0	3	45

Course Objectives

1. Understand the concepts of marketing with respect to the changing business environment.
2. Obtain knowledge from theoretical and practical aspects of marketing research
3. Learn the concepts of Pricing, Promotion and Distribution Strategy
4. Encourage the students to take up a critical and analytical thinking through research
5. Know about the Internet marketing and business to business marketing in detail

Course Outcomes

CO1 - Understand basic marketing concepts **(K2)**
CO2 - Comprehend the dynamics of marketing and analyse how its various components interact with each other in the real world **(K2)**
CO3 - Leverage marketing concepts for effective decision making **(K2)**
CO4 - Understand basic concepts and application of statistical tools in Marketing research **(K3)**
CO5 - Understand internet marketing, Business to Business marketing, Promotion in business markets, CRM and Strategies adopted in B2B markets. **(K3)**

UNIT – I Marketing Concepts **(9 Hrs)**

Marketing Concepts and Applications: Introduction to Marketing & Core Concepts, Marketing of Services, Importance of marketing in service sector.

Marketing Planning & Environment: Elements of Marketing Mix, Analyzing needs & trends in Environment - Macro, Economic, Political, Technical & Social.

Understanding the consumer: Determinants of consumer behavior, Factors influencing consumer behaviour.

Market Segmentation: Meaning & Concept, Basis of segmentation, selection of segments, Market Segmentation strategies, Target Marketing, Product Positioning.

UNIT – II Product Management **(9 Hrs)**

Product Life cycle concept, New Product development & strategy, Stages in New Product development, Product decision and strategies, Branding & packaging

UNIT – III Pricing, Promotion and Distribution Strategy **(9 Hrs)**

Policies & Practices – Pricing Methods & Price determination Policies. Marketing Communication – The promotion mix, Advertising & Publicity, 5 M's of Advertising Management. Marketing Channels, Retailing, Marketing Communication, Advertising

UNIT – IV Marketing Research **(9 Hrs)**

Introduction, Type of Market Research, Scope, Objectives & Limitations

Marketing Research Techniques, Survey Questionnaire design & drafting, Pricing Research, Media Research, Qualitative Research

Data Analysis: Use of various statistical tools – Descriptive & Inference Statistics, Statistical Hypothesis Testing, Multivariate Analysis - Discriminant Analysis, Cluster Analysis, Segmenting and Positioning, Factor Analysis

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UNIT – V Internet Marketing **(9 Hrs)**

Introduction to Internet Marketing. Mapping fundamental concepts of Marketing (7Ps, STP); Strategy and Planning for Internet Marketing. **Business to Business Marketing:** Fundamental of business markets. Organizational buying process. Business buyer needs. Market and sales potential. Product in business markets. Price in business markets. Place in business markets. Promotion in business markets. Relationship, networks and customer relationship management. Business to Business marketing strategy. Marketing of software products, ITIL functions and processes.

Home Assignments

1. **Written Analyses of Cases** – Students are expected to report on their analysis and recommendations of what to do in specific business situations by applying concepts and principles learned in class (Case Studies to be shared by Faculty) e.g. "Marketing Myopia"
2. Case study: To insist the students to study the software products and latest tools used in the marketing filed and comparison of tools also required.
3. Field visit & live project covering steps involved in formulating Market Research Project
4. Measuring Internet Marketing Effectiveness: Metrics and Website Analytics

Text Books

1. Philip Kotler, "Marketing Management (Analysis, Planning, Implementation & Control)", Paperback, 1993.
2. William J. Stanton & Others, "Fundamentals of Marketing",
3. Marketing Management – V.S. Ramaswamy and S. Namakumari
4. Marketing Research – Rajendra Nargundkar
5. Market Research – G.C. Beri
6. Market Research, Concepts, & Cases – Cooper Schindler

Reference Books

1. Marketing Management – Rajan Saxena
2. Marketing Management – S.A. Sherlekar
3. Service Marketing – S.M. Zha
4. Journals – The IUP Journal of Marketing Management, Harvard Business Review
5. Research for Marketing Decisions by Paul Green, Donald, Tull
6. Business Statistics, A First Course, David M Levine at al, Pearson Publication

Web References

1. https://www.questionpro.com/blog/what-is-market-research/
2. https://www.productplan.com/learn/what-is-product-management/
3. https://www.sheerid.com/business/resources/promotional_pricing/
4. https://en.wikipedia.org/wiki/Marketing_research
5. https://blog.hubspot.com/marketing/internet-marketing

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	2	1	1	-	-	2	1	-	1	-	2	2	2	2	2
CO2	2	1	1	-	-	2	1	-	1	-	2	2	2	2	2
CO3	2	1	-	-	-	2	1	-	1	-	2	2	1	1	1
CO4	2	1	-	-	-	2	1	-	1	-	2	2	1	1	1
CO5	2	1	-	-	-	2	1	-	1	-	2	2	2	2	2

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

2.A.11.49

U20CBE825	SMART SYSTEMS	L	T	P	C	H
		2	1	0	3	45

Course Objectives

1. Includes the basics of Deep Neural networks
2. Understand the architecture of processor
3. Comprises Design of Arduino board
4. Analyses the various security techniques.
5. To know the implementation of block chain technology

Course Outcomes

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

CO1 - Show an understanding of Smart Systems, their implementation and applications **(K2)**
CO2 - Interpret and explain the impact of Smart Systems, ethical, legal, social, environmental implications. **(K3)**
CO3 - Explain concepts used in Smart Systems and associated architectures. **(K2)**
CO4 - Explain the major Smart Systems application areas and techniques used within them **(K2).**
CO5 - Discuss examples of Smart Systems used in real life situations **(K3)**

Unit I Deep Learning **(9 Hrs)**

Basics of Neural Networks-Basic Concept of Neurons – Perceptron Algorithm – Feed Forward and Backpropagation Networks- CNN Architectures – Convolution – Pooling Layers – Transfer Learning – Image Classification using Transfer Learning – Recurrent and Recursive Nets – Recurrent Neural Networks – Deep Recurrent Networks – Recursive Neural Networks – Applications.

Unit II IOT 8-bit embedded processor **(9 Hrs)**

8-Bit Microcontroller – Architecture – Instruction Set and Programming – Programming Parallel Ports – Timers and Serial Port – Interrupt Handling.

Unit III IOT and Arduino Programming **(9Hrs)**

ARM Processor – Introduction to the Concept of IOT Devices – IOT Devices Versus Computers – IOT Configurations – Basic Components – Introduction to Arduino – Types of Arduino – Arduino Toolchain – Arduino Programming Structure – Sketches – Pins -Input/Output From Pins Using Sketches – Introduction to Arduino Shields – Integration of Sensors and Actuators with Arduino

Unit IV Introduction of Cryptography and Block chain **(9 Hrs)**

Introduction about Block chain, Block chain Technology Mechanisms & Networks, Block chain Origins, Objective of Block chain, Block chain Challenges, Transactions and Blocks, P2P Systems, Keys as Identity, Digital Signatures, Hashing, and public key cryptosystems, private vs. public Block chain

Unit V Solidity Programming **(9 Hrs)**

Solidity – Language of Smart Contracts, Installing Solidity & Ethereum Wallet, Basics of Solidity, Layout of a Solidity Source File & Structure of Smart Contracts, General Value Types (Int, Real, String, Bytes, Arrays, Mapping, Enum, address)

Text Books

1. Ian J. Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2017.
2. Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press, 2016.
3. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies", 2016,
4. Muhammed Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, "The 8051 Microcontroller and Embedded Systems", Pearson Education, Second Edition, 2014.
5. Adrian McEwen, Hakim Cassimally "Designing the Internet of Things", John Wiley and Sons, 2014.

References Books

1. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017.
2. Andreas M. Antonopoulos,"Mastering Bitcoin", 2016.
3. Michael J. Pont, "Embedded C", Pearson Education, 2007.
4. Wayne Wolf, "Computers as Components: Principles of Embedded Computer System Design", Elsevier, 2006

Web References

1. https://nptel.ac.in/courses/106/104/106104220/#
2. https://onlinecourses.nptel.ac.in/noc22_cs53/preview
3. https://nptel.ac.in/courses/200/204/306104564/#

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	2	2	2	1	1	1	1	2	1	2	2	2	2
2	1	1	2	2	2	1	1	1	1	2	1	2	2	2	2
3	1	1	2	2	2	1	1	1	1	2	1	2	2	2	2
4	1	1	2	2	2	1	1	1	1	2	2	2	2	2	2
5	1	1	2	2	2	1	1	1	1	2	2	2	2	2	2

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

2.A.11.51

U20CBE826 **ENTERPRISE SYSTEMS**

L	T	P	C	H
3	0	0	3	45

Course Objectives

- Understand the components of an ERP system.
- Know the implementation stages and processes of an ERP system.
- Understand the process of integrating legacy systems and other current IT systems with an ERP system.
- Understand the infrastructure of ERP systems.
- Understand and know the modern Enterprise Information Systems

Course Outcomes

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

CO1 - Understand basic elements of Enterprise systems **(K2)**
CO2 - Develop skills in understanding architecture and non-functional requirements in developing Enterprise system development and their deployment **(K3)**
CO3 - Understand Enterprise Patterns **(K2)**
CO4 - To Develop enterprise applications. **(K3)**
CO5 - Understand future trends in Enterprise architectures **(K2)**

UNIT I Introduction **(9 Hrs)**

Introduction to Modern Enterprise Systems: Introduction to enterprise systems. Elements of enterprise systems – Business Information system, Decision support systems, Knowledge management systems, Financial and human resource systems. Kinds of Enterprise systems- B2C and B2B models. **Components of Enterprise systems:** Channels (Mobile, web, desktop, partner integration), Data management, workflow, Controlling and Auditing, Accounting etc. **Sample Enterprise systems:** ERP, SCM, CRM, Product Life cycle management (PLM), HR Systems (HRM), GL systems.

UNIT – II Enterprise Systems Architecture, Key Characteristics, Applications (9 **Hrs)**
Key characteristics Enterprise systems: Distributivity, Managed redundancy, Exception processing, Collaboration, Data transformation. **Enterprise System architectures:** Batch processing, Monolithic, client server, ecommerce, service oriented, micro service, and cloud architectures. **Introduction to Enterprise Application architectures:** Layer Architecture, Event driven Architecture, Service oriented Architecture, Micro service architecture, Plug-in architecture

UNIT – III Architecture Patterns, Integration Techniques **(9 Hrs)**
Application architecture Patterns: Layering, Organizing domain logic, Mapping to database, Web Presentation, Concurrency. Enterprise Application Integration: Introduction to Enterprise Integration, different integration styles. Elements of messaging-based Integration. Enterprise Integration patterns: Modern service integration techniques. Introduction to WSDL, SOAP. Introduction RESTful web services integration. Differences between SOAP and REST.

UNIT – IV Cloud Computing in Enterprise Systems **(9 Hrs)**
Deployment of Enterprise applications: Key requirements in deployment - Stability, capacity, Security, availability, Network, Availability, and Transparency (Basic Introduction only). Concepts of Cloud computing, cloud platforms and their role in Enterprise systems: Core Concepts – Types of Cloud: Private, public, and Hybrid clouds. Advantage of cloud computing – Scaling, Availability, and cost. Disadvantages – Technology overload, Security, Monitoring and troubleshooting, Testing, Latency etc. Cloud service models: - Infrastructure, platform, Software as a Service in Cloud Computing. Major public clouds: Google cloud, AWS, Azure.

UNIT – V Cloud Application Development and Deployment **(9 Hrs)**

Application development and deployment in cloud – Dockers, micro services, Kubernetes, Serverless. Continuous Integration/Continuous Delivery Introduction to Enterprise Architecture: Importance of Enterprise Architecture. Enterprise architecture models. Zachman Framework, TOGAF Framework. **Enterprise Architecture Case study**: Implementing EA in secret service systems, Health care organization, Manufacturing Company, case study of University, case study of midsized municipal government.

Home Assignments

- Identify an open-source tools for developing application and ask students to study/develop/modify various elements of the application from enterprise systems architecture, development and deployment perspective. Architecture related case studies are available in Ref [3].

  Note: Open source tools for enterprise simulation are Minitab Workspace, Mimic Simulator, MATLAB, IGrafx.

Textbooks

1. Martin Fowler et al, "Pattern of Enterprise Application Architecture", Addison-Wesley, 2012
2. Gregor Hohpe, Bobby Woolf, Enterprise Integration Patterns: Designing, Building, and Deploying Messaging Solutions,
3. Mark Richards, "Software Architecture patterns", 2015, O'Reilly.
4. Sam Newman, "Building Microservices", O'Reilly.0, 2015.

Reference Books

1. Ravi Shankar & S. Jaiswal, Galgotia, "Enterprise Resource Planning", 1st Edition, 1999.
2. Alexis Leon, "Enterprise Resource Planning", Tata McGraw Hill, 3rd Edition, 2017.

Web References

1. https://www.classcentral.com/course/enterprise-systems-12165
2. https://nptel.ac.in/courses/124/107/124107008/
3. https://www.tutorialspoint.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	2	1	3	2	3	1	3	3	2	2	2	3	-	1	2
CO2	2	1	2	2	2	1	2	1	2	2	3	3	-	1	2
CO3	1	2	1	2	2	2	3	3	3	3	2	3	-	1	2
CO4	2	2	3	3	3	2	3	3	1	1	2	2	-	1	2
CO5	1	2	3	3	3	3	2	3	2	2	2	2	-	1	2

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

2.A.11.56

U20CBE827	Services Science & Service Operational Management	L	T	P	C	H
		3	0	0	3	45

Course Objectives

1. Understand the services and service operations management concepts.
2. Comprehend the techniques of service operations.
3. Understand the service quality and service design aspects.
4. Understand the service innovation aspects.
5. To analyze how services are different from products by its characteristics.

Course Outcomes

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

CO1 - Understand concepts about Services and distinguish it from Goods **(K2)**
CO2 - Able to identify characteristics and nature of Services **(K2)**
CO3 - Comprehend ways to design Services and evaluate them using Service qualities **(K3)**
CO4 - Understand how various methods can be used to operate and manage Service businesses **(K2)**
CO5 - Understand how innovation can be approached from Services point of view **(k2)**

UNIT – I Introduction to Services **(9 Hrs)**

Introduction: Introduction to the course, Introduction to service operations, Role of service in economy and society, Introduction to Indian service sector. **Nature of Services and Service Encounters:** Differences between services and operations, Service package, characteristics, various frameworks to design service operation system, Kind of service encounter, importance of encounters **Service-Dominant Logic:** From Goods-Dominant logic to Service-Dominant logic, Value Co-creation

UNIT – II Service Design **(9 Hrs)**

Service Strategy and Competitiveness: Development of Strategic Service Vision (SSV), Data Envelopment Analysis. **New Service Development**: NSD cycle, Service Blueprinting, Elements of service delivery system. **Service Design:** Customer Journey and Service Design, Design Thinking methods to aid Service Design. **Locating facilities and designing their layout:** models of facility locations (Huff's retail model), Role of service-scape in layout design. **Service Quality:** SERVQUAL, Walk through Audit, Dimensions of Service quality & other quality tools

UNIT – III **(9 Hrs)**

Service Guarantee & Service Recovery: How to provide Service guarantee. Service Level Agreement (SLA), SLA Template, how to recover from Service failure?

UNIT – IV Forecasting, Managing capacity and Facilities **(9 Hrs)**

Forecasting Demand for Services: A review of different types of forecasting methods for demand forecasting. **Managing Capacity and Demand**: Strategies for matching capacity and demand,Psychology of waiting, Application of various tools used in managing waiting line in services.
Managing Facilitating Goods: Review of inventory models, Role of inventory in services. **Managing service supply relationship:** Understanding the supply chain/hub of service, Strategies for managing suppliers of service. **Vehicle Routing Problem:** Managing after sales service, understanding services that involve transportation of people and vehicle, Techniques for optimizing vehicle routes

UNIT – V Service Innovation and Case studies **(9 Hrs)**

Service Innovation: Services Productivity, Need for Services Innovation.

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Student Project

Choose any two different service organization and present the report from the perspective of: nature of service, classification of service, blueprint or service design analysis, service quality, and any additional perspective you would like to add.

Text Books

1. Fitzsimmons & Fitzsimmons, "Service Management: Operations, Strategy, Information Technology", McGraw Hill publications (7th Edition)

Reference Books

1. Wilson, A., Zeithaml, V. A., Bitner, M. J., & Gremler, D. D," Services marketing: Integrating customer focus across the firm", McGraw Hill, 2012.
2. Lovelock, C, "Services Marketing", 7/e. Pearson Education India, 2011.
3. Reason, Ben, and Lovlie, Lavrans, "Service Design for Business: A Practical Guide to Optimizing the Customer Experience", Pan Macmillan India, 2 012.
4. Chesbrough, H, "Open services innovation: Rethinking your business to grow and compete in a new era", John Wiley & Sons, 2010.
5. Robert Johnson, Graham clark, "Service Operations Management", Pearson Education, 2nd Edition, 2005.

Web References

1. https://en.wikipedia.org/wiki/Operations_management_for_services
2. https://archive.nptel.ac.in/courses/110/106/110106046/
3. https://en.wikipedia.org/wiki/Service_innovation
4. https://careerfoundry.com/en/blog/ux-design/what-is-service-design-how-to-implement-service-design-processes/
5. https://www.youtube.com/watch?v=DYkwTBrpBtE

Reference Papers

1. Karmarkar, U. (2004). Will you survive the services revolution? Harvard Business Review, 100-107.
2. Vargo, S. L., & Lusch, R. F. (2008). From goods to service (s): Divergences and convergences of logics. Industrial marketing management, 37(3), 254-259.
3. Vargo, S. L., & Lusch, R. F. (2008). "Service-Dominant Logic: Continuing the Evolution," Journal of the Academy of Marketing Science (36:1), pp. 1-10
4. Silvestro, R., Fitzgerald, L., Johnston, R., & Voss, C. (1992). Towards a classification of service processes. International journal of service industry management, 3(3), 62-75.
5. Vargo, S. L., Maglio, P. P., & Akaka, M. A. (2008). On value and value co-creation: A service systems and service logic perspective. European management journal, 26(3), 145-152.
6. Shostack, G.L., (1984), "Designing Services That Deliver," Harvard Business Review, January-February 1984, pp. 132-139
7. Evenson, S., & Dubberly, H. (2010). Designing for service: Creating an experience advantage. Introduction to service engineering, 403-413.
8. Edvardsson, B., & Olsson, J. (1996). Key concepts for new service development. Service Industries Journal, 16(2), 140-164.
9. Goldstein, S. M., Johnston, R., Duffy, J., & Rao, J. (2002). The service concept: the missing link in service design research? Journal of Operations management, 20(2), 121-134.
10. Kumar, A., Zope, N. R., & Lokku, D. S. (2014, April). An approach for services design by understanding value requirements, identifying value carriers, developing value proposition, and subsequently realizing value. In Global Conference (SRII), 2014 Annual SRII (pp. 298-304). IEEE.

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11. Parasuraman, A., Zeithaml, V.A., and Berry, L.L., (1985), "A Conceptual Model of Service Quality and Its Implications for Future Research," The Journal of marketing, Vol. 49, No. 4, pp. 41-50
12. Cronin, J.J., and Taylor, S.A., (1992), "Measuring Service Quality: A Reexamination and Extension," The Journal of Marketing, Vol. 56, No. 3, pp. 55-68
13. Van Ree, H. J., (2009), Service Quality Indicators for Business Support Services, Ph.D. Thesis, University College London, London.
14. Zope, N. R., Anand, K., & Lokku, D. S. (2014, April). Reviewing Service Quality for IT Services Offerings: Observations in the Light of Service Quality Models & Determinants. In Global Conference (SRII), 2014 Annual SRII (pp. 43-49). IEEE.
15. Heskett, J.L., Jones, T.O., Loveman, G.W., Sasser, W.E., and Schlesinger, L.A., (2008), "Putting the Service-Profit Chain to Work," Best of HBR, Harvard Business Review, July-August 2008, pp. 118-128
16. Clatworthy, S. (2011). Service innovation through touch-points: Development of an innovation toolkit for the first stages of new service development. International Journal of Design, 5(2).
17. Barras, R. (1986). "Towards a Theory of Innovation in Services," Research Policy (15), pp. 161-173.
18. Gustafsson, A., and Johnson, M. (2003). Competing in a Service Economy: How to Create a Competitive Advantage Through Service Development and Innovation, San Francisco: Jossey-Bass.
19. Barrett, M., Davidson, E., Prabhu, J., & Vargo, S. L. (2015). "Service innovation in the digital age: key contributions and future directions". Mis Quarterly, 39(1), 135-154.
20. Lusch, R. F., and Nambisan, S. (2015). "Service Innovation; A Service-Dominant Logic Perspective," MIS Quarterly (39:1), pp.155-175

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	3	2	-	1	2
CO2	1	1	1	1	3	1	1	1	1	1	2	2	-	1	2
CO3	2	1	1	1	1	1	2	1	1	1	2	2	-	1	2
CO4	1	1	1	2	1	1	1	2	1	1	2	1	-	1	2
CO5	1	1	2	1	2	2	1	1	1	1	2	2	-	1	2

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

2. A. 11. 60

U20CBE828 **Image Processing and Pattern Recognition**

L	T	P	C	H
3	0	0	3	45

Course Objectives

1.To learn the fundamentals of image formation and formats.
2. To understand the intensity transformations and filtering techniques.
3. To acquire knowledge on image segmentation operations.
4. To learn the feature extraction and image registration process.
5. To understand the components of colour image processing

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

CO1 - Be familiar with the fundamentals of image formation and formats **(K2)**
CO2 - Perform image transformation functions and filtering operations. **(K3)**
CO3 - Apply the segmentation techniques on the images**(K3)**
CO4 - Extract the features of an image and perform image registration**(k4)**
CO5 - Able to do colour image processing and conversion operations **(K4)**

UNIT I Introduction and Image Formation **(9Hrs)**
Introduction: Image processing systems and its applications. Basic image file formats
Image formation: Geometric and photometric models; Digitization - sampling, quantization; Image definition and its representation, neighbourhood metrics.

UNIT II Intensity transformations and spatial filtering **(9Hrs)**
Enhancement, contrast stretching, histogram specification, local contrast enhancement; Smoothing, linear and order statistic filtering, sharpening, spatial convolution, Gaussian smoothing, DoG, LoG.

UNIT III Image Segmentation **(9Hrs)**
Pixel classification; Grey level thresholding, global/local thresholding; Optimum thresholding - Bayes analysis, Otsu method; Derivative based edge detection operators, edge detection/linking, Canny edge detector; Region growing, split/merge techniques, line detection, Hough transform.

UNIT IV Feature Extraction and Image Registration **(9Hrs)**
Textural features - gray level co-occurrence matrix; Moments; Connected component analysis; Convex hull; Distance transform, medial axis transform, skeletonization / thinning, shape properties.
Registration: Mono-modal/multimodal image registration; Global/local registration; Transform and similarity measures for registration; Intensity/pixel interpolation.

UNIT V Colour image processing **(9Hrs)**
Fundamentals of different colour models - RGB, CMY, HSI, YCbCr, Lab; False colour; Pseudo colour; Enhancement; Segmentation.
Morphological Filtering Basics: Dilation and Erosion Operators, Top Hat Filters

Text Books

1. Jain Anil K., "Fundamentals Digital Image Processing" Prentice Hall India, 2010
2. R. C. Gonzalez and R. E. Woods, "Digital Image Processing" Prentice Hall,2008.

2.A.11.61

Reference Books

1. Maria Petrou and Panagiota Bosdogianni , "Image Processing: The Fundamentals", John Wiley & Sons, Ltd, 2010.
2. A. Blake and A. Zisserman , "Visual Reconstruction", MIT Press, Cambridge, 2003.
3. K. R. Castleman , "Digital Image Processing", Prentice Hall, Englewood Cliffs, 1996
4. A. N. Netravali and B. G. Haskell , "Digital Pictures", Plenum Press,1995.
5. A. B. Watson, "Digital Images and Human Vision", MIT Press, Cambridge,1993.

Web References

1. https://bohr.wlu.ca/hfan/cp467/12/notes/cp467_12_lecture1_intro.pdf
2. https://core.ac.uk/download/pdf/231900695.pdf
3. https://www.researchgate.net/publication/328582830_Pattern_Recognition_and_Image_Processing

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	2	2	-
CO2	3	3	3	3	3	1	1	1	-	-	-	1	3	3	-
CO3	3	3	3	3	3	1	1	1	-	-	-	1	3	3	-
CO4	3	3	3	3	3	1	1	1	-	-	-	1	3	3	-
CO5	3	3	3	3	3	1	1	1	-	-	-	1	3	3	-

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

2.A.11.62

U20ITCM08	Automation Techniques and Tools - Devops	L	T	P	C	H
		3	0	0	3	45

Course Objectives

- The Background and mind set of Devops
- To enable students appreciate the agile led development environment.
- To give the students a perspective to grasp the need for Minimum viable product led development using Sprints.
- To enable students acquire fundamental knowledge of CI/CD and CAMS.
- To enable learners realize various aspects of DevOps Ecosystem.

Course Outcomes

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

CO1 - Explain traditional software development methodologies like waterfall. **(K2)**
CO2 - Apply the Agile Methodology and comparing various other software development models with agile. **(K3)**
CO3 - Explain implementing Continuous Integration and Continuous Delivery. **(K2)**
CO4 - Illustrate CAMS for DevOps (Culture, Automation, Measurement and Sharing). **(K2)**
CO5 - Construct quick MVP prototypes for modules and functionalities. **(K3)**

UNIT I TRADITIONAL SOFTWARE DEVELOPMENT **(9 Hrs)**

The Advent of Software Engineering - Software Process, Perspective and Specialized Process Models – Software Project Management: Estimation - Developers vs IT Operations conflict.

UNIT II RISE OF AGILE METHODOLOGIES **(9 Hrs)**

Agile movement in 2000 - Agile Vs Waterfall Method - Iterative Agile Software Development - Individual and team interactions over processes and tools - Working software over comprehensive documentation - Customer collaboration over contract negotiation - Responding to change over following a plan

UNIT III INTRODUCTION DEVOPS **(9 Hrs)**

Introduction to DevOps - Version control - Automated testing - Continuous integration - Continuous delivery - Deployment pipeline - Infrastructure management – Databases

UNIT IV PURPOSE OF DEVOPS **(9 Hrs)**

Minimum Viable Product- Application Deployment- Continuous Integration- Continuous Delivery

UNIT V CAMS (CULTURE, AUTOMATION, MEASUREMENT AND SHARING) **(9 Hrs)**

CAMS – Culture, CAMS – Automation, CAMS – Measurement, CAMS – Sharing, Test-Driven Development, Configuration Management-Infrastructure Automation- Root Cause Analysis- Blamelessness- Organizational Learning

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Text Books

1. GrigGheorghiu, Alfredo Deza, Kennedy Behrman, Noah Gift, "Python for DevOps", 2019.
2. Len Bass, Ingo Weber, Liming Zhu, "DevOps - A Software Architect's Perspective", Pearson Education, 2015.

Reference Books

1. Deepak Gaikwad, Viral Thakkar, DevOps Tools: from practioner's point of view, Wiley, 1st Edition, 2019.
2. Gene Kim, Jez Humble, Patrick Debois, and Willis," The DevOps Handbook", IT Revolution Press, 2016.
3. JoakimVerona, "Practical DevOps", O'Reilly, 2016.

Web References

1. www.ibm.com/cloud/devops.
2. www.softwaretestinghelp.com>devops-automation.
3. https://cloudify.co/devops-automation-tools-the-ultimate-list/

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	-	-	-	-	-	-	-	3	2	3
2	3	2	1	1	2	-	-	-	-	-	-	-	3	2	3
3	2	1	-	-	2	-	-	-	-	-	-	-	3	2	3
4	2	1	-	-	2	-	-	-	-	-	-	-	3	2	3
5	3	2	1	1	2	-	-	-	-	-	-	-	3	2	3

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

2.A.11.64

U20CSCM03	AUGMENTED REALITY	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

1. Understanding the System Architecture of Augmented Reality
2. Learn the Hardware for Augmented Reality
3. Learn the Software for Augmented Reality
4. Understanding the Augmented Reality and Mixed Reality
5. Understanding the AR Digital Entertainment

Course Outcomes

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

CO1 – Apply geometric concepts to understand Augmented Reality (K3)
CO2 – Utilize hardware components for Augmented Reality (K4)
CO3 – Make use of software components for Augmented Reality (K3)
CO4 – Apply AR with the Virtual Reality to provide Mixed Reality (K4)
CO5 – Apply AR in Digital Entertainment (K4)

UNIT I INTRODUCTION OF AUGMENTED REALITY (AR) **(9 Hrs)**

System Structure of Augmented Reality – Key Technology in AR – General Solution for Calculating Geometric – Illumination Consistency in the Augmented Environment.

UNIT II 3D USER INTERFACE INPUT HARDWARE **(9 Hrs)**

Input Device Characteristics – Desktop Input Devices – Tracking Devices – 3D Mice - Special Purpose Input Devices – Direct Human Input – Home-Brewed Input Devices - Choosing Input Devices for 3D Interfaces.

UNIT III SOFTWARE TECHNOLOGIES **(9 Hrs)**

Database-World Space, World Coordinate, World Environment, Objects-Geometry, Position / Orientation, Hierarchy, Bounding Volume, Scripts and Other Attributes, VR Environment-VR Database, Tessellated Data, LODs, Cullers and Occludes, Lights and Cameras, Scripts, Interaction-Simple, Feedback, Graphical User Interface, Control Panel, 2D Controls, Hardware Controls, Room / Stage / Area Descriptions, World Authoring, and Playback, VR toolkits.

UNIT IV AUGMENTED AND MIXED REALITY **(9 Hrs)**

Taxonomy, Technology and Features of Augmented Reality, Difference between AR and VR, Challenges with AR, AR Systems and Functionality, Augmented Reality Methods, Visualization Techniques for Augmented Reality, Wireless Displays in Educational Augmented Reality Applications, Mobile Projection Interfaces, Marker-less Tracking for Augmented Reality, Enhancing Interactivity in AR Environments, Evaluating AR Systems.

2.A.11.65

UNIT V DEVELOPMENT TOOLS AND FRAMEWORKS IN AR **(9 Hrs)**

Frameworks of Software Development Tools in AR. X3D Standard; Vega, MultiGen, Virtools etc. Applications of AR in Digital Entertainment: AR Technology in Film & TV Production.AR Technology in Physical Exercises and Games. Demonstration of Digital Entertainment by AR.

Assignments:

1. Hands on training should be conducted for each unit.
2. AR Assistance Licensed tool should be used

Text Books

3. Peddie, Jon, —Augmented Reality Where We Will All Livell, 1st Edition, 2017.
4. Dieter Schmalstieg and Tobias Hollerer, —Augmented Reality: Principles and Practice (Usability)ll,
1. Addison-Wesley Educational Publishers, 1st Edition, 2016.
2. Alan B Craig, William R Sherman and Jeffrey D Will, Developing Virtual Reality applications: Foundations of Effective Design', Morgan Kaufmann publishers, 2009.

Reference Books

1. N. Honcharova, "Technology of augmented reality in textbooks of new generation", Boeing Corporation, 2019.
2. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, "3D User Interfaces: Theory and Practice", Addison Wesley, 2nd Edition, 2017.
3. Borko Furht, "Handbook of Augmented Reality", Springer, 2011.
2. Michael Haller, "Emerging Technologies of Augmented Reality: Interfaces and Design", Idea Group Publishing, 2007.
4. Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", Springer, 2005.

Web References

1. https://www.8thwall.com/
2. https://developers.google.com/web/updates/2018/06/ar-for-the-web
3. https://www.sitepen.com/blog/augmented-reality-on-the-web-in-2019/
4. https://hacks.mozilla.org/2019/01/augmented-reality-and-the-browser%E2%80%8A-%E2%80%8Aan-appexperiment/

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
CO1	2	1	-	-	2	-	-	-	-	-	-	-	-	2	3
CO2	2	1	-	-	2	-	-	-	-	-	-	-	-	2	3
CO3	2	1	-	-	2	-	-	-	-	-	-	-	-	2	3
CO4	2	1	-	-	2	-	-	-	-	-	-	-	-	2	3
CO5	2	1	-	-	2	-	-	-	-	-	-	-	-	2	3

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

2. A. 11. 66

U20CBEP81	ENTERPRISE SYSTEMS LABORATORY	L	T	P	C	H
		0	0	2	1	30

Course Objectives

1. To introduce the essential concepts of ERP involved in business processes
2. To impart skills in the design and implementation of ERP architecture
3. To familiarize with various tools and technologies for developing ERP for large project
4. To analyse VPN connections
5. To identify COTS configuration developing real time applications

Course Outcomes

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

CO1- Ability to design and deploy simple web applications using MVC architecture **(K3)**
CO2 - Evaluate SOA and ERP models **(K5)**
CO3 - Ability to design and implement CRM models **(K4)**
CO4 - Implement interactive network and application **(K4)**
CO5 - Evaluate organizational opportunities and challenges in the design system and Ability to develop model for ERP for large projects **(K5)**

List of Exercises

1. Introduction to ERP systems and review oon different ERP Packages
2. Find a procedure to transfer mthe files from one virtual machine to another virtual machine.
3. Implementation of SOAP Web services in C#/ JAVA applications
4. Develop a Hello World Application using Google APP Engine
5. Develop a Guest Book application using Google APP Engine
6. Develop a windows AZURE Hello world application
7. Case study Amazon Web Services.

Text Books

1. Alexis Leon, Enterprise Resource Planning, 4th Edition, Tata McGraw Hill, 2020.
2. Alexis Leon, "Enterprise Resource Planning", Tata McGraw Hill, 3rd Edition, 2017.
3. Alexis Leon, "Enterprise Resource Planning – Diversified", TMH, 2nd Edition, 2015.

Reference Books

1. Ravi Shankar & S. Jaiswal, Galgotia, "Enterprise Resource Planning", 1st Edition, 1999.
2. Alexis Leon, "Enterprise Resource Planning", Tata McGraw Hill, 3rd Edition, 2017.

Web References

1.https://www.gambitcomm.com/site/enterprise-vlab.php

2. https://www.its.ac.id/sp/lab-enterprise-system/

3. https://www.geeksforgeeks.org/introduction-to-erp/

4.https://www.tutorialspoint.com/management_concepts/enterprise_resource_planning.htm

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5. http://nfra.eresourceerp.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	1	2	1	1	1	-	-	-	1	2	2	1	2	2	3
2	1	1	1	-	1	-	-	-	-	1	1	-	1	1	3
3	1	1	-	-	1	-	-	-	1	-	-	1	1	2	2
4	1	1	-	-	1	-	-	-	1	-	-	1	2	2	3
5	2	2	2	1	1	-	-	-	1	1	-	1	2	2	3

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

2. A.11.68

U20CBEP82	SERVICES SCIENCE & SERVICE OPERATIONAL MANAGEMENT LABORATORY	L	T	P	C	H
		0	0	2	1	30

Course Objectives

1. Understand the services and service operations management concepts.
2. Comprehend the techniques of service operations.
3. Understand the service quality and service design aspects.
4. Understand the service innovation aspects.
5. To analyse how services are different from products by its characteristics.

Course Outcomes

CO1 - Understand concepts about services and distinguish it from goods.**(K2)**
CO2 - Able to identify characteristics and nature of services. **(K2)**
CO3 - Comprehend ways to design services and evaluate them using service qualities. **(K2)**
CO4 - Understand how various methods can be used to operate and manage service businesses. **(K2)**
CO5 - Understand how innovation can be approached from services point of view.**(K2)**

List of Exercises

1. Design a new super market in a cosmopolitan city (Identify important attributes, specify attribute levels, experimental design, presentation of alternatives to respondents and estimation of choice model)
2. Choose any service organization and present it from the perspective of nature of service, classification of service, blueprint or service design analysis, and service quality
3. Prepare a service blueprint for a fast food outlet (Service Design and Service Management Model)
4. Using data, software, user and mashup as services prepare a next gen service oriented architecture.
5. Prepare a review article after analyzing 5 relevant papers in services and explain your understanding and feedback on the same
6. Analyze a fortune 500 company in digital media and point out how these technologies could be effectively used in a startup in digital space
7. Analyze the booking policy of an international flight operator, assuming that the average number of no shows is 10%, explain why the best overbooking necessary isn't be 10% always.
8. Prepare a comparative chart analyzing any four food delivery agencies and rank them based on reliability, responsiveness, assurance, and empathy.

Text Books

1. Fitzsimmons & Fitzsimmons, "Service Management: Operations, Strategy, Information Technology", McGraw Hill publications, 7th Edition, 2017.
2. Christopher H.Lovelock and JochenWirtz, "Services Marketing", Pearson Education, New Delhi, 7th Edition, 2011.
3. Richard Metters, Karthryn King-Metters, Madeleine pullman, Steve Walton, "Successful Service Operations Management", South-Western, Cengage Learning, 2nd Edition, 2008.
4. Cengiz Haksever, Barry Render, Roberta S Russell, Pobert G Mirdick, "Service Management and Operations", Pearson Education, 2nd Edition, 2000.

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Reference Books

1. Reason, Ben, and Lovlie, Lavrans, "Service Design for Business: A Practical Guide to Optimizing the Customer Experience", Pan Macmillan India, 2016.
2. Wilson, A., Zeithaml, V. A., Bitner, M. J., & Gremler, D. D., "Services marketing: Integrating customer focus across the firm", McGraw Hill, 2012
3. Lovelock, C,Services, " Marketing", Pearson Education India, 7 th Edition ,2011.
4. Chesbrough, H, "Open Services Innovation: Rethinking Your Business To Grow and Compete in a New Era". John Wiley & Sons, 2010.
5. Robert Johnson, Graham clark, "Service Operations Management", Pearson Education, 2nd Edition, 2005.

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1. https://biblus.accasoftware.com/en/how-to-design-a-supermarket-the-complete-technical-guide/
2. https://creately.com/diagram/example/jomhemda/new-fast-food-and-quick-serve-restaurant-service-blueprint-classic
3. https://toppandigital.com/translation-blog/technology-behind-fortune-global-500-companies/
4. https://www.researchgate.net/publication/342765294_A_STUDY_ON_CONSUMERS_PERCEPTION_ON_FOOD_APPS

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	3	2	-	1	2
CO2	1	1	1	1	3	1	1	1	1	1	2	2	-	1	2
CO3	2	1	1	1	1	1	2	1	1	1	2	2	-	1	2
CO4	1	1	1	2	1	1	1	2	1	1	2	1	-	1	2
CO5	1	1	2	1	2	2	1	1	1	1	2	2	-	1	2

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

2.A.11.20

U20CBEP83	IMAGE PROCESSING AND PATTERN RECOGNITION LABORATORY	L	T	P	C	H
		0	0	0	1	30

Course Objectives

1. To learn the fundamentals of image formation and formats.
2. To understand the intensity transformations and filtering techniques.
3. To acquire knowledge on image segmentation operations.
4. To learn the feature extraction and image registration process.
5. To understand the components of colour image processing

Course Outcomes

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

CO1 - Perform image transformation functions and filtering operations. **(K2)**
CO2 - Apply the segmentation techniques on the images. **(K3)**
CO3 - Extract the features of an image and perform image registration. **(K3)**
CO4 - Able to do colour image processing and conversion operations. **(K4)**
CO5 - Able to detect the face from the given set of images and determine the type of images **(K4)**

List of Exercises

1. Write a program for Histogram Mapping and Equalization.
2. Write a program for Image Smoothening and Sharpening.
3. Write a program for Morphological Operations on Binary Images
4. Write a program for Edge Detection using Sobel, Prewitt and Roberts Operators.
5. Write a program for Canny Edge Detector.
6. Write a program to calculate the GLCM of the given image.
7. Write a program to perform image registration of the given images.
8. Write a program to implement colour model conversion.
9. Write a program for pseudo-colour operation on the given image.
10. Write a program for Image Intensity slicing technique for image enhancement.
11. Write a program to analyze the given set of camera captured images and Identify the nature of the image.
12. Write a program to detect the face from the given set of images and determine the type of animal

Text Books

1. R. C. Gonzalez and R. E. Woods, "Digital Image Processing", Pearson, 4th Edition, 2018.
2. Maria Petrou and Panagiota Bosdogianni, "Image Processing: The Fundamentals", John Wiley & Sons, Ltd, 2nd Edition, 2010.
3. K. R. Castleman, "Digital Image Processing", Prentice Hall, Englewood Cliffs, 1st Edition, 1995

Reference Books

1. Blake and A. Zisserman, "Visual Reconstruction", MIT Press, Cambridge. https://doi.org/10.7551/mitpress/7132.001.0001
2. A. N. Netravali and B. G. Haskell, "Digital Pictures", Plenum Press, 2nd Edition, 1995
3. A. B. Watson, "Digital Images and Human Vision", MIT Press, Cambridge, 1993

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Web References

1. http://ceng.metu.edu.tr/image-processing-and-pattern-recognition
2. https://towardsdatascience.com/image-processing-with-python-blurring-and-sharpening -for-beginners-3bcebec0583a
3. https://www.wiley.com/en- ai/Image+Processing+and+Pattern+Recognition: +Fundamentals+and+Techniques-p- 9780470404614

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	2	-
2	3	3	3	3	3	1	1	1	-	-	-	1	3	3	-
3	3	3	3	3	3	1	1	1	-	-	-	1	3	3	-
4	3	3	3	3	3	1	1	1	-	-	-	1	3	3	-
5	3	3	3	3	3	1	1	1	-	-	-	1	3	3	-

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

2. A.11.22

U20CBEP84	AUTOMATION TECHNIQUES AND TOOLS- DEVOPS LABORATORY	L	T	P	C	H
		0	0	0	1	30

Course Objectives

1. Insights of the DevOps environment
2. An overview of different DevOps tools
3. Continuous integration and testing
4. DevOps containerization
5. Analyse the deployment of an application

Course Outcomes

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

CO1 - Understand the basic concepts of construction of small programs **(K2)**
CO2 - Build a prototype of an application using tools **(K3)**
CO3 - Integrate DevOps with the Jenkins **(K3)**
CO4 - Build the application and apply testing **(K3)**
CO5 - Deploy the application and troubleshoot **(K3)**

List of Exercises

1. Use Version Control System for a document/program (check in/check out / update / pull / push modifications, create tags/branches)
2. Build a prototype of an application using tools (such as Maven). Prepare unit test case and execute
3. Test the prototype/application using Integration tests
4. Using Continuous Integration (CI) / Continuous Deployment (CD) automation tool (Jenkins), build pipeline. Integrate build stage. Integrate/API test stage with pipeline.
5. Set up DevOps environment for CI, CD (creation of non-root account, S3 bucket, IAM Role, attach policies, secret keys)
6. Integrate Jenkins with DevOps environment (secret keys exchange)
7. Define Jenkins pipeline incorporating, build, test and deploy (publish) stages – I
8. Define Jenkins pipeline incorporating, build, test and deploy (publish) stages - II
9. Deploy the application, run and troubleshoot

Text Books

1. Ethan Thorpe, "Devops: A comprehensive beginners guide to learn DevOps step by step", Paperback, 2019.
2. Deepak Gaikwad, Viral Thakkar, "Devops Tools from Practioners" viewpoint, Wiley
3. Gene Kim, Jez Humble, Patrick Debois, John Allspaw and John Willis, "The DevOps Handbook", Paperback, 2016.
4. Gene Kim, "The Phoenix Project A Novel about It, DevOps, and Helping Your Business Win", Paperback, 2018.
5. Jennifer Davis and Ryn Daniels, "Effective DevOps,", 2021.

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Reference Books

1. David Johnson, "Devops for Beginners Handson guide", CreateSpace Independent
2. Jez ,David "Continuous Delivery'

Web References

1. https://aws.amazon.com/devops/what-is-devops/
2. https://www.atlassian.com/blog/devops
3. https://www.youtube.com/watch?v=lpk7VpGqkKw
4. https://www.youtube.com/watch?v=hQcFE0RD0cQ
5. https://www.freecodecamp.org/news/devops-engineering-course-for-beginners/

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	2	2	1	2	2	2	1	1	1	1	3	2	3	3
2	2	2	2	2	2	2	2	1	1	1	3	3	2	2	3
3	2	2	2	2	1	2	2	1	1	1	3	3	2	3	3
4	2	2	2	2	1	2	2	1	1	1	3	3	2	3	3
5	2	2	2	2	1	2	2	1	1	1	3	3	2	3	3

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

2. A.11.74

U20CBEP85	AUGMENTED REALITY LABORATORY	L	T	P	C	H
		0	0	0	1	30

Course Objectives

1. Model and animate 3D computer-generated objects, from preproduction to production to postproduction.
2. Apply the entire production pipeline for the application of 3D media in augmented and virtual reality interfaces.
3. Design and implement an interactive computer game, simulation, or tool to display and manipulate objects or data in 3D.
4. Propose novel, disruptive applications of augmented and virtual reality.

Course Outcomes

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

CO1 - Design, create, and integrate audio, visual, and interactive elements into a comprehensive immersive experience. **(K3)**

CO2 - Develop content for successful delivery across multiple platforms, including PC, mobile devices and head-mounted displays. **(K3)**

CO3 - Evaluate current trends of AR media delivery to propose options to potential clients, and discuss the benefits, challenges and misconceptions involved with working in AR **(K4)**

CO4 - Evaluate various interaction schemes common to AR experiences. **(K4)**

CO5 - Use immersive effects of visual and audio assets to AR experiences and evaluate implementation methods. **(K4)**

List of Exercises

Name of the Language is used for implementing the following exercises:

1. Understand different forms of Augmented Reality and their applications
2. Import & Animate 3D Models
3. Detect a real toy car using 3D Object tracking and superimposing a digital car on top of the real car.
4. Develop and AR Book app which will detect multiple image targets.
5. Develop an AR greeting card app, which plays sound, and animation once opened.
6. Create an interactive business card using AR Virtual buttons
7. Play / Pause video's in real world.

Text Books

1. Peddie, Jon, "Augmented Reality Where We Will All Live", 1st Edition, 2017.
2. Dieter Schmalstieg and Tobias Hollerer, "Augmented Reality: Principles and Practice (Usability)
   Addison-Wesley Educational Publishers, 1st Edition, 2016.
3. Alan B Craig, William R Sherman and Jeffrey D Will, "Developing Virtual Reality applications: Foundations of Effective Design', Morgan Kaufmann publishers, 2009.

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Reference Books

1. N. Honcharova, "Technology of augmented reality in textbooks of new generation", Boeing Corporation, 2019.
2. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, "3D User Interfaces: Theory and Practice", Addison Wesley, 2nd Edition, 2017.
3. Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", 2016.
4. Borko Furht, "Handbook of Augmented Reality", Springer, 2011.
5. Michael Haller, "Emerging Technologies of Augmented Reality: Interfaces and Design", Idea Group Publishing, 2007.

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	3	3	2	2	2	2	1	1	1	2	2	3	3	3
2	2	3	3	2	2	2	2	1	1	1	2	2	3	3	3
3	2	2	3	2	2	2	2	1	1	1	2	2	3	3	3
4	2	2	3	2	2	2	2	1	1	1	2	2	3	3	3
5	2	2	3	2	2	2	2	1	1	1	2	2	3	3	3

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

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Annexure III

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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

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