



# **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 THIRD BOS MEETING**

#### **Venue**

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

#### ***Date & Time***

***18.8.21 & 10 A.M.***



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## Department of Computer Science and Business Systems

### Minutes of Board of Studies

The Board of Studies Third meeting of Department of Computer Science and Business Systems (CSBS) was held on 18<sup>th</sup> August 2021 at 10:00 A.M in the Lecture Hall, Department of CSBS, Sri Manakula Vinayagar Engineering College with the Head of the Department in the Chair.

The following members were present for the BoS meeting

Sl.No	Name of the Member with Designation and official Address	Members as Per UGC Norms
1	<b>Dr. G. Shanmugasundaram</b> Associate Professor and Head, Department of CSBS, SMVEC, Puducherry	Chairman
2	<b>Dr.T. Chithralekha, M.Tech., Ph.D</b> Professor and Dean, School of Engineering and Technology, Pondicherry University, R.V.Nagar, Kalapet, Puducherry	Subject Expert (University Nominee)
3	<b>Dr. K.Devaki, M.E., Ph.D.,</b> Professor, Department of Computer Science and Engineering, Rajalakshmi Engineering College, Chennai.	Subject Expert (Academic Council Nominee)
4	<b>Dr. M.Chinnadurai, M.E., Ph.D.,</b> 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	<b>Mr. Asoke Das Sarma</b> BPO Transformation Lead, Tata Consultancy Services, Kolkata.	Representative from Industry
6	<b>Dr. P. Victor Paul, M.Tech., Ph.D.,</b> Assistant Professor, Department of Computer Science and Engineering, Indian Institute of Information Technology, Kottayam - 686635, Kerala.	Postgraduate Alumnus (nominated by the Principal)

7	<b>Dr. N.S.N. Cailassame, M.B.A,Ph.D.,</b> Professor and Head, Department of Management Studies, SMVEC.	Internal Member
8	<b>Dr. G. Bala Sendhil Kumar,</b> Professor, Department of Management Studies, SMVEC.	Internal Member
9	<b>Dr. C. Punitha Devi, M.Tech, Ph.D</b> Professor, Department of Information Technology, SMVEC.	Internal Member
10	<b>Mr.R. Saravanan, M.E., (Ph.D),</b> Associate Professor, Department of Information Technology, SMVEC.	Internal Member
11	<b>Mrs.N. Thilagavathi, M.Tech., (Ph.D),</b> Associate Professor, Department of Information Technology, SMVEC.	Internal Member
12	<b>Dr.T. Gayathri</b> Professor and Head, Dept of Mathematics, SMVEC	Internal Member
13	<b>Dr.D. Jaichithra</b> Professor and Head, Dept. of English,SMVEC	Internal Member
14	<b>Dr. T. Jayavarthan</b> Professor, Dept. of Physics, SMVEC	Internal Member

#### **Agenda of the Meeting**

- 1) Confirmation of Second BOS meeting Minutes was held on 27th March 2021.
- 2) Review of Curriculum (I to VIII Semesters) and Syllabi (I to IV Semesters) for 2020-24 batch under Autonomous R-2020 Regulations
- 3) To discuss and recommend the syllabi for V and VI Semesters under R2020 Regulations for UG Programme: B.Tech. CSBS in the AY 2020-21 for the students admitted in the year 2020-21
- 4) To discuss about certification and Skill Development Courses
- 5) To discuss about online platforms used for teaching and assessments and to discuss about Extra Curricular and Co – Curricular activities
- 6) Any other item with the permission of chair

#### **Minutes of the Meeting**

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

- Chairman, BoS, appraised the minutes of 2<sup>nd</sup> BoS, its implementation and then it is confirmed with the approval for the incorporation of minor revisions in curriculum (III to VIII) and syllabi (III and IV semesters). The changes in semester III and IV are needed as mentioned below.

S I. N o	Regulation	Sem	Subject Name with Code	Unit	Particulars
1	R-2020	III	Computer Organization & Architecture / U20CBT303	III	Topics related recent processor architecture such as Introduction to multicore processor, multiprocessor and cluster multiprocessor may be added in Unit III
2	R-2020	III	Object Oriented Programming Laboratory / U20CBP302	III	Study of different UML diagrams exercise is removed
3	R-2020	III	Computational Statistics Laboratory / U20BSP329	III	Basic Python concepts and visualization Exercises are removed.
4	R-2020	IV	Business Communication & Value Science – III /U20HST404	IV	The entire content of Unit IV is replaced with self-driven human values and its futurism concepts
5	R-2020	IV	Introduction to Innovation, IP Management & Entrepreneursh ip /U20HST405	IV	Topics such as Types of Innovation and Challenges in Innovation may be added in Unit I
6	R-2020	IV	Database Management Systems / U20CBT407	IV	SQL Topics added in unit II Contents related advanced database concepts may be moved to content beyond syllabus
7	R-2020	IV	Database Management Systems Laboratory /U20CBP406	IV	Exercises specific to SQL and NoSQL are included

	The above corrections were made and was approved by Academic Council and confirmed by the BoS members. <b>( Annexure- I)</b>
<b>BOS/2021/CSBS/UG/3.2</b>	<b>Review of Curriculum (I to VIII Semesters) and Syllabi (I to IV Semesters) for 2020-24 batch under Autonomous R-2020 Regulations</b>
	<p>The Curriculum (I to VIII Semesters) and Syllabi (I to IV Semesters) for 2020-24 batch under Autonomous R-2020 Regulations was reviewed by the BoS members and recommended the following suggestion</p> <p><b><u>Curriculum Revisions</u></b></p> <ul style="list-style-type: none"> <li>• U20CBT509 - Design and Analysis of Algorithms course shall be moved from semester 5 to 4</li> <li>• U20CBT305 - Software Engineering course shall be moved from semester 3 to 4</li> <li>• U20CBT408 - Software Design using UML course shall be moved from semester 4 to 5</li> <li>• U20CBT407 - Database Management Systems course shall be moved from semester 4 to 3</li> <li>• Change of evaluation Pattern from External to Internal <ul style="list-style-type: none"> <li>○ Business communication &amp; value science III (Semester 4)</li> <li>○ Business communication &amp; value science IV (Semester 6)</li> </ul> </li> <li>• Revision of credits for BCVS IV Course in Semester 6 from 3 to 2</li> <li>• Revision of credits for Software Design using UML Course from 2 to 3 credits</li> <li>• Revision of Course completion hours based on course credits (Semester I, II, IV – 2 credit course allotted to maximum of 45 hours, it can be reduced to 30 hrs.)</li> </ul> <p>The changes were made as per the suggestions and it is approved by the BoS members. <b>(Annexure- II)</b></p>
<b>BOS/2021/CSBS/UG/3.3</b>	<b>To discuss and recommend the syllabi for V and VI Semesters under R2020 Regulations for UG Programme: B.Tech. CSBS in the AY 2020-21 for the students admitted in the year 2020-21</b>
	The BoS members recommended the following changes in the V & VI semesters and submitted to Academic council for approval.


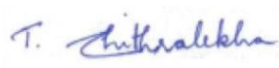


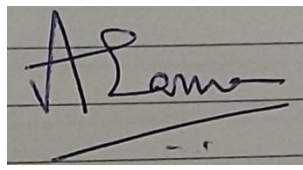

S I. N o	Regulation	Sem	Subject Name with Code	Unit	Particulars
1	R-2020	IV	Design and Analysis of Algorithms / U20CBT408	III & IV	Changing the unit order - Unit III and Unit IV are interchanged.
2	R-2020	V	Business Intelligence/ U20CBE504	II & III	Unit II data mining topics specific to Business Intelligence are included Unit III classification and clustering techniques specific to Business Intelligence are included
3	R-2020	V	Machine Learning/ U20CBE503	II,III, IV,V	Naive Bayes classification; Bayesian networks; Decision Tree and Random Forests; k- Nearest neighbor classification; Support Vector Machines are moved to Unit II  Hidden Markov Models and Regression techniques are moved to Unit III  Unit IV topics are deals with Unsupervised algorithms and Unit IV deals with only Mining algorithms
4	R-2020	VI	Robotics and Embedded Systems/ U20CBE606	V	Unit V - Recent trends and open challenges topics are included.
5	R-2020	VI	Data Mining and Analytics/ U20CBE608	IV	Non Linear Regression contents in Unit IV are removed
6	R-2020	VI	Financial and Cost Accounting/ U20HST611	II & III	Unit II - Practical's using Tally and in Unit III Application of Tally in Financial Statement Analysis topics are included

The above corrections are incorporated and the syllabi of semester V & VI are approved by the BoS members (**Annexure- III**).







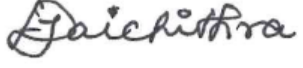

<b>BOS/2021/CSBS/UG/ 3.4</b>	<b>To discuss about certification and Skill Development Courses</b>
	<p>The BoS members recommended the following changes to be made in certification and Skill Development Courses</p> <ul style="list-style-type: none"> <li>• The no. of skill development courses may be reduced in the V and VI semesters</li> </ul> <p>The above corrections are incorporated was approved by the BoS members (<b>Annexure- II</b>).</p>
<b>BOS/2021/CSBS/UG/ 3.5</b>	<b>To discuss about online platforms used for teaching and assessments and to discuss about Extra Curricular and Co – Curricular activities</b>
	<p>The chairman briefed the Learning Management systems, Extra Curricular and Co – Curricular activities to the BoS members.</p> <p>The BoS Members appreciated</p> <ul style="list-style-type: none"> <li>• Great learning platform used for online class</li> <li>• Conduction of End Semester Examination in blended mode <ul style="list-style-type: none"> <li>- Amcat proctor System for online mode of examination</li> </ul> </li> <li>• Certification Courses completed by the Students and Staff through edx platform</li> <li>• “Train the Trainer Program” for the Faculties, currently for the Semester III to transit the knowledge and teach TCS designed courses.</li> </ul> <p>Guest lectures and workshops conducted</p>
<b>BOS/2021/CSBS/UG/ 3.6</b>	<b>Any other item with the permission of chair</b>
	<ul style="list-style-type: none"> <li>• Reduce the skill development courses and may be specified as optional</li> </ul>

The meeting was concluded at 01:00 PM with vote of thanks by **Dr. G. Shanmugasundaram**, Chairman, Board of Studies, Department of Computer Science and Business Systems.

**Members Present:**

Sl.No	Name of the Member with Designation and official Address	Responsibility in the BoS	Signature
1	<b>Dr. G.Shanmugasundaram</b> Associate Professor and Head, Department of CSBS, SMVEC, Puducherry	Chairman	
2	<b>Dr.T. Chithralekha, M.Tech., Ph.D</b> Professor and Dean, School of Engineering and Technology Pondicherry University, R.V.Nagar, Kalapet, Puducherry	Subject Expert (University Nominee)	 <small>Dr.T. CHITHRALEKHA, M.Tech., Ph.D Professor Department of Computer Science, School of Engineering &amp; Technology, Pondicherry University, Puducherry - 605 014.</small>
3	<b>Dr. K.Devaki, M.E., Ph.D.,</b> Professor, Department of Computer Science and Engineering, Rajalakshmi Engineering College, Chennai.	Subject Expert (Academic Council Nominee)	
4	<b>Dr. M.Chinnadurai, M.E., Ph.D.,</b> 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	<b>Mr. Asoke Das Sarma</b> BPO Transformation Lead, Tata Consultancy Services, Kolkata.	Representative from Industry	
6	<b>Dr. P. Victor Paul, M.Tech., Ph.D.,</b> Assistant Professor, Department of Computer Science and Engineering, Indian Institute of Information Technology, Kottayam - 686635, Kerala.	Postgraduate Alumnus (nominated by the Principal)	



7	<b>Dr. N.S.N. Cailassame, M.B.A,Ph.D.,</b> Professor and Head, Department of Management Studies, SMVEC.	Internal Member	
8	<b>Dr. G. Bala Sendhil Kumar,</b> Professor, Department of Management Studies, SMVEC.	Internal Member	
9	<b>Dr. C. Punitha Devi, M.Tech, Ph.D</b> Professor, Department of Information Technology, SMVEC.	Internal Member	
10	<b>Mr.R. Saravanan, M.E., (Ph.D),</b> Associate Professor, Department of Information Technology, SMVEC.	Internal Member	
11	<b>Mrs.N. Thilagavathi, M.Tech., (Ph.D),</b> Associate Professor, Department of Information Technology, .SMVEC.	Internal Member	
12	<b>Dr.T. Gayathri</b> Professor and Head, Dept of Mathematics, SMVEC	Internal Member	
13	<b>Dr.D. Jaichithra</b> Professor and Head, Dept. of English, SMVEC	Internal Member	
14	<b>Dr. T. Jayavarthan</b> Professor, Dept. of Physics, SMVEC	Internal Member	

Chairman- BoS (CSBS)  
(Dr. G.Shanmugasundaram)

Dean Academics  
(Dr. S. Anbumalar)

Director cum Principal  
(Dr. V. S. K. Venkatachalapathy)

# ANNEXURE I

## **PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)**

### **Existing PEO1**

- **PEO1:** To apply computer science and management concepts to solve the real-world problems

### **Revised PEO1**

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

## **PROGRAM SPECIFIC OUTCOME (PSOs)**

### **Existing PSO2**

- **PSO2:** Ability to demonstrate the technical and organizational skills and provide solutions for the societal needs

### **Revised PSO2**

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

- The skill development courses such as python and R programming are included in Semester II and III.
- The choice for elective courses is increased and the elective courses suggested by BOS members are also included.

SEMESTER – II										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
<b>Theory</b>										
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	2	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
<b>Practical</b>										
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
<b>Employability Enhancement Course</b>										
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
<b>Mandatory Course</b>										
12	U20CBM202	Environmental Sciences	MC	2	0	0	-	100	-	100
							19	600	600	1200

SEMESTER – III										
Sl. No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
<b>Theory</b>										
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	Software Engineering	PC	3	0	0	3	25	75	100
<b>Practical</b>										
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	Software Engineering Laboratory	PC	0	0	2	1	50	50	100
<b>Employability Enhancement Course</b>										
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
<b>Mandatory Course</b>										
11	U20CBM303	Physical Education	MC	0	0	2	-	100	-	100
							18	575	525	1100

**PROFESSIONAL ELECTIVE COURSES (18 CREDITS)**

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

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

**PROFESSIONAL ELECTIVE PRACTICAL COURSES (4 CREDITS)**

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



**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 – I
4.	U20CBS504	Skill Development Course 4 : Foreign Language/ IELTS -I
5.	U20CBS505	Skill Development Course 5 : Presentation Skills using ICT
6.	U20CBS606	Skill Development Course 6 : Foreign Language/ IELTS - II
7.	U20CBS607	Skill Development Course 7 : Technical Seminar
8.	U20CBS608	Skill Development Course 8 : NPTEL / MOOC - I
9.	U20CBS809	Skill Development Course 9 : NPTEL / MOOC-II

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

## Revised Syllabus

<b>U20CBT303</b>	<b>COMPUTER ORGANIZATION AND ARCHITECTURE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hrs</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>45</b>

### **Course Objectives**

- To understand the basic structure and operation of a digital computer
- To learn the fundamentals of organizational and architectural aspects of control unit
- To obtain knowledge on pipelining concepts and parallel processing
- To acquire knowledge about processor and memory design of a digital computer
- To have a broad understanding of various system interfaces and Input output devices

### **Course Outcomes**

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

**CO1** - Identify and explain the basic structure of a computer and instruction sets with addressing modes and discuss the design of ALU. **(K2)**

**CO2** - Apply fixed and floating-point arithmetic operations **(K2)**

**CO3** - Illustrate the concepts of CPU design pipelining and parallel processors **(K2)**

**CO4** - Choose the appropriate memory mapping procedure to enhance the performance of the system **(K2)**

**CO5** - Describe and identify the standard I/O interfaces and peripheral devices. **(K2)**

### **UNIT I COMPUTER ORGANIZATION AND DESIGN (9 Hrs)**

Functional blocks of a computer, Instruction set architecture of a CPU: Registers -instruction execution cycle- RTL interpretation of instruction- addressing modes- instruction set. Outlining instruction sets of some common CPUs

### **UNIT II DATA REPRESENTATION AND COMPUTER ARITHMETIC (9 Hrs)**

Data representation: Signed number -fixed and floating point number -character representation  
Computer arithmetic: Integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication – shift-and-add- Booth multiplier- carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic, IEEE 754 format,

### **UNIT III PROCESSOR AND CONTROL UNIT (9 Hrs)**

Introduction to x86 architecture, CPU control unit design: Hardwired and micro-programmed design approaches - consideration design of a simple hypothetical CPU  
Basic concepts of pipelining- throughput and speedup -pipeline hazards  
Parallel Processors: Introduction to parallel processors- Concurrent access to memory - cache coherency, introduction to multicore processor, multiprocessor and cluster multiprocessor

### **UNIT IV MEMORY ORGANIZATION (9 Hrs)**

Semiconductor memory technologies- Memory interleaving, concept of hierarchical memory organization: auxiliary memory –Associate memory – Virtual memory -cache memory -cache size vs. block size-mapping functions- replacement algorithms- write policies

## UNIT V PERIPHERAL DEVICES AND THEIR CHARACTERISTICS

(9 Hrs)

Input-output subsystems- I/O device interface- I/O transfers – program controlled- interrupt driven and DMA - privileged and non-privileged instructions -software interrupts and exceptions - Programs and processes – role of interrupts in process state transitions- I/O device interfaces – SCII, USB

### Content beyond Syllabus

Recent Intel processor architectures

### Text Books

1. Morris Mano, "Computer System Architecture ", Prentice Hall of India, Third Edition, 2008
2. David A. Patterson and John L. Hennessey, "Computer Organisation and Design", Fifth edition, Morgan Kauffman / Elseveir, 2014
3. Carl Hamacher, Zvonko G. Vranesic, Safwat G. Zaky, Computer Organization, 5th edition, McGraw-Hill, 2014

### Reference Books

1. John P.Hayes, Computer Architecture and Organisation, McGraw Hill, 2012.
2. William Stallings, Computer Organization and Architecture, 7th edition, Prentice-Hall of India Pvt. Ltd., 2016.
3. Vincent P. Heuring, Harry F. Jordan, "Computer System Architecture", 2nd Edition, Pearson Education, 2005.

### Web References

1. <http://www.inetdaemon.com/tutorials/computers/hardware/cpu/>
2. <https://inst.eecs.berkeley.edu/~cs152/sp18/>
3. [http://users.ece.cmu.edu/~jhoe/doku/doku.php?id=18-447\\_introduction\\_to\\_computer\\_architecture](http://users.ece.cmu.edu/~jhoe/doku/doku.php?id=18-447_introduction_to_computer_architecture)

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

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

		L	T	P	C	Hrs
<b>U20BSP329</b>	<b>COMPUTATIONAL STATISTICS LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>	<b>30</b>

### Course Objectives

- To study the concepts of linear regression models
- To develop a sound understanding of correlation
- To analyze the concept of autocorrelation
- To apply principles of multivariate data
- To understand the concept of clustering.

### Course Outcomes

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

- CO1** - Remember the basic concepts of linear regression. **(K3)**  
**CO2** - Interpret the results of correlation coefficient. **(K3)**  
**CO3** - Develop a sound understanding of auto correlation. **(K3)**  
**CO4** – Analyze the concept of multivariate data. **(K3)**  
**CO5** – Know the application of clustering. **(K3)**

### List of experiments:

1. Program on Regression lines
2. Program on correlation coefficient
3. Program on Autocorrelation
4. Program on Multivariate analysis
5. Program on Factor scores
6. Program on multivariate data
7. Implement k-means, logistic and time series algorithm using Scikit-learn
8. Draw statistical graphics using seaborn
9. Working with hierarchical clustering
10. Working with overlapping clustering

### Text Books

1. T.W. Anderson, “An Introduction to Multivariate Statistical Analysis”, 2<sup>nd</sup> edition, 2003
2. J.D. Jobson, “Applied Multivariate Data Analysis”, Vol I & II, 2<sup>nd</sup> edition, 1991.
3. Magnus Lie Hetland, “Beginning Python: From Novice to Professional”, 9<sup>th</sup>. Edition, 2005.

### Reference Books

1. D.A. Belsey, E. Kuh and R.E. Welsch, “Regression Diagnostics, Identifying Influential Data and Sources of Collinearity”, New York, 1980.
2. D.C. Montgomery and E.A. Peck, “Introduction to Linear Regression Analysis”, 5<sup>th</sup> edition, 2012.
3. D.F. Morrison, “Multivariate Statistical Analysis”, 2013.

### Web References

1. <https://www.edx.org/course/statistical-modeling-and-regression-analysis>
2. <https://www.cin.ufpe.br/~embat/Python%20for%20Data%20Analysis.pdf>
3. <https://www.kdnuggets.com/2016/07/statistical-data-analysis-python.html>
4. <https://people.duke.edu/~ccc14/sta-663/>

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

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

**Course Objectives**

- To introduce the concepts of Basic Object Oriented concepts and Programming Basics.
- To gain insight into the Functions and Array usages using C++.
- To understand in depth about the Classes and Objects.
- To study the Operator overloading and Inheritance concepts.
- To acquaint the Files and Exception Handling concepts.

**Course Outcomes**

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

**CO1** - Implement the Object Oriented concepts in simple applications. **(K3)**

**CO2** - Employ the Functions and Arrays in simple programs. **(K3)**

**CO3** - Demonstrate simple programs with Classes and Objects. **(K3)**

**CO4** - Illustrate Operator overloading and Inheritance concepts. **(K3)**

**CO5** - Experiment Files and Exception Handling concepts. **(K3)**

**List of Exercises**

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

**Reference Books**

1. Yashavant Kanetkar, "Let Us C++ ", BPB Publications, 2020.
2. Bjarne Stroustrup, "The C++ Programming Language", Pearson Education, 3rd Edition, 2009
3. Debasish Jana, "C++ and Object-Oriented Programming Paradigm", PHI Learning, 2nd Edition, 2005
4. Bjarne Stroustrup, "Programming: Principles and Practice Using C++", Addison Wesley, 2009
5. Bjarne Stroustrup, "The Design and Evolution of C++", Pearson Education, 2009

**Web References**

1. <https://www.studytonight.com/cpp/cpp-and-oops-concepts.php>
2. <https://www.tutorialspoint.com/What-are-basic-Object-oriented-programming-concepts>
3. <https://www.cplusplus.com/doc/tutorial/>
4. <https://www.w3schools.com/cpp/>
5. <https://www.javatpoint.com/cpp-tutorial>
6. <https://www.geeksforgeeks.org/cpp-tutorial/>

**COs/POs/PSOs Mapping**

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

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

**Course Objectives**

- To develop technical writing skills
- To Introduce students to Self-analysis techniques like SWOT & TOWS
- To enrich students to the key concepts of Pluralism and cultural spaces
- To imbibe self-motivation and foresee future prospects.
- To inculcate the importance of science in nation building

**Course Outcome(s)**

**By the end of the course, students will be able to,**

**CO1:** Understand, apply & analyze the tools of technical writing **(K2)**

**CO2:** Apply basic principles of SWOT & life positions **(K3)**

**CO3:** Identify & respect pluralism in cultural spaces **(K1)**

**CO4:** Inherent the skill of self- introspection and envision the future **(K2)**

**CO5:** Learn to apply the role of science in nation building **(K3)**

**UNIT I TECHNICAL WRITING SKILLS****(9 Hrs)**

Technical writing – Introduction and application of Technical writing Identify the best practices on echnical writing. - Technical writing in profession -Theory with YouTube and Dr Bimal Ray's videos on cryptology. - Technical writing in real-life scenarios-Scenario-based Assessment on technical writing - Sell Analytics and Insight to the local tea seller -Explain the concept of Cloud to your 87 year old grandmother-Introduce the concept of friendly robots to a class 3 kid.

**UNIT II ANALYSIS OF LIFE POSITION****(9 Hrs)**

Personal analysis: SWOT analysis - SWOT and Life Positions –Analysis of others' lives – Analysis of one's own life. - TOWS Analysis: How to turn threat into opportunity – VUCA - Volatility, uncertainty, complexity and ambiguity - Application of analysis in real life scenarios – Activity: SWOT analysis of a well-known individual's life – TED talk on bio mimicry – Group activity - Presentation on strengths identified to survive in the VUCA World – Watching videos of motivation & discussion.

**UNIT III PLURALISM IN CULTURAL SPACE****(9 Hrs)**

Identifying Pluralism in cultural spaces - uniqueness and differences - Global, Glocal and Translocational cultures – benefits, differences and implications of multi-culture – Gender awareness - Roles and relations of different genders- Group activity – Exploring cultures and traditions of different states – Performing Indian dance forms – Debate on Global, Glocal and Translocational impacts – cultural misunderstanding – Group discussion on implications of cross cultural communication –Gender awareness campaign: College, Workplace, Family, Friend.

**UNIT – IV SELF DRIVEN HUMAN VALUES AND FUTURISM****(9 Hrs)**

Motivation in real life: Stories - YouTube videos on Maslow's Theory - Explain the idea of motivation with the help of examples - Gender awareness: Differentiate between the roles and relations of different gender - Gender awareness with four different themes: College-Workplace-Family-Friends. Design your college in the year 2090: Groups need to create the college of future with the future teachers, teaching methods, types of students, etc. How will offices/workplaces change in future? -Motivational TED talk videos.



## UNIT V ROLE OF SCIENCE IN NATION BUILDING

(9 Hrs)

Role of science in nation building – Pre & Post Independent scientific inventions and inventors – development of Information Technology –Discussion on the role of scientists and mathematicians – Presentation on eminent scientists and mathematicians – Quiz on Scientists and inventions – Explaining DNA ,Rings of Saturn ,structure of heart to visually impaired person.

### Reference Books

1. Self-Analysis by Ron Hubbard, Bridge Pubns; 2007th edition
2. Managing a Diverse Workforce: Learning Activities, Gary N. Powell, Sage Publication
3. Unity in Diversity: The Indian Experience in Nation-building, M.S. Gore, Rawat Publication
4. Artificial Intelligence, Russell, Pearson Education India
5. Carrie Hutchinson, "Cross Cultural Communication A Guide for International Students" Createspace Independent Pub 1 December 2013.

### Web References

1. <https://freelance-writing.lovetoknow.com/kinds-technical-writing>
2. <https://clickhelp.com/clickhelp-technical-writing-blog/11-skills-of-a-good-technical-writer/>
3. <https://www.hult.edu/blog/benefits-challenges-cultural-diversity-workplace/>
4. <https://www.investopedia.com/terms/c/cross-culture.asp>
5. <https://link.springer.com/article/10.1007/s11569-018-0327-8>

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

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

<b>U20HST405</b>	<b>INTRODUCTION TO INNOVATION, IP MANAGEMENT &amp; ENTREPRENEURSHIP</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hrs</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>45</b>

### **Course Objectives**

- To acquaint the students with the knowledge base of Entrepreneurship
- To learn about Innovation and Creativity
- To learn to manage various types of Intellectual Property Rights IPR to protect competitive advantage
- To know about the Building an Innovative Organization
- To enable students to investigate, understand and internalize the process of founding a start-up.

### **Course Outcomes**

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

**CO1** - Examine different types' entry strategies of entrepreneurship **(K3)**

**CO2** - Demonstrate about Innovation and Creativity **(K2)**

**CO3** - Elaborate on various types of Intellectual Property Rights **(K3)**

**CO4** -Analyze various entrepreneurial opportunities. **(K3)**

**CO5** - Evaluate the process of founding a start-up **(K3)**

### **UNIT I INNOVATION**

**(9 Hrs)**

Innovation: Definition and meaning; Innovation as a core business process, Sources of innovation, Types of Innovation, Challenges in Innovation, Knowledge push vs. need pull innovations. Innovation Vs. Creativity.

### **UNIT II BUILDING AN INNOVATIVE ORGANIZATION**

**(9 Hrs)**

Creating new products and services, Exploiting open innovation and collaboration, Use of innovation for starting a new venture

### **UNIT III INTELLECTUAL PROPERTY RIGHTS (IPR)**

**(9 Hrs)**

Introduction and the economics behind development of IPR: Business Perspective; IPR in India – Genesis and Development; International Context; Concept of IP Management, Use in marketing; Types of Intellectual Property: Patent- Procedure, Licensing and Assignment, Infringement and Penalty, Trademark- Use in marketing, example of trademarks- Domain name, Geographical Indications, Copyright, Industrial Designs.

### **UNIT IV ENTREPRENEURSHIP**

**(9 Hrs)**

Opportunity recognition and entry strategies, Entrepreneurship as a Style of Management, Types of Entrepreneurship, Maintaining Competitive Advantage- Use of IPR to protect Innovation.

### **UNIT V ENTREPRENEURSHIP- FINANCIAL PLANNING**

**(9 Hrs)**

Financial Projections and Valuation, Stages of financing, Debt, Venture Capital and other forms of Financing.

### Text Books

1. Joe Tidd, John Bessant. Managing Innovation: Integrating Technological, Market and Organizational Change, Sixth Edition, John Wiley & Sons Limited, 2018

### Reference Books

1. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd: Entrepreneurship (Tata McGraw Hill)
2. Arya Kumar: Creating and Leading an Entrepreneurial Organization (Pearson 2012)
3. Vasant Desai: The Dynamics of Entrepreneurial Development and Management (Himalaya Publishing House)
4. Gabe Burton: Entrepreneurship and Small Business Management (Library Press 2017)

### Web References

1. [www.ediindia.org](http://www.ediindia.org)
2. [www.enterweb.org/entrship.htm](http://www.enterweb.org/entrship.htm)
3. <https://www.theweekendleader.com/more-articles.html>

### COs/POs/PSOs Mapping

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

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

<b>U20CBT407</b>	<b>DATABASE MANAGEMENT SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hrs</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>45</b>

### Course Objectives

- To understand the various data models, conceptualize E-R diagram and depict using relational model
- To gain knowledge about database languages and frame query using Relational Algebra and SQL
- To understand and design an efficient database schema using the various normal forms
- To impart knowledge on data storage and transaction processing, concurrency control techniques and recovery procedures
- To explore knowledge on database security

### Course Outcomes

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

**CO1** - Explain the concepts of Database Management System **(K2)**

**CO2** - Manipulate and build database queries using Structured and Relational Query Language **(K3)**

**CO3** - Use data normalization principles to develop a normalized database for a given application. **(K3)**

**CO4** - Illustrate various transactions and recovery techniques **(K2)**

**CO5** - Describe the concepts of Database Security **(K2)**

### UNIT I INTRODUCTION

**(9 Hrs)**

**Introduction:** Introduction to Database. Hierarchical, Network and Relational Models.

**Database system architecture:** Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML).

### UNIT II DATA MODELS AND DATABASE LANGUAGES

**(9 Hrs)**

**Data models:** Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.

**Relational query languages:** Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server

### UNIT III RELATIONAL-DATABASE DESIGN

**(9 Hrs)**

**Relational database design:** Domain and data dependency, Armstrong's axioms, Functional Dependencies, Normal forms, Dependency preservation, Lossless design.

**Query processing and optimization:** Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.

### UNIT IV DATA STORAGE AND TRANSACTION

**(9 Hrs)**

**Storage strategies:** Indices, B-trees, Hashing.

**Transaction processing:** Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.

### UNIT V DATABASE SECURITY

**(9 Hrs)**

**Database Security:** Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.

### Content Beyond Syllabus

**Advanced topics:** Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

### Text Books

1. Silberschatz, Korth, Sudarshan, Database System Concepts, 7th Edition – McGraw-Hill Higher Education, International Edition, 2019.
2. Ramez Elmasri, and Shamkant B. Navathe, Fundamentals of Database Systems (7th edition), Publisher: Pearson, 2016.
3. Raghu Ramakrishnan, —Database Management Systems, Fourth Edition, McGraw-Hill College Publications, 2015.

### Reference Books

1. Principles of Database and Knowledge – Base Systems, Vol 1 by J. D. Ullman.
2. Fundamentals of Database Systems. R. Elmasri and S. Navathe.
3. Foundations of Databases. Serge Abiteboul, Richard Hull, Victor Vianu.

### COs/POs/PSOs Mapping

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

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

<b>U20CBP406</b>	<b>DATABASE MANAGEMENT SYSTEMS LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hrs</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>	<b>30</b>

### Course Objectives

- To understand data definitions and data manipulation commands
- To understand data selection and data projection commands
- To learn the use of nested and join queries
- To understand functions, procedures and procedural extensions of databases
- To understand design and implementation of typical database applications.

### Course Outcomes

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

**CO1** - Implement relational database systems using SQL statements. **(K3)**

**CO2** - Use typical data definitions and manipulation commands in various applications. **(K3)**

**CO3** - Demonstrate applications using Nested and Join Queries. **(K3)**

**CO4** - Execute various PL/SQL Queries. **(K3)**

**CO5** - Build commercial relational database applications. **(K3)**

### List of Experiments

#### Structured Query Language:

1. Conceptual Database design using E-R DIAGRAM
2. Implementation of SQL commands DDL, DML, DCL and TCL
3. Queries to demonstrate implementation of Integrity Constraints
4. Practice of Inbuilt functions
5. Implementation of Join and Nested Queries AND Set operators
6. Implementation of virtual tables using Views

#### PL/SQL

7. Practice of Procedural extensions (Procedure, Function, Cursors, Triggers)

#### Application Development

8. Mini Project (Application Development using DB)
9. Mini Project (Application Development using NoSQL)

### Reference Books

1. Oracle developer handbook
2. SQL/PL/SQL for Oracle by P.S. Deshpande IIT Madras, Dream tech Press
3. Alan Beaulieu, Mastering SQL Fundamentals, Second Edition, O'Reilly, 2009
4. Silberschatz, Korth, Sudarshan, Database System Concepts, 7th Edition – McGraw-Hill Higher Education, International Edition, 2019

### Web References

1. [www.oracle-developer.net](http://www.oracle-developer.net)
2. [www.oracle.com/DBA](http://www.oracle.com/DBA)

**CO-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	1
2	3	2	1	1	3	-	-	-	-	-	-	-	3	2	1
3	3	2	1	1	3	-	-	-	-	-	-	-	3	2	1
4	3	2	1	1	3	-	-	-	-	-	-	-	3	3	1
5	3	2	1	1	3	-	-	-	-	-	-	-	3	3	2

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

# ANNEXURE - II



**B.Tech. Computer Science and Business Systems – R2020 Curriculum and Syllabi****STRUCTURE FOR UNDERGRADUATE ENGINEERING PROGRAMME**

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

**SCHEME OF CREDIT DISTRIBUTION – SUMMARY**

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

\* EEC and MC are not included for CGPA calculation

SEMESTER – I										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
<b>Theory</b>										
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
<b>Practical</b>										
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
<b>Employability Enhancement Course</b>										
10	U20CBC1XX	Certification Course-I **	EEC	0	0	4	-	100	-	100
<b>Mandatory Course</b>										
11	U20CBM101	Induction Program	MC	3Weeks			-	-	-	-
							19	400	600	1000

SEMESTER – II										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
<b>Theory</b>										
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
<b>Practical</b>										
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
<b>Employability Enhancement Course</b>										
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
<b>Mandatory Course</b>										
12	U20CBM202	Environmental Sciences	MC	2	0	0	-	100	-	100
							19	600	600	1200

SEMESTER – III										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
<b>Theory</b>										
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
<b>Practical</b>										
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
<b>Employability Enhancement Course</b>										
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
<b>Mandatory Course</b>										
11	U20CBM303	Physical Education	MC	0	0	2	-	100	-	100
							18	575	525	1100

SEMESTER – IV										
Sl. No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
<b>Theory</b>										
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
<b>Practical</b>										
7	U20BSP441	Operations Research Laboratory	BS	0	0	2	1	50	50	100
8	U20CBP404	Operating Systems(Unix) Laboratory	PC	0	0	2	1	50	50	100
9	U20CBP405	Software Engineering Laboratory	PC	0	0	2	1	50	50	100
10	U20CBP406	Design And Analysis of Algorithms	PC	0	0	2	1	50	50	100
<b>Employability Enhancement Course</b>										
11	U20CBC4XX	Certification Course - IV**	EEC	0	0	4	-	100	-	100
12	U20CBS403	Skill Development Course 3*	EEC	0	0	2	-	100	-	100
<b>Mandatory Course</b>										
13	U20CBM404	NSS	MC	0	0	2	-	100	-	100
							20	650	650	1300

SEMESTER – V										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
<b>Theory</b>										
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 <sup>#</sup>	PE	2	1	0	3	25	75	100
<b>Practical</b>										
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 <sup>#</sup> Laboratory	PE	0	0	2	1	50	50	100
<b>Employability Enhancement Course</b>										
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
<b>Mandatory Course</b>										
13	U20CBM505	Indian Constitution	MC	2	0	0	-	100	-	100
							20	750	650	1400

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

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

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

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

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



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

**ANNEXURE I**  
**PROFESSIONAL ELECTIVE COURSES (18 CREDITS)**

<b>Professional Elective – I (Offered in Semester V)</b>		
<b>Sl. No.</b>	<b>Course Code</b>	<b>Course Title</b>
1	U20CBE501	Conversational Systems
2	U20CBE502	Cloud, Microservices & Application
3	U20CBE503	Machine Learning
4	U20CBE504	Business Intelligence
5	U20CBE505	Business Process
<b>Professional Elective – II (Offered in Semester VI)</b>		
<b>Sl. No.</b>	<b>Course Code</b>	<b>Course Title</b>
1	U20CBE606	Robotics and Embedded Systems
2	U20CBE607	Modern Web Applications
3	U20CBE608	Data Mining and Analytics
4	U20CBE609	E- Commerce and E- Payment Systems
5	U20CBE610	Big Databases
<b>Professional Elective – III (Offered in Semester VII)</b>		
<b>Sl. No.</b>	<b>Course Code</b>	<b>Course Title</b>
1	U20CBE711	Cognitive Science & Analytics
2	U20CBE712	Introduction to IoT
3	U20CBE713	Cryptography
4	U20CBE714	Robotic Process Automation
5	U20CBE715	Cyber Security
<b>Professional Elective – IV (Offered in Semester VII)</b>		
<b>Sl. No.</b>	<b>Course Code</b>	<b>Course Title</b>
1	U20CBE716	Quantum Computation & Quantum Information
2	U20CBE717	Advanced Social, Text and Media Analytics
3	U20CBE718	Mobile Computing
4	U20CBE719	Block chain
5	U20CBE720	Virtual Reality
<b>Professional Elective – V (Offered in Semester VIII)</b>		
<b>Sl. No.</b>	<b>Course Code</b>	<b>Course Title</b>
1	U20CBE821	Behavioral Economics
2	U20CBE822	Computational Finance & Modeling
3	U20CBE823	Psychology
4	U20CBE824	Data Sciences
5	U20CBE825	Smart Systems
<b>Professional Elective – VI (Offered in Semester VIII)</b>		
<b>Sl. No.</b>	<b>Course Code</b>	<b>Course Title</b>
1	U20CBE826	Enterprise Systems
2	U20CBE827	Advance Finance
3	U20CBE828	Image Processing and Pattern Recognition
4	U20CBE829	Automation Tools and Technique - Devops
5	U20CBE830	Augmented Reality

**PROFESSIONAL ELECTIVE PRACTICAL COURSES (4 CREDITS)**

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

## ANNEXURE-II

## EMPLOYABILITY ENHANCEMENT COURSES – (A). CERTIFICATION COURSES

SI.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

Academic Curriculum R-2020

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**

# ANNEXURE - III

U20CBT408

**DESIGN AND ANALYSIS OF  
ALGORITHMS**

L	T	P	C	Hrs
3	0	0	3	45

**Course Objectives**

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

**Course Outcomes**

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

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

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

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

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

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

**UNIT I ALGORITHM ANALYSIS**

**(9 Hrs)**

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

**UNIT II FUNDAMENTAL ALGORITHMIC STRATEGIES**

**(9 Hrs)**

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

**UNIT III GRAPH AND TREE ALGORITHMS**

**(9 Hrs)**

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

**UNIT IV ALGORITHMIC STRATEGIES**

**(9 Hrs)**

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

**UNIT V TRACTABLE AND INTRACTABLE PROBLEMS**

**(9 Hrs)**

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

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

**Text Books**

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



### Reference Books

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

### Web References

1. [https://www.tutorialspoint.com/design\\_and\\_analysis\\_of\\_algorithms/index.htm](https://www.tutorialspoint.com/design_and_analysis_of_algorithms/index.htm)
2. <https://www.javatpoint.com/daa-tutorial>
3. <https://www.guru99.com/design-analysis-algorithms-tutorial.html>
4. <https://nptel.ac.in/courses/106/106/106106131/>
5. <https://online.stanford.edu/courses/soe-ycsalgorithms1-algorithms-design-and-analysis-part-1>

### COs/POs/PSOs Mapping

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

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

**U20CBE503**

**MACHINE LEARNING**

L	T	P	C	Hrs
3	0	0	3	45

**Course Objectives**

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

**Course Outcomes**

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

**CO1** - Distinguish between, supervised, unsupervised and semi-supervised learning. **(K2)**

**CO2** - Modify existing machine learning algorithms to improve classification efficiency. **(K2)**

**CO3** - Build a basic neural network for real-time data. **(K3)**

**CO4** - Use of temporal models for classification **(K3)**

**CO5** - Use unsupervised models for clustering data and design a system that uses the information mining models of machine learning. **(K3)**

**UNIT I INTRODUCTION TO MACHINE LEARNING**

**(9 Hrs)**

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

**UNIT II SUPERVISED LEARNING ALGORITHMS**

**(9 Hrs)**

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

**UNIT III CLASSIFICATION TECHNIQUES**

**(9 Hrs)**

Naive Bayes classification; Bayesian networks; Decision Tree and Random Forests; k-Nearest neighbor classification; Support Vector Machines  
Artificial neural networks including back propagation; Applications of classifications; Ensembles of classifiers including bagging and boosting

**UNIT IV HIDDEN MARKOV MODELS AND REGRESSION TECHNIQUES**

**(9 Hrs)**

Hidden Markov Models (HMM) with forward-backward and Viterbi algorithms; Sequence classification using HMM; Conditional random fields; Applications of sequence classification such as part-of-speech tagging  
Regression: Multi-variable regression; Model evaluation; Least squares regression; Regularization; LASSO; Applications of regression.

**UNIT V UNSUPERVISED LEARNING AND MINING ALGORITHMS**

**(9 Hrs)**

Clustering: Average linkage; Ward's algorithm; Minimum spanning tree clustering; K-nearest neighbours clustering; BIRCH; CURE; DBSCAN..  
Association rule mining algorithms including apriori - Expectation-Maximization (EM) Algorithm for unsupervised learning anomaly and outlier detection methods.

**Text Books**

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

### Reference Books

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

### Web References

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

### COs/POs/PSOs Mapping

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

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

U20CBE504

## BUSINESS INTELLIGENCE

L	T	P	C	HRS
3	0	0	3	45

### Course Objectives

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

### Course Outcomes

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

**CO1** - Describe business intelligence and decision support systems (**K2**)

**CO2** – Use the mathematical models for decision making process (**K3**)

**CO3** – Implement the techniques involving classification and clustering (**K3**)

**CO4** – Summarize the various business intelligence applications (**K2**)

**CO5** - Explain the context of knowledge management systems (**K2**)

### UNIT I INTRODUCTION TO BUSINESS INTELLIGENCE (9 Hrs)

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

### UNIT II DATA MINING & DATA PREPARATION (9 Hrs)

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

### UNIT III CLASSIFICATION & CLUSTERING (9 Hrs)

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

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

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

### UNIT V KNOWLEDGE MANAGEMENT (9 Hrs)

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

### Text Books

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

**Reference Books**

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

**Web References**

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

**COs/POs/PSOs Mapping**

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1															
2															
3															
4															
5															

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

<b>U20CBE606</b>	<b>ROBOTICS AND EMBEDDED SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hrs</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>45</b>

### Course Objectives

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

### Course Outcomes

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

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

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

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

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

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

### **UNIT I INTRODUCTION TO EMBEDDED SYSTEM (9 Hrs)**

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

### **UNIT II DEVICES AND COMMUNICATION BUSES (9 Hrs)**

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

### **UNIT III PROGRAM MODELLING CONCEPTS (9 Hrs)**

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

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

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

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

### **UNIT V ROBOTICS AND KINEMATICS (9 Hrs)**

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

### Text Books

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

### Reference Books

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

### Web References

1. <https://nptel.ac.in/courses/108/102/108102045/>
2. <https://www.embeddedrelated.com/tutorials.php>
3. [https://www.tutorialspoint.com/embedded\\_systems/index.htm](https://www.tutorialspoint.com/embedded_systems/index.htm)
4. <https://www.javatpoint.com/robotics-tutorial>
5. <http://www.robotictutorials.com/>

### COs/POs/PSOs Mapping

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

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

### Course Objectives

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

### Course Outcomes

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

**CO1** - Understand the fundamentals of data mining and data representation. **(K2)**

**CO2** - Perform preprocessing tasks for the data set. **(K2)**

**CO3** - Apply association rules and predictive methods for data mining. **(K3)**

**CO4** - Build data models using linear regression techniques. **(K3)**

**CO5** - Gain knowledge on time series analysis and prescriptive analysis. **(K2)**

### UNIT I INTRODUCTION AND KNOWLEDGE REPRESENTATION (9 Hrs)

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

### UNIT II DATA PREPROCESSING (9 Hrs)

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

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

### UNIT III ASSOCIATION AND MINING METHODS (9 Hrs)

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

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

### UNIT IV LINEAR MODELS (9 Hrs)

**Descriptive analytics:** Data Modeling, Trend Analysis, Simple Linear Regression Analysis

**Forecasting models:** Heuristic methods, predictive modeling and pattern discovery,

**Logistic Regression:** Logit transform, ML estimation, Tests of hypotheses, Wald test, LR test, score test, test for overall regression, multiple logistic regression, forward, backward method, interpretation of parameters, relation with categorical data analysis. Interpreting Regression Models, Implementing Predictive Models.

**Generalized Linear model:** Link functions such as Poisson, binomial, inverse binomial, inverse Gaussian, Gamma.



## UNIT V TIME SERIES ANALYSIS

(9 Hrs)

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

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

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

### Content beyond Syllabus

Non Linear Regression Models

### Text Books

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

### Reference Books

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

### Web References

1. <https://nptel.ac.in/courses/106/105/106105174/>
2. <https://nptel.ac.in/courses/110/106/110106072/>
3. [https://www.tutorialspoint.com/data\\_mining/index.htm](https://www.tutorialspoint.com/data_mining/index.htm)
4. <https://www.javatpoint.com/data-mining>
5. <https://www.guru99.com/data-mining-tutorial.html>

### COs/POs/PSOs Mapping

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

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

<b>U20HST611</b>	<b>FINANCIAL &amp; COST ACCOUNTING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hrs</b>
		<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>30</b>

### Course Objectives

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

### Course Outcomes

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

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

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

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

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

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

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

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

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

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

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

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

### Text Books

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

## Reference Books

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

## Web Resources

1. [https://icmai.in/icmai/contact\\_us.php](https://icmai.in/icmai/contact_us.php)
2. <https://home.kpmg/in/en/home/services/advisory/management-consulting/financial-management/cost-accounting-management.html>
3. <https://www.accounting.com/>
4. <https://www.erpgreat.com/general/case-study-financial-and-cost-accounting.htm>
5. [https://www.hzu.edu.in/uploads/Case\\_Studies\\_of\\_Cost\\_and\\_Works\\_Accounting.pdf](https://www.hzu.edu.in/uploads/Case_Studies_of_Cost_and_Works_Accounting.pdf)

## COs/POs Mapping

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