

2018

**[OBE DESIGN- COMPUTER
SCIENCE & INFORMATION
TECHNOLOGY DEPARTMENT]**

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PREFACE

Outcome Based Education (OBE) is the educational approach which focuses on student centric education in the context of development of personal, social, professional and knowledge (KSA) requirements in one's career and life. It is the decade ago curriculum development methodology. The educational triangle of LEARNING-ASSESSMENT-TEACHING is the unique nature of the OBE approach. The curriculum practices such as Competency Based Curriculum, Taylor's Model of Curriculum Development, Spadys' Curriculum principles, Blooms taxonomy and further use of assessment methodologies like, Norm-reference testing and Criterion reference testing, etc is being practiced since decades. It is also interesting to know that, globally, different countries and universities adopts the curriculum development models/approaches such as, CDIO (Conceive-Design-Implement-Operate), Evidenced Based Education, Systems' Approach, etc as the scientific and systematic approaches in curriculum design.

The authorities of Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (M.S.) in-lieu of accreditation standards of National Assessment and Accreditation Council, decided to opt for Outcomes Based Education (OBE). As the part of the decision, different meetings, workshops and presentations were held at the campus of university.

This document is the outcome of different meetings and workshops held at university level and department level. The detailed document is designed and the existing curriculum of the department is transformed in to the framework of OBE. This is the first step towards the implementation of OBE in the department. The document will serve all stakeholders in the effective implementation of the curriculum. The OBE is continuous process for quality enhancement and it will go a long way in order to enhance the competencies and employability of the graduates/Post-graduates of the university department.

Head of Department

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OUTCOME BASED EDUCATION

Faculty of Science & Technology

Department of Computer Science and Information Technology

1. Mission:

Mission Statement

- To offer post-graduate and research programs having focus on development of hardware and design distributed embedded system oriented towards industrial applications.
- To develop the computer and IT competencies at par with national and international standards by adopting OBE approach.
- To develop post-graduates with life-long learning capabilities required in industry and self-enterprise.
- The department follows (To offer) the student centric and professional specific approach in its learning design.

2. Vision:

Vision Statement

The department vision is to offer five year integrated program in computer science & information technology under the CBCS with cafeteria approach. The department will have a strong hardware laboratory with facilities to design distributed embedded system oriented towards industrial applications. The department will have virtual learning center and student development cell for counseling and enhancing campus placements of graduates.

3. Title of the Program (s):

- a. Master of Computer Science
- b. Master of Information Technology
- c. Master of Technology (Computer Science)

4. Program Educational Objectives:

The program educational objectives (PEO) are the statement that describes the career and professional achievement after the program of studies (graduation/ post-graduation). The PEO s are driven form question no. (ii) of the Mission statement (What is the purpose of organization). The PEOs can be minimum three and maximum five.

PEO1: To have advance knowledge of computer science to provide middle level leadership to the profession.

PEO2: To provide the professional services to industry, research organization, institutes as software designer/system administrator.

PEO3: To provide the professional consultancy and research support for the relevant organization in the domain of software/hardware.

PEO4: To opt for higher education, disciplinary & multi-disciplinary research and to be a life-long learner.

PEO5: To provide, value based and ethical leadership in the professional and social life.

5. Program Outcomes:

The program outcomes (PO) are the statement of competencies/ abilities. POs are the statement that describes the knowledge and the abilities the graduate/ post-graduate will have by the end of program studies.

MASTER OF COMPUTER SCIENCE/ MASTER OF INFORMATION TECHNOLOGY

PO1	Domain specific Engineering knowledge : Attainment of the ability to acquire and apply knowledge of mathematics, electronics, computer science, information technology and specialization so as to make analysis of complex chemical engineering problems.
PO2	Problem Analysis ability : Attainment of the ability to acquire knowledge which will enable them to analyze problems while working in software, hardware and computer system, networking, information technology administration and allied industries as well as consultancies.
PO3	Acquiring skills to Design/develop solutions to problems : Acquiring skills in selection, design, development of software and computer system and to attain ability to understand the past and present trends in computing.
PO4	Capacity to investigate complex problems : Attainment of the ability to identify new research areas in computer/information technology and to use research-based knowledge and research methods including development of software/ system, programming and testing.
PO5	Modern tool usage : Attainment of the ability to create, select and apply appropriate language, operating platform, networking, database and relevant techniques, resources, and modern engineering and IT tools including 'modeling and prediction' to complex engineering activities so as to solve advanced engineering problems.
PO6	The engineer's connectivity with 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 awareness: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Practicing Ethics and Values: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Ability to work as an Individual and in team: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Acquiring Communication Skills: 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 aspects: 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 attitude: 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.

6. Course- Program outcome Matrix:

The Program Outcomes are developed through the curriculum (curricular/co-curricular-extra-curricular activities). The program outcomes are attained through the course implementation. As an educator, one must know, **“to which POs his/her course in contributing?”**. So that one can design the learning experiences, select teaching method and design the tool for assessment. Hence, establishing the Course-PO matrix is essential step in the OBE. The course-program outcomes matrix indicates the co-relation between the courses and program outcomes. The CO-PO matrix is the map of list of courses contributing to the development of respective POs.

The CO-PO MATRIX is provided in the below table.

COURSE AND PO ATTAINMENT LEVELS
Master of Science (Computer)

Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Advanced Java	*	*										
Neural Network	*	*										
Digital Signal Processing	*	*										
Advanced Operating System	*	*			*							
Practical 401	*	*			*	*	*			*	*	*
Practical 402	*	*			*	*	*			*	*	*
Practical 403	*	*			*	*	*			*	*	*
Practical 404	*	*			*	*	*			*	*	*
Data Structure and Analysis of Algorithm	*	*	*	*	*							
Advance Neural Network and Fuzzy System	*	*		*								
Image processing	*	*		*								

Parallel Computing	*	*		*								
Practical 405	*	*		*	*	*	*		*	*	*	*
Practical 406	*	*		*	*	*	*		*	*	*	*
Practical 407	*	*		*	*	*	*		*	*	*	*
Practical 408	*	*		*	*	*	*		*	*	*	*
Java Network Programming		*	*	*	*							
Advanced Software Engineering and Technology		*	*	*								
Computer Vision		*	*	*								
E1:		*	*	*	*							
Practical 501		*	*	*	*	*	*	*	*	*	*	*
Practical 502		*	*	*	*	*	*	*	*	*	*	*
Practical 503		*	*	*	*	*	*	*	*	*	*	*
Practical 504		*	*	*	*	*	*	*	*	*	*	*
Pattern Recognition		*	*	*								
437		*	*	*								
Practical 505		*	*	*	*	*	*	*	*	*		*
Practical 506		*	*	*	*	*	*	*	*	*		*
Major Project	*	*	*	*	*	*	*	*	*	*	*	*
Seminar			*	*	*			*	*	*		

Master of Information technology

Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12
Object Oriented Programming in C++	*	*										
Computer System Architecture	*	*										
Operating System	*	*										
Relational database Management System	*	*			*							
Practical 401	*	*			*	*	*	*	*	*	*	*
Practical 402	*	*			*	*	*	*	*	*	*	*
Practical 403	*	*			*	*	*	*	*	*	*	*
Practical 404	*	*			*	*	*	*	*	*	*	*
Programming in Core Java	*	*	*	*	*							
Software Engineering and CASE Tools	*	*		*								
Data Structure and Algorithm	*	*		*								
Computer Networks	*	*		*								
Practical 405	*	*			*	*	*	*	*	*	*	*
Practical 406	*	*		*	*	*	*	*	*	*	*	*

Practical 407	*	*		*	*	*	*	*	*	*	*	*
Practical 408	*	*		*	*	*	*	*	*	*	*	*
Programming in Advanced Java		*	*	*	*							
Decision Support System and Intelligent System		*	*	*								
Network Security		*	*	*								
E1:		*	*	*	*							
Practical 501		*	*	*	*	*	*	*	*	*	*	*
Practical 502		*	*	*	*	*	*	*	*	*	*	*
Practical 503		*	*	*	*	*	*	*	*	*	*	*
Practical 504		*	*	*	*	*	*	*	*	*	*	*
VB Net Technology		*	*	*								
E2		*	*	*								
581			*	*	*							
Practical 505		*	*	*	*		*	*	*	*		*
Practical 505		*	*	*	*		*	*	*	*		*
Major Project	*	*	*	*	*	*	*	*	*	*	*	*
Seminar			*	*	*			*	*	*		

7. Course Outcomes (for all courses):

The course outcomes are the statement that describes the knowledge & abilities developed in the student by the end of course (subject) teaching. The focus is on development of abilities rather than mere content. There can be 5 to 7 course outcomes of any course. These are to be written in the specific terms and not in general. The list of Course Outcomes is the part of **Annexure-C** attached herewith.

8. Set Target levels for Attainment of Course Outcomes:

The course outcome attainment is assessed in order to track the graduates' performance w.r.t target level of performance. The CO-PO attainment is the tool used for continuous improvement in the graduates' abilities through appropriate learning & teaching strategies. In order to assess students' performance with respect to abilities (at the end of course teaching/by the end of program) the course outcome attainment are measured/calculated. In order to calculate the program outcome attainment, the course outcome attainment is calculated. Prior to that, the course-program outcome mapping is done.

9. Set Target level for Attainment of Program Outcomes:

The program outcome attainment is assessed in order to track the graduates' performance w.r.t target level of performance. The CO-PO attainment is the tool used for continuous improvement in the graduates' abilities through appropriate learning & teaching strategies. In order to assess students' performance with respect to abilities (at the end of course teaching/by the end of program) the course outcome attainment and program outcome attainment is measured/calculated. The program outcome attainment is governed by curricular, co-curricular and extra-curricular activities including the stakeholders' participation. The direct method and indirect method is adopted to calculate the PO attainment. The direct method implies the attainment by course outcomes contributing to respective program outcomes. And indirect method is the satisfaction/feed-back survey of stakeholders. In order to calculate the program outcome attainment, the course outcome attainment is calculated. Prior to that, the course-program outcome mapping is done.

The set target level is the set benchmark to ensure the continuous improvements in the learners/ graduates' performance.

10. Course Attainment Levels:

- a. CO attainment is defined/set at three levels;
- b. The CO attainment is based on end term examination assessment and internal assessment;
- c. The Co attainment for M. Sc. Computer Science is defined at three levels in ascending order-
 - i. e.g. For end term and internal examination;
 - ii. Level-1: 40% students scored more than class average

- iii. Level-2: 50% students score more than class average;
 - iv. Level-3: 60% students score more than class average.
- d. The Co attainment for M. Sc. Information Technology is defined at three levels in ascending order-
 - i. e.g. For end term and internal examination;
 - ii. Level-1: 30% students scored more than class average
 - iii. Level-2: 40% students score more than class average;
 - iv. Level-3: 50% students score more than class average.
- e. The target level is set (e.g. Level-2). It indicates that, the current target is level-2; 50% for Computer Science and 40% for Information Technology students score more than class average. The CO attainment is measured and the results are obtained. Based on the results of attainment, the corrective measures/remedial action are taken.
- f. CO Attainment= 80% (Attainment level in end term examination) + 20% (Attainment level in internal examination).
- g. **The example of calculating CO attainment is explained in Point No. 12. The example of one course from Master of Computer Science is demonstrated here.**

11. Program attainment Level:

- a. PO attainment is defined at five levels in ascending order;
- b. The PO attainment is based on the average attainment level of corresponding courses (Direct Method) and feed-back survey (Indirect method);
- c. The PO attainment levels are defined / set as stated below;
 - i. Level-1: Greater than 0.5 and less than 1.0 (0.5>1)- Poor
 - ii. Level-2: 1.0>1.5-Average
 - iii. Level-3: 1.5>2.0-Good
 - iv. Level-4: 2.0>2.5-Very Good
 - v. Level-5: 2.5>3.0 -Excellent
- d. The PO attainment target level is set/defined (say, Level-4). It implies that, the department is aiming at minimum level-4 (very good) in the performance of abilities by the graduates. Based upon the results of attainment, the remedial measures are taken;
- e. PO ATTAINMENT TARGET FOR COMPUTER SCIENCE IS LEVEL-4.
- f. PO ATTAINMENT FOR INFORMATION TECHNOLOGY IS LEVEL-3
- h. PO Attainment= 80% (Average attainment level by direct method) + 20% (Average attainment level by indirect method).
- i. **The example of calculating CO attainment is explained in Point No. 12. The example of one course from Master of Computer Science is demonstrated here.**

12. The Results of CO Attainment:

ANNEXURE –B PROVIDES THE RESULT OF CO ATTAINMENT

FOR EXAMPLE:

COURSE CODE/TITLE: Advanced Java

- e.g. For end term and internal examination;
- i. Level-1: 40% students scored more than class average
 - ii. Level-2: 50% students score more than class average;
 - iii. Level-3: 60% students score more than class average

Average Marks in External examination: 45

% Students score more than 45 is 19/29 i.e. 65.51% i.e. Level-3

Average Marks in Internal examination= 15

% Students score more than 15 is 16/29 i.e.55.17%, i.e. Level-2

A (CO) Advanced Java= 80% (3) +20(2)

$$=2.4+0.4$$

$$= 2.8$$

Hence, The attainment level is Level-2 and the set target level is Level-2 and therefore the CO is Fully attained.

Table No. 1.0: CO Attainment Level

Master of Computer Science

Course Title	CO Attainment Value	Target Attainment level	Fully Attained/Partly Attained	Remedial Measures
Advanced Java	2.8	2	Fully Attained	
Neural Network	2.8	2	Fully Attained	
Digital Signal Processing	3	2	Fully Attained	
Advanced Operating System	2.6	2	Fully Attained	
Practical 401	2	2	Fully Attained	
Practical 402	1	2	Not Attained	Exercises, Practical training
Practical 403	3	2	Fully Attained	
Practical 404	2	2	Fully Attained	
Data Structure and Analysis of Algorithm	3	2	Fully Attained	
Advance Neural Network and Fuzzy System	2	2	Fully Attained	
Image processing	2	2	Fully Attained	
Parallel Computing	2.8	2	Fully Attained	
Practical 405	1	2	Not Attained	Exercises, Practical training

Practical 406	3	2	Fully Attained	
Practical 407	2	2	Fully Attained	
Practical 408	1	2	Not Attained	Exercises, Practical training
Java Network Programming	1	2	Not Attained	Assignment, tutorials, exercise, remedial classes
Advanced Software Engineering and Technology	1.2	2	Not Attained	
Computer Vision	2.2	2	Fully Attained	
E1:	3	2	Fully Attained	
Practical 501	1	2	Not Attained	Exercises, Practical training
Practical 502	2	2	Fully Attained	
Practical 503	2	2	Fully Attained	
Practical 504	1	2	Not Attained	Exercises, Practical training
Pattern Recognition	2	2	Fully Attained	
437	2.2	2	Fully Attained	
Practical 505	2	2	Fully Attained	
Practical 506	1	2	Not Attained	Exercises, Practical training
Major Project	3	2	Fully Attained	
Seminar	3	2	Fully Attained	

Master of Information Technology

Course Title	CO Attainment Value	Attainment Target Level	Fully Attained/ Not Attained	Remedial Measures
Object Oriented Programming in C++	3	2	Fully Attained	
Computer System Architecture	1.2	2	Fully Attained	
Operating System	1.2	2	Fully Attained	
Relational database Management System	2	2	Fully Attained	
Practical 401	3	2	Fully Attained	
Practical 402	1	2	Fully Attained	
Practical 403	2	2	Fully Attained	
Practical 404	2	2	Fully Attained	
Programming in Core Java	2	2	Fully Attained	
Software Engineering and CASE Tools	2	2	Fully Attained	
Data Structure and Algorithm	2	2	Fully Attained	
Computer Networks	1.8	2	Fully Attained	
Practical 405	1	2	Not Attained	Remedial classes, assignment, exercises, coaching to the collaborating courses w.r.t. PO
Practical 406	2	2	Fully Attained	
Practical 407	2	2	Fully Attained	
Practical 408	1	2	Not Attained	Remedial classes, assignment, exercises, coaching.
Programming in Advanced Java	1.2	2	Not Attained	
Decision Support System and Intelligent System	1.4	2	Not Attained	

Network Security	2	2	Fully Attained	
E1:	3	2	Fully Attained	
Practical 501	1	2	Not Attained	Remedial classes, assignment, exercises, coaching.
Practical 502	3	2	Fully Attained	
Practical 503	2	2	Fully Attained	
Practical 504	3	2	Fully Attained	
VB Net Technology	2.8	2	Fully Attained	
E2	2.2	2	Fully Attained	
581	2.2	2	Fully Attained	
Practical 505	2	2	Fully Attained	
Practical 505	3	2	Fully Attained	
Major Project	3	2	Fully Attained	
Seminar	3	2	Fully Attained	

13.The Results of PO Attainment:

ANNEXURE- B PROVIDES THE RESULT OF PO ATTAINEMENT

FOR EXAMPLE:

PO NO.: PO7

(Note: Refer point No. 11 above which describes the attainment level and set target attainment level)

PO Attainment= 80% (Average attainment level by direct method) + 20% (Average attainment level by indirect method).

A (PO) 7 = 80% (2+1+3+2+1+3+2+1+1+2+2+1+2+1+3)/15 +20% (2.00)

=80% (2.00) + 20% (2.00)

= 2.00 i.e. Level-4. The Target Level is Level-4. Hence, PO is attained.

Table No. 2.0 PO Attainment Level

Master of Computer Science

PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
PO Attainment Value	2.30	2.06	1.97	1.97	1.98	2	2	2	2	2	2	2	2
Target Attainment Level	4	4	4	4	4	4	4	4	4	4	4	4	4
Fully Attained/ Not attained			Not Attained										
Remedial Measures			Remedial classes, assignment, exercises, coaching to the collaborating courses w.r.t. PO										

Master of Information technology

PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
PO Attainment Value	1.89	2.03	2.3	2.16	2.11	2	2	2	2	2	2	2	3
Target Attainment Level	4	4	4	4	4	4	4	4	4	4	4	4	4
Fully Attained/ Not attained	Not Attained												
Remedial Measures	Remedial Measures to the contributing courses.												

14. Planned Actions for Course Attainment:

The courses having attainment level less than Level-2 shall be addressed by designing for remedial measures like assignments, tutorials and lectures.

15.Planned Actions for Program Outcome Attainment:

The PO having attainment level less than Level-4 shall be addressed by designing remedial measures for the corresponding courses w.r.t. the PO.

ANNEXURE-B
COURSE AND PO ATTAINMENT LEVELS
Master of Science (Computer)

Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Advanced Java	2.8	2.8										
Neural Network	2.8	2.8										
Digital Signal Processing	3	3										
Advanced Operating System	2.6	2.6			2.6							
Practical 401	2	2			2	2	2			2	2	2
Practical 402	1	1			1	1	1			1	1	1
Practical 403	3	3			3	3	3			3	3	3
Practical 404	2	2			2	2	2			2	2	2
Data Structure and Analysis of Algorithm	3	3	3	3	3							
Advance Neural Network and Fuzzy System	2	2		2								
Image processing	2	2		2								
Parallel Computing	2.8	2.8		2.8								

Practical 405	1	1		1	1	1	1		1	1	1	1
Practical 406	3	3		3	3	3	3		3	3	3	3
Practical 407	2	2		2	2	2	2		2	2	2	2
Practical 408	1	1		1	1	1	1		1	1	1	1
Java Network Programming		1	1	1	1							
Advanced Software Engineering and Technology		1.2	1.2	1.2								
Computer Vision		2.2	2.2	2.2								
E1:		3	3	3	3							
Practical 501		1	1	1	1	1	1	1	1	1	1	1
Practical 502		2	2	2	2	2	2	2	2	2	2	2
Practical 503		2	2	2	2	2	2	2	2	2	2	2
Practical 504		1	1	1	1	1	1	1	1	1	1	1
Pattern Recognition		2	2	2								
437		2.2	2.2	2.2								
Practical 505		2	2	2	2	2	2	2	2	2		2
Practical 506		1	1	1	1	1	1	1	1	1		1
Major Project	3	3	3	3	3	3	3	3	3	3	3	3
Seminar			3	3	3			3	3	3		
	2.30	2.06	1.97	1.97	1.98	2	2	2	2	2	2	2

Master of Information technology

Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12
Object Oriented Programming in C++	3	3										
Computer System Architecture	1.2	1.2										
Operating System	1.2	1.2										
Relational database Management System	2	2			2							
Practical 401	3	3			3	3	3	3	3	3	3	3
Practical 402	1	1			1	1	1	1	1	1	1	1
Practical 403	2	2			2	2	2	2	2	2	2	2
Practical 404	2	2			2	2	2	2	2	2	2	2
Programming in Core Java	2	2	2	2	2							
Software Engineering and CASE Tools	2	2		2								
Data Structure and Algorithm	2	2		2								
Computer Networks	1.8	1.8		1.8								
Practical 405	1	1			1	1	1	1		1	1	1
Practical 406	2	2		2	2	2	2	2	2	2	2	2

Practical 407	2	2		2	2	2	2	2	2	2	2	2
Practical 408	1	1		1	1	1	1	1	1	1	1	1
Programming in Advanced Java		1.2	1.2	1.2	1.2							
Decision Support System and Intelligent System		1.4	1.4	1.4								
Network Security		2	2	2								
E1:		3	3	3	3							
Practical 501		1	1	1	1	1	1	1	1	1	1	1
Practical 502		3	3	3	3	3	3	3	3	3	3	3
Practical 503		2	2	2	2	2	2	2	2	2	2	2
Practical 504		3	3	3	3	3	3	3	3	3	3	3
VB Net Technology		2.8	2.8	2.8								
E2		2.2	2.2	2.2								
581			2.2	2.2	2.2							
Practical 505		2	2	2	2		2	2	2	2		2
Practical 505		3	3	3	3		3	3	3	3		3
Major Project	3	3	3	3	3	3	3	3	3	3	3	3
Seminar			3	3	3			3	3	3		
	1.89	2.03	2.3	2.16	2.11	2	2	2	2	2	2	2

ANNEXURE-C
COURSE OUTCOMES
M.Sc.(Information Technology)

Course Code	Course Title	Course Outcomes
CSI402	Research Methodology	<ul style="list-style-type: none"> • To identify the overall process of designing a research study from its inception to its report. • To equip students with a basic understanding of the underlying principles of quantitative and qualitative research. • To introduce students to the key data generation methods. • To enable students to chose the most appropriate research method to address a particular research question. • To enable students to gain a basic overview of a range of quantitative and qualitative approaches to analysis. • To provide students with the knowledge and skill to undertake the design of a research proposal.
CSI403	Programming in Core Java	<ul style="list-style-type: none"> • Good JAVA Programmer. • Useful for NET/SET Examination. • Useful for JAVA Certification. • Useful for Applets and Apps Development.
CSI404	Computer System Architecture	<ul style="list-style-type: none"> • To study the basic working and organization of various components of computer systems. • To have a thorough understanding of the basic structure and operation of a digital computer. • To discuss in detail the operation of the arithmetic unit including the algorithms & implementation of fixed-point and floating-point addition, subtraction, multiplication & division.

		<ul style="list-style-type: none"> • To study the different ways of communicating with I/O devices and standard I/O Interfaces. • To study the hierarchical memory system including cache memories and virtual memory.
CSI405	Operating System	<ul style="list-style-type: none"> • This course introduces basic issues in operating systems. • Topics include Threads, processes, concurrency, memory management, I/O Control and case studies. • Hands-on study of Linux operating system design and kernel internals.
CSI406	Information Theory	<ul style="list-style-type: none"> • Information Theory provides the fundamental backbone of reliable communications, reliable data storage, and data compression. • This subject provides the rigorous basis of 'information', showing it to have deep links to randomness, the ability to reduce data to its essence, and to the ultimate limits to communication
CSI407	Research Project Review Writing	<ul style="list-style-type: none"> • With this course, students will become familiar with and learn to identify the most relevant textbooks, reviews, papers and journals for their research topics. During the course the students will also learn how to critically read and assess research papers and reviews. The review should point to research gaps that can be operationalised into feasible research questions.
CSI408	Interactive Programming using Python	<ul style="list-style-type: none"> • This course will provide a gentle, yet intense, introduction to programming using Python for highly motivated students with little or no prior experience in programming. • The course will focus on planning and organizing programs, as well as the grammar of the Python programming

		language.
CSI409	Software Engineering and CASE Tools	<ul style="list-style-type: none"> • In the theoretical part, students will learn about the principles and methods of software engineering, including current and emerging software engineering practices and support tools. • In the practical part, students will become familiar with the development of software products from an industry perspective, including generation of appropriate documents, under tight schedules and limited resources.
CSI410	Data Structure	<ul style="list-style-type: none"> • Understand structure and behavior of Algorithms. • Better scope to write effective programs. • Helpful in the preparation of UGC SET/NET, various entry level Examinations.
CSI501	Advance Programming using python	<ul style="list-style-type: none"> • This course will provide an opportunity for student to use python threading, GUI building, use of databases, Web Framework, • Web Services etc. FLASK framework, exposure to compatible framework will be provided to the student so that they may utilize python for their target web applications.
CSI502	Data Warehousing MY SQL	<ul style="list-style-type: none"> • Have an understanding of the foundations, the design, the maintenance, the evolution and the use of data warehouses, by looking at these topics in a rigorous way. • Have mastered the basic range of techniques for creating, controlling and navigating dimensional business databases, by being able to use a powerful tool for dimensional modeling and analysis. • Acquire hands-on experience with key components of an integrated data

		warehousing.
CSI502	Data Warehousing Using SQL	<ul style="list-style-type: none"> • A student completing this course unit should: Have an understanding of the foundations, the design, the maintenance, the evolution and the use of data warehouses, by looking at these topics in a rigorous way. • Have mastered the basic range of techniques for creating, controlling and navigating dimensional business databases, by being able to use a powerful tool for dimensional modeling and analysis. • Acquire hands-on experience with key components of an integrated data warehousing
CSI524	Elective I Network Security	<ul style="list-style-type: none"> • Are well-positioned to discuss the major aspects of Computer Security at an informal and semi-formal level, and have acquired the ability to critically analyze written and oral arguments. • Demonstrate a breadth of knowledge in the many topics of Computer Security, and understand its relevance and potential for an ever increasing number of applications. • Show insight into the practical issues of securing computer and information systems, including the human components, the overall social, economic, political and professional contexts, and are aware of the ethical and legal responsibilities that come with this knowledge.
CSI503	Data Mining	<ul style="list-style-type: none"> • To develop an understanding of the strengths and limitations of popular data mining techniques and to be able to identify promising business applications of data mining. Students will be able to actively manage and participate in data mining projects executed by consultants or specialists in data mining. • A useful take away from the course will be

		the ability to perform powerful data analysis.
CSI530	VB.NET using MySQL	<ul style="list-style-type: none">• The course provides students with the knowledge and skills needed to develop applications in Microsoft Visual Basic .NET for the Microsoft .NET platform.• The course focuses on user interfaces, program structure, language syntax, and implementation details. This is the first course in the Visual Basic .NET curriculum and will serve as the entry point for other .NET courses.