

# **Academic Regulations (VR 22)**

## **Program Structure & Detailed Syllabus**

**For**

Post Graduate Programme

## **Master of Computer Applications (MCA)**

(TWO YEARS PROGRAM)

(Applicable for Batches Admitted From 2022 – 2023)



**VIGNAN'S INSTITUTE OF INFORMATION TECHNOLOGY**

(AUTONOMOUS)

DUVVADA - VISAKHAPATNAM – 530 049

(An Autonomous Institute, Accredited by NAAC, Affiliated to JNTU-GV, Vizianagaram, AP)

# **Academic Regulations**

## **(MCA-VR22)**



**VIGNAN'S INSTITUTE OF INFORMATION TECHNOLOGY (Autonomous)**  
**MASTER OF COMPUTER APPLICATIONS (MCA)**  
(For Two-Year PG Programme)

**ACADEMIC REGULATIONS MCA 2022-23**

(Effective for the students admitted into first year from the Academic year 2022-23)

**1.0 ELIGIBILITY FOR ADMISSION**

- 1.1 Admission to the MCA program shall be made subject to the eligibility, qualifications and specialization prescribed by the University from time to time.
- 1.2 Admissions shall be made on the basis of merit rank obtained by the qualifying candidate at ICET examination or Entrance Test conducted by the University subject to reservations prescribed by the University from time to time.

**Note: Recognized Bachelor's Degree of minimum 3 years duration with Mathematics at 10+2 level or Graduate Level.**

**2.0 AWARD OF DEGREE**

- 2.1 A student shall be declared eligible for the award of the MCA degree, if he/she pursues a program of study and completes all 80 credits successfully not less than two academic years and not more than four academic years.
- 2.2 A student, who fails to fulfill all the academic requirements for the award of the degree within four academic years from the year of his/her admission, shall forfeit his/her degree in MCA program.
- 2.3 The minimum instruction days for each semester shall be 90 days.
- 2.4 A student shall register for courses in each semester as per the courses offered by the department.

**3.0 ATTENDANCE**

- 3.1 Aggregate 75% of the attendance is required for promotion to next semester.
- 3.2 Condonation of shortage of attendance in aggregate up to maximum of 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee based on genuine medical grounds. This privilege is given to any student only two times during the entire program of study.
- 3.3 A stipulated fee shall be payable towards condonation of shortage of attendance. Students availing condonation on medical ground shall produce a medical certificate by the competitive authority.
- 3.4 Shortage of attendance may be considered for the students who participate in prestigious sports, Co-curricular and extra-curricular activities if their attendance is in the minimum prescribed limit.



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Note: Shortage of Attendance below 65% in aggregate shall not be condoned.

#### **4.0 EVALUATION (for all Courses)**

##### **4.1 Evaluation for Theory Courses/Professional Electives (100 M):**

For theory course (including all types of electives), the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End Examinations.

###### **4.2.1 Internal 30 marks shall be awarded as follows:**

- i) 20 marks for descriptive exam
- ii) 10 marks for continuous assessment

For theory subjects, during a semester, there shall be two mid-term examinations. Internal marks can be calculated with 80% weightage for better of the two mids and 20% weightage for another mid exam.

###### **4.2.2. External examination shall be conducted for 70 marks.**

The semester end examinations will be conducted for 70 marks consist of five questions carrying 14 marks each. Each of these questions is from one unit and may contain sub-questions. For each question there will be an internal choice, which means that there will be two questions from each unit and the student should answer either of the two questions.

##### **4.3. Evaluation for laboratory course:**

There shall be continuous evaluation during the semester. Each Lab exam is evaluated for 100 marks. 30 marks shall be awarded for internal examination and 70 marks shall be awarded for external examinations.

###### **4.3.1. Internal marks shall be awarded as follows (30 M)**

- i) Day to day assessment including record– 10 Marks
- ii) Internal laboratory exam– 20 Marks

###### **4.3.2. External marks shall be awarded as follows (70 M)**

- i) Aim, Theory, Procedure/Program and Experimentation – 15 Marks
- ii) Execution – 25 M   iii) Result/Output – 15 M   iii) Viva Voce - 15 Marks

The semester end examinations shall be conducted by the internal and external examiner



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**4.4. Technical Seminar:** The Technical Seminar shall be conducted in the II-year first semester. For Technical Seminar, a student under the supervision of faculty member, shall collect the literature on a topic and critically review and analyze the literature and submit it to the department in the form of a report and shall make an oral presentation before the Departmental Committee. The Departmental Committee consists of Head of the Department, Seminar Supervisor and the senior faculty members of the department. For Technical seminar, there will be only internal evaluation for 50 marks and a student has to secure minimum of 50% of marks to be declared successful.

**4.5. MOOCs:** It is an online course (Minimum of 12 weeks) to promote advanced knowledge suitable for placement and research.

**To award credits, the student should get certificate after they have registered for written exam and successfully passed**

(Or)

College will conduct the written examination/Viva-voce and award the credits and grades.

In case a student fails in any online course, he/she may be permitted to register for the same course or an alternate course decided by the department committee. The internal marks secured earlier will be nullified if the course is changed. The assessment procedure of MOOCs course remains same as general theory course.

**Note:** The registered course must not be same as any of the courses listed in the program structure of their regulation till final year including electives.

## **5.0 EVALUATION OF PROJECT WORK**

### **5.1 Societal Relevant Project**

It is to be carried out during the I Year first semester. Students have an option to choose their own area of interest related to problems impacting the society. There will be internal evaluation of 50 marks

- i) Internal assessment - 20 marks    ii) Project submission and Viva-Voce - 30 marks

A candidate has to secure a minimum of 50% marks to be declared as successful.

### **5.2 Skill Oriented Course**

The skill-oriented courses may be registered at the college or at any accredited external agency. The course will be evaluated for 50marks.

- a) Day to Day Assessment - 20 marks



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**b) Final Assessment – 30 marks**

If the student completes skill-oriented course at external agency, a certificate from the agency to be submitted.

**5.3 Mini Project:**

There shall be a Mini project presentation in I Year second semester. For presentation there will be only internal evaluation of 50 marks. A student has to secure a minimum of 50% of marks to be declared successful. The assessment will be made by a Board consisting of Head of the Department and two other senior staff member(s) of the department.

**5.4 Major Project:**

A student shall be allowed to submit the project report only after fulfilling the attendance requirements of all the semesters. The viva-voce examination shall be conducted at the end of the course work and after the completion of the end semester examination of the final semester.

**General Guidelines:**

**5.2.1** A Project review committee (PRC) of the college is to be constituted with principal as chairperson, Head of the department, which are offering PG course and two other senior faculty members of the departments offering MCA, as members.

**5.2.2 Registration of Project work:** A student is permitted to register for the project work after satisfying the attendance requirement of all the courses (theory and practical courses) up to third semester.

**5.2.3** Every student shall work on project approved by the PRC of the college (or) shall undergo internship for minimum of 4 months and produce the project report to the PRC for external evaluation.

**5.2.4** The duration of the project is for one semester.

**5.2.5** Three copies of thesis, certified by the supervisor shall be submitted to the Institute.

**5.2.6** The project report shall be adjudicated by the external examiner selected by the controller of Examinations from the panel who are eminent in that field of study by Head of the Department.

**5.2.7** If the report of the examiner is not favorable, the candidate shall revise and resubmit the Thesis, in the timeframe as decided by the PRC. If the report of the examiner is unfavorable again, the thesis shall



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be summarily rejected. The candidate has to re-register for the project and complete the project within the stipulated after taking approval.

- 5.2.8** The viva-voce examination of the project report shall be conducted by a board consisting of the external examiner, the Head of Department and Supervisor for a maximum of 100 marks, if the report of the examiner is favorable.

Head of the department shall co-ordinate and make arrangements for conduct of viva-voce examination.

- 5.2.9** If the report of the viva-voce is unsatisfactory (i.e., < 50 marks), the student will re-take the viva-voce examination after 3 months. If he fails to get a satisfactory report at the second viva-voce examination, he will not be eligible for the award of the degree, unless the student is asked to revise and re-submit. If the report of the examiner is unfavorable again, the project shall be summarily rejected.

**5.3. Internship/Industrial Project:** Internship is introduced in the course of study in order to provide hands on experience to the students. It is expected to create a platform for a job or further research in the chosen area. Eligible students based on merit may opt for a full semester Internship during the II-year second semester in the industry of same discipline. The student has an option of choosing their own area of interest which should be related to the course work. At the end of the course work student has to submit the internship certificate to conduct final project viva voce.

**Note:** Students going for internship program should complete the theory courses of IV semester in the same semester (or) earlier semester (III semester) through MOOCs.

## 6.0. ACADEMIC REQUIREMENTS

- 6.1. For all courses, student is considered to be passed upon securing minimum 40% marks in the external examination alone and minimum 50% marks from both internal and external examination put together.
- 6.2. In case the candidate does not secure the minimum academic requirement in any subject (as specified in 6.1) he/she has to reappear for the End semester Examination in that subject. A candidate shall be given one chance to re-register for each subject provided the internal marks secured by a candidate are less than 50% and has failed in the end examination. In such a case, the candidate must re-register for the subject(s) and secure the required minimum attendance. The candidate's attendance in the re-registered subject(s) shall be



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calculated separately to decide upon his eligibility for writing the end examination in those subject(s). In the event of the student taking another chance, his internal marks and end examination marks obtained in the previous attempt are nullified. For re-registration the candidates have to apply by paying the requisite fees and get approval from the Institute before the start of the semester in which re- registration is required. At a given time a candidate is permitted to re-register for maximum of two subjects in addition to the subjects of regular semester.

6.3. In case the candidate secures less than the required attendance in any re registered subject (s), he/she shall not be permitted to write the End Semester Examination in that subject. He shall again re-register the subject when next offered.

**Note:** For courses where there is no internal evaluation or no external evaluation, pass mark is 50%.

## **7.0. EXAMINATION AND EVALUATION**

### **7.1. General guidelines**

All the semester end examinations are conducted for duration of three hours under the supervision of the Chief Superintendent of Examinations.

### **7.2. Grading System: Cumulative Grade Point Average (CGPA)**

Marks Range (in %)	Letter Grade	Level	Grade Point
$\geq 90$	O	Outstanding	10
$\geq 80$ to $<90$	A	Excellent	9
$\geq 70$ to $<80$	B	Very Good	8
$\geq 60$ to $<70$	C	Good	7
$\geq 50$ to $<60$	D	Satisfactory	6
$<50$	F	Fail	0
		Absent	-1
		Withheld	-2
		Malpractice	-3

**Computation of SGPA** The following procedure is to be adopted to compute the Semester Grade Point Average. (SGPA) and Cumulative Grade Point Average (CGPA):



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The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.

$$\text{SGPA}(\text{Si}) = \Sigma(\text{Ci} \times \text{Gi}) / \Sigma \text{Ci}$$

Where Ci is the number of credits of the  $i^{\text{th}}$  course and Gi is the grade point scored by the student in the  $i^{\text{th}}$  course.

### **Computation of CGPA**

- The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e.

$$\text{CGPA} = \Sigma(\text{Ci} \times \text{Si}) / \Sigma \text{Ci}$$

Where Si is the SGPA of the  $i^{\text{th}}$  semester and Ci is the total number of credits in that semester.

- Equivalent Percentage =  $(\text{CGPA} - 0.75) \times 10$

### **7.3. Award of Class**

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of MBA Degree, he shall be placed in one of the following four classes:

<b>Class Awarded</b>	<b>CGPA to be secured</b>	<b>From the CGPA secured from 80 Credits.</b>
First Class with Distinction	$\geq 7.75$ without course failures during entire duration of study	
First Class	$\geq 6.75$ to $< 7.75$	
Second Class	$\geq 5.75$ to $< 6.75$	

### **8. General Instructions**

- Where the words 'he', 'him', 'his', occur, they imply 'she', 'her', 'hers', also.
- The academic regulations should be read as a whole for the purpose of any interpretation.



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- iii. In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Chairman, Academic Council is final.
- iv. The college may change or amend the academic regulations or syllabi from time to time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the institute.

## **9. Withholding of Results**

If the student has not paid the dues, if any, to the Institute or if any case of indiscipline is pending against him, the result of the student will be withheld. His degree will be withheld in such cases.

## **10. Transitory Regulations**

If a student is detained and has to get Re-admitted and follow the same regulation of year of admission.

### **Transcripts**

After successful completion of the entire program of study, a transcript containing performance of all academic years will be issued as a final record. Partial transcript will also be issued up to any point of study to a student on request, after payment of requisite fee.

The Academic Calendar consisting of instruction period of the program is released for every academic year before the commencement of the class work.

There shall be no program transfers after the completion of the admission process. There shall be no transfer from one college/stream to another.

## **11. General**

**11.1** The academic regulations should be read as a whole for purpose of any interpretation.

**11.2** In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Academic Council is final.

**11.3.** The Academic Council may change or amend the academic regulations and syllabus at any time and the changes and amendments made shall be applicable to all the students with effect from the date notified by the Council.

**11.4.** Wherever the word he, him or his occurs, it will also include she, her and hers.



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## 12. Disciplinary Action for Malpractices

S. No	Nature of Malpractices/ Improper conduct	Punishment
1 (a)	If the candidate possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	If the candidate gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2	If the candidate has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled.
3	If the candidate impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the



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		remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4	If the candidate smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5	If the candidate uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6	If the candidate refuses to obey the orders of the Chief Superintendent/Assistant - Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of



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	charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7	If the candidate leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8	If the candidate possesses any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the college, expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also



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		debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and a police case will be registered against them.
10	If the candidate comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.

### **13. Malpractices identified by squad or special invigilators**

Punishments to the candidates as per the above guidelines.

### **14. UGC Recommended Punishment for Ragging**

- i. Suspension from attending classes and academic privileges
- ii. Withholding/withdrawing scholarships/fellowship and other benefits.
- iii. Debarring from appearing in any test/examination or other evaluation process
- iv. Withholding results
- v. Debarring from representing the institution in any regional, national or international meet, tournament, youth festival etc.
- vi. Suspension/expulsion from the hostel
- vii. Cancellation of admission
- viii. Rustication from the institution for period ranging from 1 to 4semesters.
- ix. Expulsion from the institution and consequent debarring from admission to any other institution for a specified period.
- x. Fine may extend up to Rs. 2.5lakh.

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**MCA COURSE STRUCTURE  
&  
SYLLABUS**

**(For PG – VR22)**



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**MCA-VR22 - PROGRAM STRUCTURE**

**I Semester**

S. No	Course Code	Course Name	Category	L	T	P	Credits
1	4098221100	Operating Systems	PC	3	0	0	3
2	4098221101	C Programming and Data Structures	PC	3	0	0	3
3	4098221102	Object Oriented Programming Through JAVA	PC	3	0	0	3
4	4098221103	Professional Communication and Soft Skills	BS&H	3	0	0	3
5	4098221104	Mathematical and Statistical Foundations	BS&H	3	0	0	3
6	4098221110	Operating Systems and Linux Lab	PC	0	0	3	1.5
7	4098221111	C Programming and Data Structures Lab	PC	0	0	3	1.5
8	4098221112	Object Oriented Programming Through Java Lab	PC	0	0	3	1.5
9	4098221170	Societal Relevant Project	PROJ	0	0	1	1
				<b>Total</b>	<b>15</b>	<b>1</b>	<b>10</b>
							<b>20.5</b>

**II Semester**

S. No	Course Code	Course Name	Category	L	T	P	Credits
1	4098221200	Database Management Systems	PC	3	0	0	3
2	4098221201	Computer Networks	PC	3	0	0	3
3	4098221202	Python Programming	PC	3	0	0	3
4	4098221203	Data Warehousing and Mining	PC	3	0	0	3
<b>(Professional Elective-I)</b>	4098221230	NOSQL Databases	PE	3	0	0	3
	4098221231	Advanced Data Structures					
	4098221232	Object Oriented Analysis and Design					
	4098221233	Artificial Intelligence					
	4098221234	Advanced Java Programming					
6	4098221210	Database Management Systems Lab	PC	0	0	3	1.5
7	4098221211	Data warehousing and Mining Lab using Python	PC	0	0	3	1.5
8	4098221212	Web Design Through PHP	SC	0	0	3	1.5
9	4098221270	Mini Project	PR	0	0	0	1.5
				<b>Total</b>	<b>15</b>	<b>0</b>	<b>10</b>
							<b>21</b>



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**III Semester**

S. No	Course Code	Course Name	Category	L	T	P	Credits	
1	4098222100	Machine Learning	PC	3	0	0	3	
2	4098222101	Internet of Things	PC	3	0	0	3	
3	4098222102	Software Engineering	PC	3	0	0	3	
4	4098222103	Cryptography and Information Security	PC	3	0	0	3	
<b>(Professional Elective-II)</b>	4098222130	Design and Analysis of Algorithms	PE	3	0	0	3	
	4098222131	Mongo DB						
	4098222132	Software Project Management						
	4098222133	Cloud Computing						
	4098222134	Advanced Web Technologies						
6	4098222110	Machine Learning Lab	PC	0	0	3	1.5	
7	4098222111	Internet of Things Lab	PC	0	0	3	1.5	
8	4098222112	Case Tools Lab	PC	0	0	4	1.5	
9	4098222180	Technical Seminar	MC	0	0	0	1	
				<b>Total</b>	<b>15</b>	<b>0</b>	<b>10</b>	<b>20.5</b>

**IV Semester**

S. No	Course Code	Course Name	Category	L	T	P	Credits	
<b>(Professional Elective-III)</b>	4098222230	Big Data Analytics	PE	3	0	0	3	
	4098222231	Optimization Techniques						
	4098222232	Software Testing Methodologies						
	4098222233	Cyber Security						
	4098222280	MOOCs-1 (NPTEL/SWAYAM) (Any recommended course)						
<b>(Professional Elective-IV)</b>	4098222234	Data Science Using Python	PE	3	0	0	3	
	4098222235	Principles and Practices of Management						
	4098222236	Software Quality Assurance						
	4098222237	Block Chain Technologies						
	4098222281	MOOCs-2 (NPTEL/SWAYAM) (Any recommended course)						
3	4098222270	Project Work	PR	0	0	0	12	
Internship				<b>Total</b>	<b>6</b>	<b>0</b>	<b>0</b>	<b>18</b>

\*Students going for internship will complete these courses through MOOCs (even in earlier semester)

\*Students going for internship are mandatory to complete project work and he/she has to submit thesis.

$$(19.5 + 21.5 + 21 + 18 = 80 \text{ Credits})$$



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<b>I Semester</b>	MCA-VR22	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	1	0	4
<b>4098221100</b>	<b>OPERATING SYSTEMS</b>				

**Course Objectives:**

The objectives of this course are to

- Conceptualize the basics of organizational and architectural issues of a digital computer.
- Learn the function of each element of a memory hierarchy.
- Study various data transfer techniques in digital computer.

**Course Outcomes (COs):** At the end of the course, student will be able to

- Understand the basic organization of computer and different instruction formats and addressing modes
- Analyze the concept of pipelining, segment registers and pin diagram of CPU.
- Understand and analyze various issues related to memory hierarchy
- Evaluate various modes of data transfer between CPU and I/O devices
- Examine various inter connection structures of multi processors

### **UNIT I: INTRODUCTION TO OPERATING SYSTEM CONCEPT**

Types of operating systems, operating systems concepts, operating systems services, Introduction to System call, System call types.

### **UNIT II: PROCESS MANAGEMENT**

Process concept, The process, Process State Diagram ,Process control block, Process Scheduling-Scheduling Queues, Schedulers, Operations on Processes, Inter process Communication, Threading Issues, Scheduling-Basic Concepts, Scheduling Queues, Scheduling Criteria, Scheduling Algorithms.

### **UNIT III: CONCURRENCY**

Process Synchronization, The Critical- Section Problem, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors, Synchronization, Examples

### **PRINCIPLES OF DEADLOCK**

System Model, Deadlock Characterization, Deadlock Prevention, Detection and Avoidance, Recovery from Deadlock

**UNIT IV: MEMORY MANAGEMENT:** Swapping, Contiguous Memory Allocation, Paging, structure of the Page Table, Segmentation

**VIRTUAL MEMORY MANAGEMENT:** Virtual Memory, Demand Paging, Page-Replacement Algorithms, Thrashing



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**UNIT V: FILE SYSTEM INTERFACE**

The concept of a file, Access Methods, Directory structure, File system, file mounting, file sharing, Protection. **File System implementation-** File system structure, allocation methods, free-space management **Mass-storage structure** overview of Mass-storage structure, Disk scheduling, Device drivers

**Text Books:**

1. Operating System Concepts, Abraham Silberschatz, Peter Baer Galvin and Greg Gagne 9th Edition, John Wiley and Sons Inc., 2012.
2. Operating Systems – Internals and Design Principles, William Stallings, 7th Edition, Prentice Hall, 2011.
3. Operating Systems-S Halder, Alex A Aravind Pearson Education Second 2016.

**Reference Books:**

1. Modern Operating Systems, Andrew S. Tanenbaum, Second Edition, Addison Wesley,2001.
2. Operating Systems: A Design-Oriented Approach, Charles Crowley, Tata Mc Graw Hill Education”, 1996.
3. Operating Systems: A Concept-Based Approach, D M Dhamdhere, Second Edition, Tata Mc Graw-Hill Education, 2007.



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<b>I Semester</b>	<b>MCA-VR22</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	0	0	3
<b>4098221101</b>	<b>C PROGRAMMING AND DATA STRUCTURES</b>				

**Course Objectives:**

The objective of this course is to explore basic data structures such as stacks and queues, introduce a variety of data structures such as hash tables, search trees, tries, heaps, graphs, sorting and pattern matching algorithms

**Course Outcomes (CO):** *At the end of the course, student will be able to*

- Implement basic programs by using C concepts.
- Select the data structures that efficiently model the information in a problem
- Assess efficiency trade-offs among different data structure implementations or combinations
- Implement and know the application of algorithms for sorting and pattern matching.

**UNIT I:**

**Introduction to C:** Identifiers, Data Types, Constants and variables, Operators and Expressions, Managing Input and Output operators, type conversions, expressions, Decision making-branching and looping, Arrays.

**UNIT II:**

Strings, Functions, Structures and Unions, Pointers in C.

**UNIT III:**

**Data structure:** Definition, types of data structure, Preliminaries of algorithms, analysis and complexity. **Linear list** – singly linked list, Double linked list and circular linked list - implementation, insertion, deletion and searching operations on linear list.

**UNIT IV:**

**Stacks**-Operations, array and linked representations of stacks, stack applications, **Queues**-operations, array and linked representations. **Searching:** Linear and Binary Search Techniques.

**UNIT V:**

**Sorting Techniques:** Insertion sort, selection sort, exchange-bubble sort, quick sort and merge sort Algorithms. **Trees:** Binary Trees, terminology, representation and traversals- pre, post & in order traversals. **Search Trees:** Binary Search Trees, Definition, Implementation, Operations- Traversal, Searching, Insertion and Deletion



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**Text Books:**

- 1) Let Us C: Authentic Guide to C Programming Language, 17<sup>th</sup> ed., Yashavant Kanetkar, BPB Publications.
- 2) Data Structures Using C. 2<sup>nd</sup> Edition, Reema Thareja, Oxford
- 3) Data Structures and Algorithm Analysis in C, 2<sup>nd</sup> ed, Mark Allen Weiss

**Reference Books:**

- 1) Data Structures: A Pseudocode Approach with C, 2<sup>nd</sup> Edition, R. F. Gilberg and B.A. Forouzan, Cengage Learning.
- 2) Programming in ANSI C, 5<sup>th</sup> ed, E. Balaguruswamy, TMH



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		3	0	0	3
<b>4098221102</b>	<b>OBJECT ORIENTED PROGRAMMING THROUGH JAVA</b>				

**Course Objectives:**

- To understand the basic concepts of object oriented programming concepts.
- To introduce the principles of inheritance and polymorphism and demonstrate how they are related to the design of abstract classes
- To understand the implementation of packages and interfaces
- To introduce the concept of multithreading and exception handling
- To learn and understand the design of Graphical User Interface using applets and swing controls

**Course Outcomes (COs):** At the end of the course, student will be able to

- Describe the uses OOP concepts
- Apply OOP concepts to solve real world problems
- Distinguish the concept of packages and interfaces
- Demonstrate the exception handing, multithread applications with synchronization
- Design the GUI based applications using AWT and Swings
- Discuss the Collection Framework

### **UNIT-I**

#### **INTRODUCTION TO OOPS**

Introduction to object-oriented programming -principles of object-oriented languages -procedural languages Vs. OOPs -applications of OOPs -java features - JVM -program structures -Variables -primitive data types – identifiers -naming conventions –keywords –literals –operators –binary –unary and ternary –expression – precedence rules and associativity –primitive type conversion and casting, flow of control.

### **UNIT-II**

#### **PROGRAMMING CONSTRUCTS**

Arrays-one dimensional and multidimensional -command line arguments. Introducing classes –class fundamentals –methods -objects -constructors –this keyword –garbage collection-Nested Classes – Polymorphism.

### **UNIT-III**

#### **INHERITANCE, INTERFACE AND EXCEPTIONS**

Types of inheritance-Super and Final -Interface-Abstract Classes- Interface vs Abstract classes Default Interfaces Methods ,Use Static methods in an interface and private Interface methods, Packages-Creating Packages -access protection - Exception handling, importance of try, catch, throw, throws and finally block, user defined exceptions, Assertions.

### **UNIT-IV**

#### **MULTITHREADING AND I/O**

Threads -Thread Life Cycle-Thread priority –multithreading –Synchronization -suspending and resuming threads -communication between threads. Java I/O streaming –filter and pipe streams.



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**UNIT-V**

**COLLECTION FRAMEWORKS**

Collection Framework in Java –Introduction to Java Collections, Overview of Java Collection frame work, Generics, commonly used Collection classes–Array List, Vector, Hash table, Stack, Enumeration, Iterator, StringTokenizer, Lambda Expressions.

**Text Books:**

1. The complete Reference Java, 12th edition, Herbert Schildt, TMH.
2. Programming in JAVA, Sachin Malhotra, Saurabh Choudary, Oxford.
3. Introduction to java programming, 7th edition by Y Daniel Liang, Pearson.

**Reference Books:**

1. Head First Java, Author – Kathy Sierra & Bert Bates,Latest Edition – 2nd Edition, Publisher – Shroff/O'Reilly
2. Effective Java,Author – Joshua Bloch,Latest Edition – 3rd Edition, Publisher – Addison Wesley
3. Core Java: An Integrated Approach, New: Includes All Versions upto Java 8 Paperback – 1 January 2016by R. Nageswara Rao

**E-Books:**

<https://docs.oracle.com/en/java/>

**NPTEL/MOOC:**

<https://nptel.ac.in/courses/106/105/106105191/>  
[https://onlinecourses.nptel.ac.in/noc20\\_cs85/preview](https://onlinecourses.nptel.ac.in/noc20_cs85/preview)



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		3	0	0	3
<b>4098221103</b>	<b>Professional Communication and Soft Skills</b>				

**Course Overview:**

In this course students will read, analyze, and interpret material from general and technical fields, and will practice reading, writing, listening and speaking skills on a variety of contemporary topics.

**Course Objectives:**

- To introduce students to the specific use of English for Professional Communication.
- To develop the overall English proficiency of students and enable them to function effectively in different professional contexts.
- To strengthen student skills in the areas of reading, writing, listening and speaking and enable them to function effectively in their professional sphere.

**Course Outcomes (COs):** At the end of the course, student will be able to

- The students will be able to read, understand and interpret material on Environment, Science and Technology, tourism, Energy Sources, Social Awareness
- The students will be able to analyze the functions of language and grammar in spoken and written forms.
- The students will be able to write effectively on various domains.
- The students will be able to prepare and exhibit oral presentation skills by using ICT.(Individual/Team)

**UNIT - 1**

Reading Text: ENVIRONMENTAL CONSCIOUSNESS

Grammar: Articles, Prepositions

Writing: Letter writing (formal)

Activity: Cover letter and Resume writing

**UNIT – 2**

Text: GETTING JOB-READY

Grammar: Tenses

Writing: Paragraph writing (Descriptive and narrative)

Activity: Mock Interviews



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**UNIT – 3**

Text: Human Values

(Grammar: Subject-Verb agreement, Sentence construction

Writing: Report writing (Formal)

Activity: Group Discussions

**UNIT – 4**

Reading Text : Artificial Intelligence (AI)

Grammar: Sentence transformation (Degrees of Comparison, Voice)

Composition: Note-Making & Note Taking

Activity: Listening Comprehension-Practice

**UNIT – 5**

Text: e-MEDIA

Grammar: Common errors

Composition: E-mail Writing, Making advertisements

Activity: Presentations-Group &Individual

**Reference Books:**

1. A course in Technical English by D.Praveen Sam, KN. Sobha-Cambridge University Press-2020.
2. The Big Book of English Grammar for ESL and English Learners: Prepositions, Phrasal Verbs, English Articles (a, an and the), Gerunds and Infinitives, Focus on English Grammar Big Book Series) - Thomas Celentano –Paperback-2020
3. English Grammar Rules You Must Know:Writing & Speaking 101 for Beginners, Daily English for friendly Conversation &Business Applications Understanding Grammar to AVOID Errors that make you look DUMB!-Lissie Bradach-2020
4. <https://bookauthority.org/books/new-english-grammar-books>
5. The Handy Parts of Speech Guide: Enjoy Learning The Basics of Grammar-Elizabeth O' Brien-2021.



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		3	0	0	3
<b>4098221104</b>	<b>Mathematical and Statistical Foundations</b>				

**COURSE OBJECTIVES:**

- This course is aimed at enabling the students to
- Understand the mathematical fundamentals that is prerequisites for variety of courses like Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems bioinformatics, Machine learning.
  - Develop the understanding of the mathematical and logical basis to many modern techniques in computer science technology like machine learning, programming language design, and concurrency.
  - Study various sampling and classification problems.

**COURSE OUTCOMES:**

<b>COs</b>	<b>At the end of the course, the student will have the ability to:</b>
<b>CO1</b>	Apply the basic rules and theorems of probability theory such as Baye's Theorem, determine probabilities that help to solve engineering problems and to determine the expectation and variance of a random variable from its distribution.
<b>CO2</b>	Able to perform and analyze of sampling, means, proportions, variances and estimates the maximum likelihood based on population parameters.
<b>CO3</b>	Learn how to formulate and test hypotheses about sample means, variances and proportions and to draw conclusions based on the results of statistical tests.
<b>CO4</b>	•Design various ciphers using number theory. Apply graph theory for real time problems like network routing problem.

**UNIT I:**

**NUMBER THEORY**

Properties of Integers, Division Theorem, The Greatest Common Divisor, Euclidean Algorithm, Least Common Multiple, Testing for Prime Numbers, The Fundamental Theorem of Arithmetic, Modular Arithmetic (Fermat's Theorem and Euler's Theorem) (without proofs)

**UNIT II:**

**GRAPH THEORY**



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Basic Concepts of Graphs, Sub graphs, Matrix Representation of Graphs: Adjacency Matrices, Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs, Multigraphs, Planar Graphs, Euler's Formula, Graph Colouring and Covering, Chromatic Number.

**UNIT III**

**BASIC PROBABILITY AND RANDOM VARIABLES**

Random Experiments, Sample Spaces Events, the Concept of Probability the Axioms of Probability, Some Important Theorems on Probability Assignment of Probabilities, Conditional Probability Theorems on Conditional Probability, Independent Events, Bayes Theorem or Rule. Random Variables, Discrete Probability Distributions, Distribution Functions for Random Variables, Distribution Functions for Discrete Random Variables, Continuous Random Variables.

**UNIT IV**

**SAMPLING AND ESTIMATION THEORY**

Introduction, Population and samples, Sampling distribution of mean for large and small samples (with known variance), proportion - Point and interval estimators for means and proportions (for large and small samples), Maximum error.

**UNIT V**

**TESTING OF HYPOTHESIS**

Introduction, Null and alternative hypothesis, Type I and Type II errors, one tail, two-tail tests, Level of Significance. Tests concerning means, proportions and their differences using Z-test. Student's t-test, F-test and  $\chi^2$  test of goodness of fit and independence of attributes.

**Text Books:**

1. Foundation Mathematics for Computer Science, 1st Edition, John Vince, Springer, 2015.
2. Probability & Statistics, 3rd Edition, Murray R. Spiegel, John J. Schiller and R. Alu Srinivasan, Schaum's Outline Series, Tata McGraw-Hill Publishers, 2018.
3. Probability and Statistics with Reliability, 2nd Edition, K. Trivedi, Wiley, 2011.
4. Discrete Mathematics and its Applications with Combinatorics and Graph Theory, 7th Edition, H. Rosen, Tata McGraw Hill, 2003.

**Reference Books:**

1. Probability and Computing: Randomized Algorithms and Probabilistic Analysis, 1st Edition, M. Mitzenmacher and E. Upfal, 2005.
2. Applied Combinatorics, 6th Edition, Alan Tucker, Wiley, 2012.



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		0	0	3	1.5
<b>4098221110</b>	<b>OPERATING SYSTEMS AND LINUX LAB</b>				

**Course Objectives:**

This Course will enable students to implement CPU scheduling algorithms, Disk scheduling algorithms, Execute different types of Linux commands and Write shell scripts

**Course Outcomes (COs):** At the end of the course, student will be able to

- Implement various CPU scheduling algorithms and compare results
- Implement various disk scheduling algorithms and compare results
- Implement page replace algorithms
- Implement various memory management techniques.
- Execute basic Linux commands

**List of Experiments:**

**Operating Systems Lab**

1. Simulate the Following CPU Scheduling Algorithms  
A) FCFS B) SJF C) Priority D) Round Robin
2. Multiprogramming-Memory Management- Implementation of fork(), wait(), exec() and exit(), system calls
3. Simulate The Following
  - a. Multiprogramming with A Fixed Number Of Tasks (MFT)
  - b. Multiprogramming with A Variable Number Of Tasks (MVT)
4. Simulate Bankers Algorithm for Dead Lock Avoidance
5. Simulate The Following Page Replacement Algorithms.  
a) FIFO                    b) LRU                    c) LFU



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**Linux Lab**

1. Unix Basic commands
2. Session 1
  - a. Login to the system
  - b. Use VI editor to create a file called myfile.txt which contains some text
  - c. Correct typing errors during creation
  - d. Save file
  - e. Logout of the system

Session-2: Inserting or Adding Text

Session-3: Changing Text

Session-4: Deleting Text

3. Write a shell script to display the reverse numbers from given argument list
4. Write a shell script to which will display Armstrong numbers from given arguments
5. Write a shell script to display the factorial value from given argument list
6. Write a shell script to computes the gross salary of a employee according to the following rules:
  - a. i)If basic salary is < 1500 then HRA = 10% of the basic and DA=90% of the basic
  - b. ii)If basic salary is>=1500 then HRA =Rs500 and DA=98% of the basic.

The Basic salary is entered interactively through the key board.

7. Write a shell script that accepts two integers as its arguments and computes the value of first number raised to the power of the second number.
8. Write a shell script that takes a command-line argument and reports on whether it is directory, file or something else.
9. Write a shell script to generate mathematical table
10. Write a script which will display Fibonacci series up to a given no. of arguments



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		0	0	3	1.5
<b>4098221111</b>	<b>C PROGRAMMING AND DATA STRUCTURES LAB</b>				

**Course Objectives:** This Course will enable students to

- Design and implement various data structures.
- Implement operations like searching, insertion, and deletion, traversing mechanism
- Develop applications using data structure algorithms.

**Course Outcomes (COs):** At the end of the course, student will be able to

- Implement various basic data structures and its operations.
- Apply sorting and searching algorithms to given numbers
- Implement various tree operations.
- Implement various graphs algorithms.
- Develop applications using various data structures.

**Experiment 1:**

- a) Write a program in C to display the n terms of even natural number and their sum.
- b) Write a program in C to display the reverse of a given positive number
- c) Write a C program to check whether a given number is an Armstrong number or not.
- d) Write a C program to calculate the factorial of a given number.

**Experiment 2:**

- a) Write a program in C for multiplication of two square Matrices.
- b) Write a program in C to find transpose of a given matrix.

**Experiment 3:**

- a) Write a program in C to check whether a number is a prime number or not using the function.
- b) Write recursive program which computes the  $n^{\text{th}}$  Fibonacci number, for appropriate values of n.
- c) Write a program in C to add numbers using call by reference.

**Experiment 4:**

- a) Write a program in C to append multiple lines at the end of a text file.
- b) Write a program in C to copy a file in another name.

**Experiment 5:**

Write recursive program for the following

- a) Write recursive and non recursive C program for calculation of Factorial of an integer.
- b) Write recursive and non recursive C program for calculation of GCD (n, m)
- c) Write recursive and non recursive C program for Towers of Hanoi: N disks are to be transferred from peg S to peg D with Peg I as the intermediate peg.



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**Experiment 6:**

- a) Write C program that use both recursive and non recursive functions to perform Linear search for a Key value in a given list.
- b) Write C program that use both recursive and non recursive functions to perform Binary search for a Key value in a given list.

**Experiment 7:**

- a) Write C program that implement stack (its operations) using arrays.
- b) Write C program that implement stack (its operations) using Linked list.

**Experiment 8:**

- a) Write a C program that uses Stack operations to convert infix expression into postfix expression.
- a) Write C program that implement Queue (its operations) using arrays.
- b) Write C program that implement Queue (its operations) using linked lists.

**Experiment 9:**

Write a C program that uses functions to create a singly linked list and perform various operations on it.

**Experiment 10:**

Write a C program to store a polynomial expression in memory using linked list and perform polynomial addition.

**Experiment 11:**

Write a recursive C program for traversing a binary tree in preorder, inorder and postorder.

**Experiment 12:**

- a) Write C program that implement Bubble sort, to sort a given list of integers in ascending order.
- b) Write C program that implement Quick sort, to sort a given list of integers in ascending order.
- c) Write C program that implement merge sort, to sort a given list of integers in ascending order



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		0	0	3	1.5
<b>4098221112</b>	<b>OBJECT ORIENTED PROGRAMMING THROUGH LAB</b>				

**Course Objectives:**

- Implementing program for user interface and application development using core java principles.
- Comprehension of java programming constructs, control structures in java.
- Implementing object-oriented constructs such as various class hierarchies, interfaces and exception handling.
- Understanding of thread concepts and I/O in java
- To understand computer programming and application software, package/ suites.

**Course Outcomes (COs):** At the end of the course, student will be able to

- Use the Java programming language for various programming technologies.
- Develop software in the Java programming language.
- Evaluate user requirements for software functionality required to decide whether the Java programming language can meet user requirements.
- Propose the use of certain technologies by implementing them in the Java programming language to solve the given problem.

**List of Experiments**

<b>S. No.</b>	<b>Name of the experiment</b>	<b>Skill</b>
1.	<p><b>Exercise – 1 (Basics)</b></p> <p>a) Write a JAVA program to display default value of all primitive data type of JAVA</p> <p>b) Write a java program that display the roots of a quadratic equation <math>ax^2+bx=0</math>. Calculate the discriminate D and basing on value of D, describe the nature of root.</p> <p>c) Five Bikers Compete in a race such that they drive at a constant speed which may or may not be the same as the other. To qualify the race, the speed of a racer must be more than the average speed of all 5 racers. Take as input the speed of each racer and print back the speed of qualifying racers.</p> <p>d) Write a case study on public static void main (250 words)</p>	Basic Programming
2	<p><b>Exercise – 2</b></p> <p>a) Write a JAVA program to search for an element in a given list of elements using binary search mechanism.</p> <p>b) Write a JAVA program to sort for an element in a given list of elements using bubble sort.</p>	Sorting



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	c) Write a JAVA program to sort for an element in a given list of elements using merge sort. d) Write a JAVA program using String Buffer to delete, remove character.	
3	<b>Exercise – 3</b> a) Write a JAVA program to implement class mechanism. – Create a class, methods and invoke them inside main method. b) Write a JAVA program to implement constructor	Constructor
4	<b>Exercises –4</b> a) Write a JAVA program to implement constructor overloading. b) Write a JAVA program implements method overloading.	Constructor Overloading
5	<b>Exercise -5</b> a) Write a JAVA program to implement Single Inheritance b) Write a JAVA program to implement multi-level Inheritance c) Write a java program for abstract class to find areas of different shapes	Inheritance
6	<b>Exercise -6</b> a) Write a JAVA program give example for “super” keyword. b) Write a JAVA program to implement Interface. What kind of Inheritance can be achieved? c) Write a program to demonstrate the functional Interfaces and static interfaces.	Programming using “super” Keyword  Interfaces usage
7	<b>Exercise -7</b> a) Write a JAVA program that describes exception handling mechanism b) Write a JAVA program Illustrating Multiple catch clauses	Exception Handling
8	<b>Exercise -8</b> a) Write a JAVA program that implements Runtime polymorphism b) Write a Case study on run time polymorphism, inheritance that implements in above problem	Runtime Polymorphism
9	<b>Exercise -9</b> a) Write a JAVA program for creation of Illustrating throw b) Write a JAVA program for creation of Illustrating finally c) Write a JAVA program for creation of Java Built-in Exceptions d) Write a JAVA program for creation of User Defined Exception e) Write a Program to implement set and set Operations.	Exceptions
10	<b>Exercise -10</b> a) Write a JAVA program that creates threads by extending Thread class. First thread display “Good Morning “every 1 sec, the second thread displays “Hello “every 2 seconds and the third display “Welcome” every 3 seconds, (Repeat the same by implementing Runnable)	Threads



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	b) Write a program illustrating is Alive and join c) Write a Program illustrating Daemon Threads.	
11	<b>Exercise -11</b> a) Write a JAVA program for Producer Consumer Problem b) Write a case study on thread Synchronization after solving the above producer consumer problem	Synchronization
12	<b>Exercise -12</b> a) Write a JAVA program illustrates class path b) Write a case study on including in class path in your os environment of your package. c) Write a JAVA program that import and use the defined your package in the previous Problem	Package
13	<b>Exercise -13</b> a) What is the difference between List and Set? Implement a Program to show the differences. b) What is the difference between HashSet and TreeSet? Implement a Program to show the differences. c) What is the difference between Set and Map? Implement a Program to show the differences. d)Write a program to demonstrate various lambda expressions in java.	Set and Map

**Text Books:**

1. The complete Reference Java, 8th edition, Herbert Schildt, TMH.
2. Programming in JAVA, Sachin Malhotra, SaurabhChoudary, Oxford.
3. Introduction to java programming, 7th edition by Y Daniel Liang, Pearson.

**Reference Books:**

1. Head First Java, Author – Kathy Sierra & Bert Bates,Latest Edition – 2nd Edition, Publisher – Shroff/O'Reilly
2. Effective Java,Author – Joshua Bloch,Latest Edition – 3rd Edition,Publisher – Addison Wesley
3. Core Java: An Integrated Approach, New: Includes All Versions upto Java 8 Paperback – 1 January 2016by R. Nageswara Rao



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<b>I Semester</b>	<b>MCA-VR22</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		0	0	3	1.5
<b>4098221170</b>	<b>SOCIALLY RELEVANT PROJECT</b>				



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		3	0	0	3
<b>4098221200</b>	<b>DATABASE MANAGEMENT SYSTEMS</b>				

**Course Objectives:**

This Course will enable students to

- Explain the concept of databases, database management systems, database structures and how they work.
- Make use of Entity-Relationship Modeling and Relational Modeling for creating simple databases from the real world scenarios.
- Write relational algebra and structured query language (SQL) statements.
- Normalize a database using Normalization Rules.
- Discuss the issues associated with Transaction Management and Recovery, Tree Structured and Hash-Based Indexing

**Course Outcomes (COs):** At the end of the course the student will be able to

- Illustrate the concept of databases, database management systems, database languages, database structures and their work
- Apply ER modeling and Relational modeling for designing simple databases.
- Summarize the concepts related to relational model and SQL and Write database queries using relational algebra and structured query language.
- Design and develop databases from the real world by applying the concepts of Normalization.
- Outline the issues associated with Transaction Management and Recovery, Tree Structured and Hash-Based Indexing

**UNIT I:**

**Introduction to Databases:** Introduction, An Example, Characteristics of the Database Approach, Actors on Scene, Workers behind the scene, Advantages of Using the DBMS Approach, A Brief History of Database Applications, When Not to Use a DBMS [**Text book-3**]

**Overview of Database Languages and Architectures:** Data Models, Schemas and Instances, Three-Schema Architecture and Data Independence, Database Languages and Interfaces, The Database System Environment, Centralized and Client/Server Architecture for DBMSs, Classification of Database Management Systems [**Text book-3**]

**UNIT II:**

**Introduction to Database Design:** Database Design and ER Diagrams, Entities, Attributes and Entity Sets, Relationships and Relationship Sets, Additional Features of the ER Model, Conceptual Design with the ER Model, Conceptual Design for Large Enterprises



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**Relational Model:** Introduction to the Relational Model, Integrity Constraints over Relations, Enforcing Integrity Constraints, Querying Relational Data, Logical Database Design: ER to Relational, Introduction to Views, Destroying/Altering Tables and Views

**UNIT III:**

**Relational Algebra:** Selection and Projection, Set Operations, Renaming, Joins, Division, More Examples of Algebra Queries.

**SQL: Queries, Constraints, Triggers:** The Form of a Basic SQL Query, UNION, INTERSECT and EXCEPT, Nested Queries, Aggregate Operators, Null Values, Complex Integrity Constraints in SQL, Triggers and Active Databases, Designing Active Databases.

**UNIT IV:**

**Introduction to Normalization Using Functional and Multivalued Dependencies:** Informal Design Guidelines for Relation Schema, Functional Dependencies, Normal Forms Based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form.

**UNIT V:**

**Transaction Management and Concurrency Control:** Transaction Concept, A Simple Transaction Model, Storage Structure, ACID Properties, Serializability, Transaction Isolation Levels, Concurrency Control, Lock-Based Protocols, Validation-Based Protocols [**Text Book-2**]

**Overview of Storage and Indexing:** Data on External Storage – File Organization and Indexing – Cluster Indexes, Primary and Secondary Indexes – Index data Structures – Hash Based Indexing – Tree base Indexing.

**Note: For Practical Examples Please Go Through Reference 1**

**Text Books:**

- 1) Database Management Systems, 3/e, Raghurama Krishnan, Johannes Gehrke, Mc Graw-Hill
- 2) Database System Concepts, 6/e, Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Mc Graw-Hill
- 3) Database Systems, 6/e Ramez Elmasri, Shamkant B. Navathe, Pearson

**Reference Books:**

- 1) Database Systems, 9/e, Carlos Coronel, Steven Morris, Peter Rob, Cengage
- 2) Introduction to Database Systems, 8/e, C J Date, Pearson



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		3	0	0	3
<b>4098221201</b>	<b>COMPUTER NETWORKS</b>				

**Course Objectives:**

At the end of the course, the students will be able to:

- Understands the fundamental concepts of computer networking and OSI Reference model.
- Familiarize the student with the basic taxonomy and terminology of the computer networking area.
- Learn and understand the advanced networking concepts, preparing the student for entry advanced courses in computer networking.
- Develop and gain expertise in some specific areas of networking such as the design and maintenance of individual networks.

**Course Outcomes (COs):** At the end of the course, student will be able to

- Explain the network architecture, TCP/IP and OSI reference models
- Identify and understand various techniques and modes of transmission
- Demonstrate the data link protocols, multi-channel access protocols and IEEE 802 standards for LAN
- Describe routing and congestion in network layer with routing algorithms and classify IPV4 addressing scheme
- Discuss the elements and protocols of transport layer
- Develop network security and define various protocols such as FTP, HTTP, Telnet, DNS

**UNIT I:**

**Introduction:** Network Topologies, Types of networks. Reference models- The OSI Reference Model-the TCP/IP Reference Model - A Comparison of the OSI and TCP/IP Reference Models. **Physical Layer** –Introduction to physical layer-Data and Signals, switching , -Introduction to Guided Media-Twisted-pair cable, Coaxial cable and Fiber optic cable and Unguided media: Wireless-Radio waves, microwaves, infrared.

**UNIT II:**

**The Data Link Layer** - Services Provided to the Network Layer – Framing – Error Control – Flow Control, Error Detection and Correction – Error-Correcting Codes – Error Detecting Codes. **Elementary Data Link Protocols**- -A Simplex Stop and Wait Protocol for an Error free channel- Sliding Window Protocols-A One Bit Sliding Window Protocol-A Protocol Using Go-Back-N- A Protocol Using Selective Repeat.



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**UNIT III:**

**The Medium Access Control Sub layer**-The Channel Allocation Problem-Static Channel Allocation-Assumptions for Dynamic Channel Allocation, Multiple Access Protocols-Aloha-Pure aloha- slotted aloha-Carrier Sense Multiple Access Protocols- Collision-Free Protocols-

**Wireless LAN Protocols**- Ethernet-types - Wireless LANs-The 802.11 Architecture and Protocol Stack-The 802.11 Physical Layer-The 802.11 MAC Sub-layer Protocol- The 802.11 Frame Structure-Services.

**UNIT IV:**

**The Network Layer Design Issues** – Store and Forward Packet Switching-Services Provided to the Transport layer- Implementation of Connectionless Service-Implementation of Connection Oriented Service-, Routing Algorithms-The Optimality principle-Shortest path, Flooding, Distance vector, Link state, Hierarchical.

**Congestion Control algorithms**-General principles of congestion control, Congestion prevention policies, Approaches to Congestion Control-Traffic Aware Routing- Admission Control-Traffic Throttling-Load Shedding.

**Internet Working** - Tunneling, internetwork routing-, Fragmentation, network layer in the internet – IP protocols- , IP addresses-, Subnets- Internet control protocols- ICMP-ARP- DHCP.

**UNIT V:**

**The Transport Layer:** Transport layer protocols: Introduction-services- port number-User data gram protocol-User datagram-UDP services-UDP applications-Transmission control protocol: TCP services-TCP features- Segment- A TCP connection- windows in TCP- flow control-Error control.

**Application Layer** -- Network Security. Security Mechanisms: Authentication Protocols, Firewalls, Cryptographic Algorithms: DES, RSA, World Wide Web: HTTP , FTP-, -Electronic mail-Architecture-web based mail- email security. **Domain Name System:** Name Space, DNS in Internet, DNS Name Servers.

**Text Books:**

- 1) Computer Networks: Andrew S Tanenbaum David J. Wetherall, 5/e, Pearson
- 2) Data communications and networking: Behrouz Forouzan, 5/e, McGraw Hill

**Reference Books:**

- 1) Computer Networks – A System Approach, Peterson, Bruce Davie, 2/e , Harcourt Asia
- 2) Compute communications and networking technologies, Gallo, Hancock, Cengage
- 3) An Engineering approach to compute networking, Kesha, Pearson



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		3	0	0	3
<b>4098221202</b>	<b>PYTHON PROGRAMMING</b>				

**Course Objectives:**

- To understand structure of scripting languages
- To understand operators, functions, key concepts of OOP in Python
- Exposure to various problem solving approaches of computer applications

**Course Outcomes (COs):** At the end of the course, student will be able to

- Construct software easily right out of the box
- Experiment with an interpreted language
- Build software for real needs
- Explain to testing Orielly.

**UNIT I:**

History of Python, Need of Python Programming, Applications Basics of Python, Programming Using the REPL(Shell), Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation

**UNIT II:**

Types - Integers, Strings, Booleans; Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations Control Flow- if, if-elif-else, for, while, break, continue, pass.

**UNIT III:**

Lists - Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences, Comprehensions.

**UNIT IV:**

Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Fruitful, Functions(Function Returning Values), Scope of the Variables in a Function - Global and Local variables. Modules: Creating modules, import statement, from. Import statement, name spacing. Python packages, Introduction to PIP, Installing Packages via PIP, Using Python Packages

**UNIT V:**

**Object Oriented Programming OOP in Python:** Classes, self-variable, Methods, Constructor, Method, Inheritance, Overriding Methods and Data hiding.

**Error and Exceptions:** Difference between an error and Exception, Handling Exception, try, except block, Raising Exceptions, User Defined Exceptions

**Introduction to ML/DS Libraries:** Introduction to NumPy, Pandas, SciPy and Matplotlib



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**Text Books:**

1. Learning Python, Mark Lutz, Orliey
2. Python Programming: A Modern Approach, Vamsi Kurama, Pearson

**Reference Books:**

1. Think Python, Allen Downey, Green Tea Press
2. Core Python Programming, W. Chun, Pearson.
3. Introduction to Python, Kenneth A. Lambert, Cengage



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		3	0	0	3
<b>4098221203</b>	<b>DATA WAREHOUSING AND MINING</b>				

**Course Objectives:**

- Be familiar with mathematical foundations of data mining tools..
- Understand and implement classical models and algorithms in data warehouses and data mining
- Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.
- Develop skill in selecting the appropriate data mining algorithm for solving practical problems.

**Course Outcomes (COs):** At the end of the course, student will be able to

- Understand the basics of types of data, quality of data, suitable techniques required for preprocessing and measures required to perform data analysis
- Describe the need of classification, identify suitable technique(s) to perform classification, model building and evaluation
- Identify the requirements and usage of association rule mining on categorical and continuous data.
- Compare and Identify suitable clustering algorithm(s) (apply with open source tools), interpret, evaluate and report the result
- Describe the requirements and the need of web mining

**UNIT I:**

Introduction to Data mining, types of Data, Data Quality, Data Processing, Measures of Similarity and Dissimilarity, Exploring Data: Data Set, Summary Statistics, Visualization, Data Warehouse, OLAP and multi dimensional data analysis.

**UNIT II:**

**Classification:** Basic Concepts, Decision Trees and model evaluation: General approach for solving a classification problem, Decision Tree induction, Model over fitting: due to presence of noise, due to lack of representation samples, Evaluating the performance of classifier. Nearest Neighborhood classifier, Bayesian Classifier, Support vector Machines: Linear SVM, Separable and Non Separable case.

**UNIT III:**

**Association Analysis:** Problem Definition, Frequent Item-set generation, rule generation, compact representation of frequent item sets, FP-Growth Algorithms. Handling Categorical, Continuous attributes, Concept hierarchy, Sequential, Sub graph patterns



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**UNIT IV:**

**Clustering:** Over view, K-means, Agglomerative Hierarchical clustering, DBSCAN, Cluster evaluation: overview, Unsupervised Cluster Evaluation using cohesion and separation, using proximity matrix, Scalable Clustering algorithm

**UNIT V:**

**Web data mining:** Introduction, Web terminology and characteristics, Web content mining, Web usage mining, web structure mining, Search Engines: Characteristics, Functionality, Architecture, Ranking of WebPages, Enterprise search

**Text Books:**

- 1) Introduction to Data Mining, Tan, Steinbach and Vipin Kumar, Pearson Education, 2016
- 2) Data Mining: Concepts and Techniques, 2<sup>nd</sup> Edition, Jiawei Han and Micheline Kamber, ELSEVIER

**Reference Books:**

- 1) Data Mining: The Textbook, Springer, May 2015, Charu C. Aggarwal.

**Web resources:**

- 1) NPTEL: <https://nptel.ac.in/courses/106/105/106105174/>
- 2) [https://www.saedsayad.com/data\\_mining.htm](https://www.saedsayad.com/data_mining.htm)



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		3	0	0	3
<b>4098221230</b>	<b>NoSQL DATABASES</b> <b>(Professional Elective-I)</b>				

**Course Objectives:**

The objective of the course is to:

- Define, compare and use the four types of NoSQL Databases (Document-oriented, Key Value Pairs, Column oriented and Graph)
- Demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Column-oriented NoSQL databases
- Explain the detailed architecture, define objects, load data, query data and performance tune Document oriented NoSQL databases
- Ability to design entity relationship model and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data

**Course Outcomes:**

After the completion of the course, student will be able to do the following

- Identify what type of NoSQL database to implement based on business requirements (key-value, document, full text, graph, etc.)
- Apply NoSQL data modeling from application specific queries
- Use Atomic Aggregates and denormalization as data modelling techniques to optimize query processing

**UNIT I:**

**Introduction to NoSQL:** - Define what a NoSQL database is, why we need NoSQL and how it is different from traditional databases, NoSQL database environment, benefits and drawbacks to using NoSQL database, NoSQL VS SQL.

**UNIT II:**

**Introduction to NoSQL Environment:** Schema less Development, Data Models, Distribution Models, Consistency, Categories of NoSQL - Key-Value Stores , Wide-Column Family Stores, Document Databases, Graph Databases, Object-Oriented Databases.

**UNIT III:**

**Wide-Column Databases:** Column Family, Key and Keyspace, Categories of NoSQL, Examples using in Cassandra and MapR

**Key-Value Databases:** Major Keys, Minor Keys, Values, Examples using in Oracle NoSQL Database, Redis



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**UNIT IV:**

**Document Databases:** NoSQL, Attributes, Metadata, Formats, XML, JSON and BSON

Examples using Elastic Search, Couch DB, Mongo DB

**Graph Databases:** Edges, Nodes, Relationships, Examples using Neo4J,InfoGrid,GraphBase

**UNIT V**

Cloud Computing with NoSQL Databases: Big Data, Remote Searches, Hadoop, MapReduce, REST, AWS

**Text Books:**

- 1) Pramod Sadalage and Martin Fowler, NoSQL Distilled, Addison-Wesley Professional, 2012.
- 2) Dan McCreary and Ann Kelly, Making Sense of NoSQL, Manning Publications, 2013.

**Reference Books:**

- 1) Shashank Tiwari, Professional NoSQL, Wrox Press, Wiley, 2011, ISBN: 978-0-470-94224-6
- 2) Gaurav Vaish, Getting Started with NoSQL, Packt Publishing, 2013.



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		3	0	0	3
<b>4098221231</b>	<b>ADVANCED DATA STRUCTURES</b> <b>(Professional Elective-I)</b>				

**Course Objectives:**

- Describe and implement a variety of advanced data structures (hash tables, priority queues, balanced search trees, graphs).
- Analyse the space and time complexity of the algorithms studied in the course.
- Identify different solutions for a given problem; analyse advantages and disadvantages to different solutions

**Course Outcomes:**

- To understand graph representations, minimum Spanning Trees and traversals.
- Understand Dictionaries, hashing mechanism which supports faster retrieval.
- Implement heaps, queues and their operations, B Trees and B+ Trees
- Illustration tries which share some properties of table look up, various issues related to the design of file structures.

**UNIT-I:**

**GRAPHS:** The Graph Abstract Data Type, Introduction, Definition, Graph Representation, Elementary Graph Operation, Depth First Search, Breadth First Search, Connected Components, Spanning Trees, Biconnected Components, Minimum Cost Spanning Trees, Kruskal's Algorithm, Prim's Algorithm Sollin's Algorithm, Shortest Paths and Transitive Closure, Single Source/All Destination: Nonnegative Edge Cost, Single Source/All Destination: General Weights, All-Pairs Shortest Path, Transitive Closure.

**UNIT-II:**

**HASHING:** Dictionary ADT, Introduction-Static Hashing- Hash Table- Hash Functions- Secure Hash Function- Overflow Handling- Theoretical Evaluation of Overflow Techniques, Dynamic Hashing- Motivation for Dynamic Hashing -Dynamic Hashing Using Directories- Directory less Dynamic, Hashing.

**UNIT-III:**

**PRIORITY QUEUES AND EFFICIENT BINARY SEARCH TREES:**

Priority Queue ADT, Model, Simple Implementation, Binary Heap, Applications of Priority Queues- The Selection Problem Event Simulation Problem, Binomial Queues- Binomial Queue Structure – Binomial Queue Operation- Implementation of Binomial Queues. Binary Search Tree, AVL Tree, Insertion into a AVL Tree, Deletion from a AVL Tree, Red-Black Trees, Definition- Representation of a Red- Black Tree- Searching a Red-Black Tree- Inserting into a Red Black Tree- Deletion from a Red Black Tree, Splay Trees.



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**UNIT-IV:**

**MULTIWAY SEARCH TREES:** M-Way Search Trees, Definition and Properties- Searching an M-Way Search Tree, B-Trees, Definition and Properties- Number of Elements in a B-tree- Insertion into B-Tree- Deletion from a B-Tree- B+-Tree Definition- Searching a B+-Tree- Insertion into B+-tree- Deletion from a B+-Tree.

**UNIT-V:**

**DIGITAL SEARCH STRUCTURES:** Digital Search Trees, Definition- Search, Insert and Delete- Binary tries and Patricia, Binary Tries, Compressed Binary Tries- Patricia, Multiway Tries- Definitions- Searching a Trie-Sampling Strategies- Insertion into a Trie- Deletion from a Trie- Keys with Different Length-Height of a Trie- Space Required and Alternative Node Structure- Prefix Search and Applications- Compressed Tries- Compressed Tries With Skip Fields- Compressed Tries With Labelled Edges- Space Required by a Compressed Tries, Tries and Internet Packet Forwarding -IP Routing- 1-Bit Tries- Fixed-Stride Tries-Variable-Stride Tries.

**Text Books:**

1. Data Structures, a Pseudocode Approach, Richard F Gilberg, Behrouz A Forouzan, Cengage.
2. Fundamentals of DATA STRUCTURES in C: 2ndded, , Horowitz , Sahani, Anderson-freed, Universities Press
3. Data structures and Algorithm Analysis in C, 2nd edition, Mark Allen Weiss, Pearson

**Reference Books:**

1. Web : <http://lcm.csa.iisc.ernet.in/dsa/dsa.html>
2. [http://utubersity.com/?page\\_id=878](http://utubersity.com/?page_id=878)
3. <http://freevideolectures.com/Course/2519/C-Programming-and-Data-Structures>
4. <http://freevideolectures.com/Course/2279/Data-Structures-And-Algorithms>
5. File Structures :An Object oriented approach with C++, 3rded, Michel J Folk, Greg Riccardi, Bill Zoellick
6. C and Data Structures: A Snap Shot oriented Treatise with Live examples from Science and Engineering, NB Venkateswarlu& EV Prasad, S Chand, 2010.



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		3	0	0	3
<b>4098221232</b>	<b>OBJECT ORIENTED ANALYSIS AND DESIGN</b> <b>(Professional Elective-I)</b>				

**Course Overview:**

This course is intended to provide an in depth understanding of object oriented approaches to software development, in particular to the analysis and design phases of the software life cycle. Topics include notation, methods, competing methodologies, issues in object oriented development, and recent advancements which complement traditional object-oriented methodologies..

**Course Objectives:**

1. Essential and fundamental aspects of object-oriented analysis and design, in terms of “how to use” it for the purpose of specifying and developing software.
2. Explore and analyze different analysis and design models, such OO Models, Structured Analysis and Design Models, etc
3. Understanding the insight and knowledge into analyzing and designing software using different object-oriented modeling techniques
4. Understanding the fundamental principles through advanced concepts of analysis and design using UML

**Course Outcomes:**

1. Possess an ability to practically apply knowledge software engineering methods, such as object-oriented analysis and design methods with a clear emphasis on UML
2. Have a working ability and grasping attitude to design and conduct object-oriented analysis and design experiments using UML, as well as to analyze and evaluate their Models.
3. Have a capacity to analyze and design software systems, components to meet desired needs
4. Display an ability to identify, formulate and solve software development problems: software requirements, specification (problem space), Software design, and implementation (solution space).
5. Show an ability to use the graphical UML representation using tools, such as IBM’s Rational Rose or Microsoft’s Vision.



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**Unit-I:**

**Introduction to UML**

The meaning of Object-Orientation, object identity, encapsulation, information hiding, polymorphism, generosity, importance of modeling, principles of modeling, object oriented modeling, conceptual model of the UML, Architecture.

**Unit-II:**

**Basic structural Modeling & Class & object diagrams**

**Basic structural Modeling:** Classes, relationships, common mechanisms, diagrams, Advanced structural modeling: advanced relationships, interfaces, types & roles, packages, instances.

**Class & object diagrams:** Terms, concepts, examples, modeling techniques, class & Object diagrams.

**Unit-III:**

**Sequence diagrams & Collaboration diagrams**

**Sequence diagrams:** Terms, concepts, differences between collaboration and sequence diagrams, depicting synchronous messages with/without priority call back mechanism broadcast message.

**Collaboration diagrams:** Terms, Concepts, depicting a message, polymorphism in collaboration diagrams, iterated messages, use of self in messages.

**Unit-IV:**

**Behavioral Modeling & Advanced Behavioral Modeling**

**Behavioral Modeling:**

Interactions, use cases, use case diagrams, activity diagrams.

**Advanced Behavioral Modeling:** Events and signals, state machines, processes & threads, time and space, state chart diagrams



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**Unit-V:**

**Architectural Modeling**

Terms, concepts, examples, modeling techniques for component diagrams and deployment diagrams.

**Case study:** Railway Reservation System, Hospital Management System

**Text Books:**

1. The Unified Modeling Language User Guide, Grady Booch, Rumbaugh, Ivar Jacobson, PEA
2. Fundamentals of Object Oriented Design in UML, Meilir Page-Jones, Addison Wesley

**Reference Books:**

1. Head First Object Oriented Analysis &Design, McLaughlin, SPD O'Reilly,2006
2. Object oriented Analysis& Design Using UML, Mahesh ,PHI
3. The Unified Modeling Language Reference Manual, 2/e, Rumbaugh, GradyBooch,etc., PEA
4. Object Oriented Analysis & Design, Satzinger, Jackson, Thomson
5. Object Oriented Analysis Design & implementation, Dathan.,Ramnath, University Press
6. Object Oriented Analysis & Design, John Deacon, PEA
7. Fundamentals of Object Oriented Analysis and Design in UML, M Pages-Jones, PEA
8. Object-Oriented Design with UML, Barclay, Savage, Elsevier,2008



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		3	0	0	3
<b>4098221233</b>	<b>ARTIFICIAL INTELLIGENCE</b> <b>(Professional Elective-I)</b>				

**Course Objectives:**

- To have a basic proficiency in a traditional AI language including an ability to write simple to intermediate programs and an ability to understand code written in that language
- To have an understanding of the basic issues of knowledge representation and blind and heuristic search, as well as an understanding of other topics such as minimax, resolution that play an important role in AI programs
- To have a basic understanding of some of the more advanced topics of AI

**Course Outcomes:**

- Outline problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem
- Apply the language/framework of different AI methods for a given problem
- Implement basic AI algorithms
- Design and carry out an empirical evaluation of different algorithms on problem formalization and state the conclusions that the evaluation supports

**UNIT I:**

Introduction, history, intelligent systems, foundations of AI, applications, tic-tac-toe game playing, development of AI languages, current trends.

**UNIT II:**

Problem solving: state-space search and control strategies: Introduction, general problem solving, characteristics of problem, exhaustive searches, heuristic search techniques, iterative deepening A\*, constraint satisfaction

Problem reduction and game playing: Introduction, problem reduction, game playing, alpha beta pruning, two-player perfect information games.

**UNIT III:**

Logic concepts: Introduction, propositional calculus, propositional logic, natural deduction system, axiomatic system, semantic tableau system in propositional logic, resolution refutation in propositional logic, predicate logic.



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**UNIT IV:**

Knowledge representation: Introduction, approaches to knowledge representation, knowledge representation using semantic network, extended semantic networks for KR, knowledge representation using frames Advanced knowledge representation techniques: Introduction, conceptual dependency theory, script structure, CYC theory, case grammars, semantic web.

**UNIT V:**

Expert system and applications: Introduction phases in building expert systems, expert system versus traditional systems

Uncertainty measure: probability theory: Introduction, probability theory, Bayesian belief networks, certainty factor theory, dempster-shafer theory.

Fuzzy sets and fuzzy logic: Introduction, fuzzy sets, fuzzy set operations, types of membership functions, multi valued logic, fuzzy logic, linguistic variables and hedges, fuzzy propositions, inference rules for fuzzy propositions, fuzzy systems.

**Text Books:**

- 1) Artificial Intelligence- Saroj Kaushik, CENGAGE Learning.
- 2) Artificial intelligence, A modern Approach , 2nded, Stuart Russel, Peter Norvig, PEA.

**Reference Books:**

- 1) Artificial Intelligence- Deepak Khemani, TMH, 2013.
- 2) Introduction to Artificial Intelligence, Patterson, PHI.
- 3) Artificial intelligence, structures and Strategies for Complex problem solving, George F Lugar, 5<sup>th</sup> ed, PEA.

**e-Resources:**

- 1)<https://nptel.ac.in/courses/106/105/106105077/>
- 2)<http://aima.cs.berkeley.edu/>



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		3	0	0	3
<b>4098221234</b>	<b>ADVANCED JAVA PROGRAMMING</b> <b>(Professional Elective-I)</b>				

**Course Overview:**

This course of study builds on the skills gained by students in Advanced Java concepts and helps to advance Java programming skills. Students will design object-oriented applications with Java and will create Java programs using hands-on, engaging activities

**Course Objectives:**

1. To understand the concepts of Hypertext Markup Language and Cascading Style Sheets.
2. To learn JavaScript for creating dynamic websites.
3. To learn the operations perform on data among web applications using XML
4. To acquire knowledge on creation of software components using JAVA Beans.
5. To learn Server-Side Programming using Servlets and Java Server Pages.
6. To learn the creation of pure Dynamic Web Application using JDBC.

**Course Outcomes:**

1. Implement web based applications using features of HTML and XML
2. Develop reusable component for Graphical User Interface applications
3. Apply the concepts of server side technologies for dynamic web applications.
4. Implement the web based applications using effective data base access with rich client interaction.

**Unit I:**

Basic Syntax, Standard HTML Document Structure, Basic Text Markup, Images, Hypertext Links, Lists, Tables, Forms, HTML5.CSS: Levels of Style Sheets, Style Specification Formats, Selector Forms, The Box Model, Conflict Resolution. (Book 1)



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**UNIT - II:**

The Basic of Java script: Objects, Primitives Operations and Expressions, Screen Output and Keyboard Input, Control Statements, Object Creation and Modification, Arrays, Functions, Constructors, Pattern Matching using Regular Expressions, Document Object Model (DOM). Introduction to XML, JSON files. Ajax and its architecture (Book 1)

**UNIT - III:**

Installing Tomcat Server & Testing Tomcat.

**Introduction to Servlets:** Lifecycle of a Servlet, Servlet API, The javax.servlet Package, Reading Servlet parameters, Reading Initialization parameters. The javax.servlet.HTTTP Package, Handling Http Request & Responses, Using Cookies-Session Tracking, Security Issues. (Book 3)

**UNIT - IV:**

**Introduction to JSP:** The Problem with Servlet. The Anatomy of a JSP Page, JSP Processing. JSP Application Design with MVC.

**JSP Application Development:** Generating Dynamic Content, Using Scripting Elements Implicit JSP Objects, Conditional Processing – Displaying Values Using an Expression to Set an Attribute, Declaring Variables and Methods Error Handling and Debugging, Passing Control and Data between JSP Pages, Memory Usage Considerations (Book 4)

**UNIT - V:**

**Database Access:** Role of JDBC, JDBC API, Types of JDBC Drivers, Database Programming using JDBC, Accessing MySQL database- Accessing MS Access database- Accessing a Database from a JSP Page Application, Deploying JAVA Beans in a JSP Page. Introduction to struts framework. (Book 5)

**TEXT BOOKS:**

1. Web Technologies The Black Book - Kogent Solutions
2. The complete Reference Java 8th Edition by Patrick Naughton and Herbert Schildt. TMH
3. Java Servlets - Jason Hunter, Oreilly
4. Java Server Pages , Hans Bergstan, Oreilly.
5. JDBC, Servlets, and JSP Black Book by K. Santosh Kumar, Dreamtech Press

**REFERENCE BOOKS:**

1. Programming world wide web-Sebesta, Pearson.
2. Core SERVLETS ANDJAVASERVER PAGES VOLUME 1: CORE TECHNOLOGIES by Marty Hall and Larry Brown Pearson.



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		0	0	3	1.5
<b>4098221210</b>	<b>DATABASE MANAGEMENT SYSTEMS LAB</b>				

**Course Objectives:**

- 1) This Course will enable students to
- 2) Populate and query a database using SQL DDL/DML Commands
- 3) Declare and enforce integrity constraints on a database
- 4) Writing Queries using advanced concepts of SQL
- 5) Programming PL/SQL including procedures, functions, cursors and triggers

**Course Outcomes:**

- 1) At the end of the course the student will be able to:
- 2) Utilize SQL to execute queries for creating database and performing data manipulation operations
- 3) Examine integrity constraints to build efficient databases
- 4) Apply Queries using Advanced Concepts of SQL
- 5) Build PL/SQL programs including stored procedures, functions, cursors and triggers

**List of Experiments:**

- 1) Execute all DDL, DML and DCL commands on sample tables.
- 2) Implementation of different types of operators and built-in functions with suitable examples
- 3) Implementation of different types of joins with suitable examples
- 4) Create views, partitions, Sequence, Indexes and locks for a particular DB
- 5) Implement different types of constraints on relations.
- 6) Implementation of sub queries and nested queries.
- 7) Implement Queries on Group By & Having Clauses, ALIAS, Sequence By, Order By
- 8) Control Structure
  - a) Write a PL/SQL block for Addition of Two Numbers
  - b) Write a PL/SQL block for IF, IF and else condition
  - c) Write a PL/SQL block for implementation of loops
  - d) Write a PL/SQL block for greatest of three numbers using IF and ELSEIF
- 9) Exception Handling- Implement the following with respect to exception handling. Raising Exceptions, User Defined Exceptions, Pre-Defined Exceptions
- 10) Write PL/SQL block for an application using exception handling *Procedures*
  - a) Write a PL/SQL Procedure using Positional Parameters
  - b) Write a PL/SQL Procedure using notational parameters
  - c) Write a PL/SQL Procedure for GCD Numbers
  - d) Write a PL/SQL Procedures for cursor implementation (explicit and implicit cursors)



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11) Functions:

- a) Write a PL/SQL block to implement factorial using functions
- b) Write a PL/SQL function to search an address from the given database

12) Write a DBMS program to prepare Pl/SQL reports for an application using functions.

13) Triggers:

- a)Write a Trigger to pop-up the DML operations
- b) Write a Trigger to check the age valid or not Using Message Alert.
- c)Create a Trigger to Raise appropriate error code and error message.
- d) Create a Trigger on a table so that it will update another table while inserting values

**Text Books:**

- 1) Oracle: The Complete Reference by Oracle Press
- 2) Nilesh Shah, "Database Systems Using Oracle", PHI, 2007
- 3) Rick F Vander Lans, "Introduction to SQL", Fourth Edition, Pearson Education, 2007



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		0	0	3	1.5
<b>4098221211</b>	<b>DATA WAREHOUSING AND DATA MINING LAB USING PYTHON</b>				

- Week-1: Matrix Operations
- Week-2: Understanding Data
- Week-3: Correlation Matrix 5
- Week-4: Data Preprocessing – Handling Missing Values
- Week-5: Association Rule Mining – Apriori
- Week-6: Classification – Logistic Regression
- Week-7: Classification - KNN
- Week-8: Classification - Decision Trees
- Week-9: Classification – Bayesian Network
- Week-11: Classification – Support Vector Machines (SVM)



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		0	0	3	1.5
<b>4098221212</b>	<b>WEB DESIGNING THROUGH PHP (SKILL ORIENTED COURSE)</b>				

**LIST OF PROGRAMS:**

1. Design a resume using basic HTML tags.
2. Design a college homepage using HTML tags.
3. Design a webpage to illustrate the following
  - Create a simple table that contains data of students using simple table tags.
  - Create a time-table of class using complex table tags.
4. Apply CSS to the above Experiment No-2
5. Design a Student Login and Registration forms using HTML.
6. Design a company webpage using bootstrap.
7. Design a Student Login and Registration forms and validate the data using java script regular expressions
8. Program on different operators in PHP
  - Arithmetic operators
  - Comparison operators
  - Logical operators
  - Assignment operators
  - Increment and decrement operators
  - Spaceship operators
9. Write a PHP program to use an user-defined function to add two numbers in a form and display the result.
10. Apply the AJAX function on Experiment No-9 to display the result in same webpage.
11. Write a program to implement the following
  - Conditional statements in PHP.
  - Looping statements in PHP.
12. Write a program to implement the following
  - Factorial of a number.
  - Reverse of a number.
  - Number is palindrome or not.
13. Write a program to implement the following
  - Reverse a string.
  - String is palindrome or not.
14. Write a program to implement arrays in PHP.
15. Write a program to implement the following
  - String functions in PHP.
  - Array functions in PHP.



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16. Write a program to illustrate the following

- Uploading an image of format(.jpg , .gif ).
- Uploading a file of format(.txt , .pdf , .doc , .docx , .ppt, .xlsx ).

17. Write a program to perform CRUD operations on Student Login and Registration forms using MySQL and PHP.

18. Write a program to illustrate the following

- Creating a cookie using PHP
- Deleting a cookie using PHP



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		0	0	0	1.5
<b>4098221270</b>	<b>MINI PROJECT</b>				



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		3	0	0	3
<b>4098222100</b>	<b>MACHINE LEARNING</b>				

**Course Objectives:**

- Familiarity with a set of well-known supervised, unsupervised and semi-supervised learning.
- The ability to implement basic machine learning algorithms.
- Understanding of how machine learning algorithms are evaluated.
- Applying new concepts in machine learning.

**1) Course Outcomes:**

- Recognize the characteristics of machine learning that make it useful to real-world Problems.
- Characterize machine learning algorithms as supervised, semi-supervised, and Unsupervised.
- Usage of support vector machine, regularized regression algorithms.
- Understand the concept behind neural networks for learning non-linear functions

**Unit-I: INTRODUCTION TO MACHINE LEARNING:**

Introduction to machine learning, Definition, traditional programming vs machine learning algorithms, learning a system, supervised learning, unsupervised learning and reinforcement learning, application areas

**Unit-II: Classification and Regression Models**

Linear separability and decision regions, linear discriminants, linear regression, logistic regression, decision trees-ID3 and C4.5, KNN

**Unit-III: Dimensionality reduction and Support vector machines**

Dimensionality reduction and Feature selection, Dimensionality reduction algorithms: LDA and PCA, Margin of a classifier, Support Vector Machine, Learning nonlinear hypothesis using kernel functions

**Unit-IV: Clustering and Ensemble Methods**

Introduction to clustering: K-means clustering, Gaussian mixture model, Ensemble Methods: bagging and boosting, Random forest and AdaBoost algorithms and Bayesian learning algorithm.



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**Unit-V: ARTIFICIAL NEURAL NETWORKS**

Introduction to perceptron ,the perceptron learning algorithm, Multilayer neural networks, activation functions, Back Propagation algorithm and introduction to Deep learning models: CNN

**Text Books:**

1. Tom Mitchell, "*Machine Learning*", Mc Graw Hill publications, 1997
2. Machine Learning: The art and science of algorithms that make sense of data, Peter Flach, Cambridge.
3. Introduction to Machine Learning with Python By Andreas C. Müller, Sarah Guido O'Reilly Media
4. Deep Learning by Josh Patterson, Adam Gibson ,O'Reilly Media

**Reference Books:**

1. Understanding Machine Learning: From Theory to Algorithms, Shai Shalev-Shwartz, Shai Ben- David, Cambridge.
2. Machine Learning in Action, Peter Harrington, 2012, Cengage.



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		3	0	0	3
<b>4098222101</b>	<b>INTERNET OF THINGS</b>				

**Course Objectives:**

- Identify the Components that forms part of IoT Architecture.
- Determine the most appropriate IoT Devices and Sensors based on Case Studies.
- Setup the connections between the Devices and Sensors.
- Evaluate the appropriate protocol for communication between IoT.
- Analyse the communication protocols for IoT.

**Course Outcomes (COs):** At the end of the course, student will be able to

- Explain the definition and usage of the term 'the internet of things' in different contexts
- Discover the various network protocols used in IoT
- Define the role of big data, cloud computing and data analytics in a typical IoT system.
- Compare and contrast the threat environment based on industry and/or device type
- Design a simple IoT system made up of sensors, wireless network connection, data analytics and display/actuators, and write the necessary control software

**UNIT I: Introduction to IOT**

**The Internet of Things:** An Overview of Internet of things, Internet of Things Technology, behind IoTs Sources of the IoTs, M2M Communication, Examples of IoTs, Design Principles for Connected Devices Internet Connectivity Principles, Internet connectivity, Application Layer Protocols: HTTP, HTTPS.

**UNIT II: Introduction to Business Model & Embedded Systems**

Business Models for Business Processes in the Internet of Things, IoT/M2M systems LAYERS AND designs standardizations, Modified OSI Stack for the IoT/M2M Systems.

Communication Technologies, Introduction, Generic computing systems Vs. Embedded systems, Purpose of Embedded Systems.

**UNIT III: Communication Protocols of IOT**

Design Principles for the Web Connectivity for connected-Devices, Web Communication protocols for Connected Devices, Message Communication protocols for Connected Devices

Communication Technologies – Wireless communication technologies



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**UNIT IV: Data Storage and Management in IOT**

Data Acquiring, Organizing and Analytics in IoT/M2M, IOT/M2M Data Acquiring and Storage, Organizing Data, Transactions.

Physical Design of IOT – Things in IOT – IOT Protocols, Logical design of IOT– IOT functional blocks, IOT communication models

**UNIT V: IOT Platform and Case Studies**

Data Collection, Storage and Computing Using a Cloud Platform for IoT/M2M Applications/Services, Data Collection, Storage and Computing Using cloud platform Everything as a service and Cloud Service Models, IOT cloud-based services using the Xively (Pachube/COSM), Nimbots and other platforms Sensor,

**Case studies:** Home Automation – Smart lighting – Home intrusion detection, Cities – smart parking, Environment – Weather monitoring system – Air Pollution Monitoring –Forest Fire Detection, Agriculture – smart irrigation system.

**Text Books:**

- 1) Internet of Things: Architecture, Design Principles And Applications, 1st ed, Rajkamal, McGraw Hill Higher Education, 2017.
- 2) Internet of Things, 1st ed, A.Bahgya and V.Madisetti, Univesity Press, 2014

**Reference Books:**

- 1) Designing the Internet of Things, 1st ed, Adrian McEwen and Hakim Cassimally, Wiley, 2013.
- 2) Getting Started with the Internet of Things, 1st ed, CunoPfister , Oreilly, 2011.



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		3	0	0	3
<b>4098222102</b>	<b>SOFTWARE ENGINEERING</b>				

**Course Objectives:**

- 1) The students will know about the various myths that exist in the software industry
- 2) The meaning of a process and the various process models
- 3) The various methods of Requirements elicitation, prioritization, specification and validation of requirements
- 4) The meaning of architecture and various architectural styles
- 5) The principles and guidelines for good coding
- 6) The testing process, various testing strategies and testing techniques

**Course Outcome:**

**Students will be able to:**

- 1) The students will know about the various myths that exist in the software industry
- 2) The meaning of a process and the various process models
- 3) The various methods of Requirements elicitation, prioritization, specification and validation of requirements
- 4) The meaning of architecture and various architectural styles
- 5) The principles and guidelines for good coding
- 6) The testing process, various testing strategies and testing techniques

**UNIT-I**

**Introduction to Software Engineering**

The evolving role of software, Changing Nature of Software, Software myths.

(Text Book 3) **The software problem:** Cost, schedule and quality, Scale and change

**Software Process**

Process and project, component software process, Software development process models : Waterfall model, prototyping, iterative development, relational unified process, Extreme programming and agile process.

**UNIT-II**

**Software requirement analysis and specification**

Value of good SRS, requirement process, requirement specification, functional specifications with use-cases, other approaches for analysis, validation.

**Planning a software project:** Effort estimation, project schedule and staffing, quality planning, risk management planning, project monitoring plan, detailed scheduling.

**UNIT-III**

**Software Architecture**

Role of software architecture, architecture views, components and connector view, architecture styles for C & C view, documenting architecture design, evaluating architectures.

**Software Design:** Overview of the Design Process, How to Characterize of a Design? Cohesion and Coupling, Layered Arrangement of Modules, Approaches to Software Design.



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**UNIT-IV**    **User Interface Design:** Characteristics of Good User Interface, Basic Concepts, Types of User Interfaces, Fundamentals of Component-based GUI Development, A User Interface Design Methodology

**Coding and Unit testing**

Programming principles and guidelines, incrementally developing code, managing evolving code, unit testing, code inspection and metrics.

Testing: Testing concepts, testing process, black-box testing, white-box testing, metrics.

**UNIT V**    **Software Reliability And Quality Management:** Software Reliability, Statistical Testing, Software Quality, Software Quality Management System, ISO 9000, SEI Capability Maturity Model.

**Software Maintenance:** Software maintenance, Maintenance Process Models, Maintenance Cost, Software Configuration Management.

**Text Books:**

- 1) A Concise introduction to software engineering (undergraduate topics in computer science), Pankaj Jalote, Springer International Edition.
- 2) Software Engineering, A Precise approach, Pankaj Jalote, Wiley
- 3) Software Engineering, 3/e ,& 7e Roger S.Pressman , TMH

**Reference Books:**

- 1) Software Engineering, 8/e, Sommerville, Pearson.
- 2) Software Engineering principles and practice, W S Jawadekar, TMH
- 3) Software Engineering concepts, R Fairley, TMH



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		3	0	0	3
<b>4098222103</b>	<b>CRYPTOGRAPHY AND INFORMATION SECURITY</b>				

**Course Objectives:**

- To learn various cryptographic algorithms including secret key cryptography, hashes and message digests, public key algorithms,
- To Familiar in design issues and working principles of various authentication protocols and various secure communication standards including Kerberos, IPsec, and S/MIME

**Course Outcomes:** At the end of the course, student will be able to

- Explain Basic Principles, different security threats, countermeasures, foundation course of cryptography mathematics and Symmetric Encryption.
- Classify the basic principles of Asymmetric key algorithms and operations of asymmetric key cryptography.
- Design Cryptographic Hash Functions as SHA-3 and Digital Signatures as Elgamal
- Explain the concept of Revise Key Management and Distribution and User Authentication
- Determine the knowledge of Network and Internet Security Protocols such as S/MIME

**UNIT I:**

**Basic Principles:** Security Goals, Cryptographic Attacks, Services and Mechanisms, Mathematics of Cryptography. **Symmetric Encryption:** Mathematics of Symmetric Key Cryptography, Introduction to Modern Symmetric Key Ciphers, Data Encryption Standard, Advanced Encryption Standard.

**UNIT II:**

**Asymmetric Encryption:** Mathematics of Asymmetric Key Cryptography-Primes, primality Testing, Factorization, Asymmetric Key Cryptography-RSA Cryptosystem, Rabin Cryptosystem, ElGamal Cryptosystem, Elliptic Curve Cryptosystem

**UNIT III:**

**Cryptographic Hash Functions:** Applications of Cryptographic Hash Functions, Two Simple Hash Functions Requirements and Security Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithm (SHA), SHA-3. **Digital Signatures:** Elgamal Digital Signature Scheme, Schnorr Digital Signature, NIST Digital Signature Algorithm

**UNIT IV:**



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**Introduction to Cybercrime**

Introduction to Cybercrime: Introduction, Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Cybercriminals, Classifications of Cybercrime, Cyberstalking, Cyber cafe and Cybercrimes, Botnets. Attack Vector, Proliferation of Mobile and Wireless Devices, Security Challenges Posed by Mobile Devices, Attacks on Mobile/Cell Phones, Network and Computer Attacks.

**UNIT V: Tools and Methods**

Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, Sniffers, Spoofing, Session Hijacking Buffer over flow, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks, Identity Theft (ID Theft), Foot Printing and Social Engineering, Port Scanning, Enumeration.

**Text Books:**

- 1) Cryptography and Network Security, 3rd Edition Behrouz A Forouzan, Deb deep Mukhopadhyay, McGraw Hill,2015
- 2) Cryptography and Network Security, William Stallings, Global Edition, 7e Pearson, 2017
- 3) Sunit Belapure Nina Godbole "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", WILEY, 2011.

**Reference Books:**

- 1) Network Security and Cryptography, First Edition, Bernard Meneges, Cengage Learning, 2018
- 2) Nelson Phillips and Enfinger Steuart, "Computer Forensics and Investigations", Cengage Learning, New Delhi, 2009



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		3	0	0	3
<b>4098222130</b>	<b>DESIGN AND ANALYSIS OF ALGORITHMS</b> <b>(Professional Elective-II)</b>				

**Course Objectives:**

- To provide an introduction to formalisms to understand, analyze and denote time complexities of algorithms
- To introduce the different algorithmic approaches for problem solving through numerous example problems
- To provide some theoretical grounding in terms of finding the lower bounds of algorithms and the NP-completeness

**Course Outcomes:**

- Describe asymptotic notation used for denoting performance of algorithms
- Analyze the performance of a given algorithm and denote its time complexity using the asymptotic notation for recursive and non-recursive algorithms
- List and describe various algorithmic approaches
- Solve problems using divide and conquer, greedy, dynamic programming, backtracking and branch and bound algorithmic approaches
- Apply graph search algorithms to real world problems
- Demonstrate an understanding of NP- Completeness theory and lower bound theory

**UNIT I:**

Introduction: Algorithm, Pseudo code for expressing algorithms, performance Analysis-Space complexity, Time complexity, Asymptotic Notation- Big oh notation, Omega notation, Theta notation and Little oh notation, Amortized analysis.

**UNIT II:**

Divide and conquer: General method, applications-Binary search, Quick sort, Merge sort, Stassen's matrix multiplication.

Greedy method: General method, applications-Job sequencing with deadlines, Greedy knapsack problem, Minimum cost spanning trees, Single source shortest path problem.

**UNIT III:**

Dynamic Programming: General method, applications-Matrix chain multiplication, Optimal binary search trees, 0/1 knapsack problem, All pairs shortest path problem, Travelling sales person problem, Reliability design.



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**UNIT IV:**

Backtracking: General method, applications-n-queen problem, sum of subsets problem, graph coloring, Hamiltonian cycles.

**UNIT V:**

Branch and Bound: General method, applications - Travelling sales person problem, 0/1 knapsack problem- LC Branch and Bound solution, FIFO Branch and Bound solution. NP-Hard and NP-Complete problems: Basic concepts, non deterministic algorithms, NP - Hard and NP Complete classes, Cook's theorem.

**Text Books:**

- 1) Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni and Rajasekharam, Universities Press
- 2) The Algorithm Design Manual, 2nd edition, Steven S. Skiena, Springer
- 3) Introduction to Algorithms, second edition, T. H. Cormen, C. E. Leiserson, R.L.Rivest and C. Stein, PHI Pvt. Ltd

**Reference Books:**

- 1) Introduction to the Design and Analysis of Algorithms, Anany Levitin, PEA
- 2) Design and Analysis of Algorithms, Pearson Education, Parag Himanshu Dave, Himansu Balachandra Dave
- 3) Introduction to Design and Analysis of Algorithms A strategic approach, R.C.T. Lee, S. S. Tseng, R.C. Chang and T. Tsai, Mc GrawHill.
- 4) Design and Analysis of algorithms, Pearson education, Aho, Ullman and Hopcroft



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		3	0	0	3
<b>4098222131</b>	<b>MONGO DB</b> <b>(Professional Elective-II)</b>				

**Course Objectives:**

- Modelling nosql schemas.
- Handle data storage for unstructured data.
- Monitoring the operational strategies.
- Design Schemas using advance queries.

**Course Outcomes:**

- The proficiently knowing how mongo db stores the data.
- Running the queries in mongodb
- Manipulating MongoDB instances for storing, manipulating and retrieving the data
- Creating and managing different types of indexes.
- Understanding MongoDB configurations.

**Unit-I: Introduction to MongoDB:** Introduction to RDBMS and NoSQL, Benefits of NoSQL, Documents, collections-Dynamic schemas, naming.

**Data Types :** Basic data types, Numbers, Dates, Arrays, Embedded Documents.

**Unit-II: Introduction to MongoDB shell:** running the shell, basic operations with shell, using mongo db shell

**Introduction to Json:** Introduction to Json, Json Structure

**Unit-III: CRUD operations & Querying :** Inserting documents, Removing Documents, Updating documents, Query criteria, Query operators, Type Specific queries- Regular expressions, querying arrays, \$where queries.

**Unit-IV: Indexing:** Introduction to indexes, how mongo db selects index, Index cardinality, types of index, Geo spatial indexes

**Aggregation:** Framework, use of pipeline,

**Unit-V: Transactions:** Introduction to transaction , How to use transaction , Definition of ACID

**Application Design:** Schema design considerations, data representations, optimizations for Data manipulation, Managing consistence, migrating schemas



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**Text Books:**

1. MongoDB Powerful and scalable Data Storage: The Definitive Guide, Shannon Bradshaw, third Edition, O'Reilly Media.
2. MongoDB Fundamentals: A hands-on guide to using MongoDB and Atlas in the real world, Amit Phaltanker, Packt publications
3. MongoDB, React, React Native Full-Stack Fundamentals and Beyond, Eric Bush

**Reference Books:**

1. Mastering MongoDB, Alex Giannas, second edition, Packt Publications
2. NoSQL with MongoDB in 24 Hours, Brad Dayley.



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		3	0	0	3
<b>4098222132</b>	<b>SOFTWARE PROJECT MANAGEMENT</b> <b>(Professional Elective-II)</b>				

**Course Objectives:**

At the end of the course, the student shall be able to:

- To describe and determine the purpose and importance of project management from the perspectives of planning, tracking and completion of project
- To compare and differentiate organization structures and project structures
- To implement a project to manage project schedule, expenses and resources with the application of suitable project management tools

**Course outcomes:**

Upon the completion of the course students will be able to:-

- Apply the process to be followed in the software development life-cycle models
- Apply the concepts of project management & planning
- Implement the project plans through managing people, communications and change
- Conduct activities necessary to successfully complete and close the Software projects
- Implement communication, modeling, and construction & deployment practices in software development

**UNIT-I:**

**Conventional Software Management:** The waterfall model, conventional software Management performance.

**Evolution of Software Economics:** Software Economics, pragmatic software cost estimation.

**Improving Software Economics:** Reducing Software product size, improving software processes, improving team effectiveness, improving automation, Achieving required quality, peer inspections.

**The old way and the new:** The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process.

**UNIT-II:**

**Life cycle phases:** Engineering and production stages, inception, Elaboration, construction, transition phases.

**Artifacts of the process:** The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts.

**UNIT- III:**

**Model based software architectures:** A Management perspective and technical perspective.

**Work Flows of the process:** Software process workflows, Iteration workflows.



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**Checkpoints of the process:** Major mile stones, Minor Milestones, Periodic status assessments.

**Iterative Process Planning:** Work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning.

**UNIT- IV:**

**Project Organizations and Responsibilities:** Line-of-Business Organizations, Project Organizations, evolution of Organizations.

**Process Automation:** Automation Building blocks, The Project Environment.

**Project Control and Process instrumentation:** The seven core Metrics, Management indicators, quality indicators, life cycle expectations, pragmatic Software Metrics, Metrics automation.

**UNIT-V:**

Agile Methodology, adapting to Scrum, Patterns for Adopting Scrum, Iterating towards Agility.

Fundamentals of DevOps: Architecture, Deployments, Orchestration, Need, Instance of applications, DevOps delivery pipeline, DevOps eco system. DevOps adoption in projects: Technology aspects, Agiling capabilities, Tool stack implementation, People aspect, processes

**Text Books:**

- 1) Software Project Management, Walker Royce, PEA, 2005.
- 2) Succeeding with Agile: Software Development Using Scrum, Mike Cohn, Addison Wesley.
- 3) The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations, Gene Kim , John Willis , Patrick Debois , Jez Humb,1st Edition, O'Reilly publications, 2016.

**Reference Books:**

- 1) Software Project Management, Bob Hughes,3/e, Mike Cotterell, TMH
- 2) Software Project Management, Joel Henry, PEA
- 3) Software Project Management in practice, Pankaj Jalote, PEA, 2005,
- 4) Effective Software Project Management, Robert K.Wysocki, Wiley,2006
- 5) Project Management in IT, Kathy Schwalbe, Cengage
- 6) Quality Software Project Management, Futrell,Donald F. Shafer, Donald I. Shafer, PEA



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		3	0	0	3
<b>4098222133</b>	<b>CLOUD COMPUTING</b> <b>(Professional Elective-II)</b>				

**Course Objectives:**

The main objective of the course is to implement Virtualization, Task Scheduling algorithms, apply Map-Reduce concept to applications, building Private Cloud and to know the impact of engineering on legal and societal issues involved

**Course Outcomes:**

At the end of the course, student will be able to

- Interpret the key dimensions of the challenge of Cloud Computing
- Examine the economics, financial, and technological implications for selecting cloud computing for own organization
- Assessing the financial, technological, and organizational capacity of employer's for actively initiating and installing cloud-based applications
- Evaluate own organizations' needs for capacity building and training in cloud computing-related IT areas
- Illustrate Virtualization for Data-Center Automation

**UNIT-I:**

**Systems modeling, Clustering and virtualization:** Scalable Computing over the Internet, Technologies for Network based systems, System models for Distributed and Cloud Computing, Software environments for distributed systems and clouds, Performance, Security And Energy Efficiency.

**UNIT-II:**

**Virtual Machines and Virtualization of Clusters and Data Centers:** Implementation Levels of Virtualization, Virtualization Structures/ Tools and mechanisms, Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data Centre Automation.

**UNIT-III:**

**Cloud Platform Architecture:** Cloud Computing and service Models, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms, Inter Cloud Resource Management, Cloud Security and Trust Management. Service Oriented Architecture, Message Oriented Middleware.

**UNIT-IV:**

**Cloud Programming and Software Environments:** Features of Cloud and Grid Platforms, Parallel & Distributed Programming Paradigms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments. **Storage Systems:**



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Evolution of storage technology, distributed file systems, general parallel file systems. Google file system, Apache Hadoop, BigTable, Megastore, Amazon Simple Storage Service(S3).

**UNIT-V:**

**Cloud Resource Management and Scheduling :** Policies and Mechanisms for Resource Management Applications of Control Theory. Two Level Resource Allocation Architecture. Feedback Control Based on Dynamic Thresholds. Resource Bundling, **Scheduling Algorithms for Computing Clouds:** Fair Queuing, Start Time Fair Queuing, Borrowed Virtual Time, Cloud Scheduling Subject to Deadlines

**Text Books:**

1. Distributed and Cloud Computing, Kai Hwang, Geoffry C. Fox, Jack J. Dongarra MK Elsevier.
2. Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier.
3. Cloud Computing, A Hands on approach, Arshadeep Bahga, Vijay Madisetti, University Press

**Reference Books:**

1. Cloud Computing: A Practical Approach. Anthony T.Velte. Toby J.VeFte, Robert Elsenpeter.Tata McGraw Hill. rp2011.
2. Enterprise Cloud Computing Gautam Shroif, Cambridge University Press. 2010.
3. Cloud Computing: Implementation, Management and Security, John W. Rittinouse, James FRansome. CRC Press, rp2012.
4. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud. GeorgeReese, O'Really SPD, rp2011.
5. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather,Subra Ktriaraswamy, Shahed Latif, O'Redç SPD, rp2011.

Note: The students shall register in any of the Clouds like AWS/Azure, etc and learn about cloud services.



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		3	0	0	3
<b>4098222134</b>	<b>ADVANCED WEB TECHNOLOGIES</b> <b>(Professional Elective-II)</b>				

**Course Objectives:**

1. To understand computer programming and application software, package/ suites.
2. Design static web application development and Students will gain the skills and front designs
3. Able to get project based experience needed for entry into web application and development careers.

**Course Outcomes:**

- Understand basic concepts of HTML & CSS to design web pages and web site
- Able to Develop dynamic web pages using JavaScript.
- Implementing the Node and React Js in web development
- Analyze a given problem and apply requisite appropriate tools for designing interactive web applications

**UNIT- I : HTML5**

New standard for HTML, XHTML, and the HTML DOM, New Features, Browser Support, New Elements in HTML5, New Markup Elements, New Media Elements, The Canvas Element, New Form Elements, New Input Type Attribute Values, Video on the Web, Video Formats.

**UNIT- II : HTML5 – Audio and Canvas**

Audio on the Web, Audio Formats, How It Works, All `<audio>` Attributes, HTML5 Canvas, What is Canvas? Create a Canvas Element, Draw With JavaScript, Understanding Coordinates, More Canvas Examples, HTML5 Web Storage, Storing Data on the Client, The local Storage Object, The session Storage Object, HTML5 Input Types, HTML5 New Input Types, Browser Support, Input Type – email, Input Type – url, Input Type – number, Input Type – range, Input Type - Date Pickers, Input Type – search, Input Type – color.

**UNIT- III : Introduction to CSS3**

What is CSS3? Differences between CSS3 and earlier CSS, Specifications How browsers are handling CSS3? CSS3 Selectors: Selectors Overview Explore specific selectors, Designing and Developing with CSS3: Background and color, Typography,CSS3 Box Model, Page layout, Media Queries, Implementing CSS3, Advantages and limitations of working with CSS.

Introduction to Bootstrap, design of responsive WebPages



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**UNIT- IV:** Introduction to JQUERY, selectors and events

**Node JS:** Node js - Basics and Setup, Node js Console, Node js Command Utilities, Node js Modules, Node js Concepts, Node js Events, Node js with Express js, Node js Database Access.

**UNIT- V: React JS**

Why React JS, React JSX, React JS components, State, Props, React Component API and Life cycle, Forms and Events.

**Text Books:**

1. HTML 5 Black Book, Covers CSS 3, JavaScript, XML, XHTML, AJAX, PHP and jQuery, 2ed, Dream Tech Black Book
2. React. Js Book: Learning React JavaScript Library from Scratch, Book by Greg Sidelnikov
3. Node.js in Action, by Alex Young , Bradley Meck , Mike Cantelon , Tim Oxley , Marc Harter , T.J. Holowaychuk , Nathan Rajlich
4. React in Action 1st Edition by Mark Tielens Thoma

**Reference Books:**

1. Build Your Own Website The Right Way Using HTML & CSS, 3rd Edition by ge The WordPress Anthology
2. The Principles of Beautiful Web Design, 2nd Edition by Jason Bear



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		0	0	3	1.5
<b>4098222110</b>	<b>MACHINE LEARNING LAB</b>				

**Course Objectives:**

- Make use of Data sets in implementing the machine learning algorithms
- Implement the machine learning concepts and algorithms in any suitable language of choice.
- Design Python programs for various Learning algorithms.

**Course Outcomes(COs):** At the end of the course, student will be able to

- Implement procedures for the machine learning algorithms
- Design Python programs for various Learning algorithms
- Apply appropriate data sets to the Machine Learning algorithms
- Identify and apply Machine Learning algorithms to solve real world problems

**Note:** Consider any dataset from kaggle

**Experiment 1:**

Installation of Python and its packages (Pandas, NumPy, SciPy, matplotlib and scikit-learn)  
 (Install Anaconda, Jupyter Notebook, Programs covering basic concepts in Python Programming)

**Basics of Python:**

Write a program to read two numbers from user and display the result using bitwise & , | and ^ operators on the numbers.

Write a program to calculate the sum of numbers from 1 to 20 which are not divisible by 2, 3 or 5.

Write a program to find the maximum of two numbers using functions.

Implement slicing operation on strings and lists.

**Experiment 2:**

Implement python program to load structured data onto DataFrame and perform exploratory data analysis

Implement python program for data preparation activities such as filtering, grouping, ordering and joining of datasets.

**Experiment 3:**

Implement Python program to prepare plots such as bar plot, histogram, distribution plot, box plot, scatter plot.

**Experiment 4:**

Implement Simple Linear regression algorithm in Python

Implement Gradient Descent algorithm for the above linear regression model



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**Experiment 5:**

Implement Multiple linear regression algorithm using Python.

**Experiment 6:**

Implement Python Program to build logistic regression and decision tree models using the Python package statsmodel and sklearn APIs.

**Experiment 7:**

Implement Python Program to perform the activities such as

- splitting the data set into training and validation datasets
- building model using Python package on training dataset and test on the validation dataset

**Experiment 8:**

Write a Python program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions.

**Experiment 9:**

Implement Support vector Machine algorithm on any data set

**Experiment 10:**

Write a program to implement the naive Bayesian classifier for a sample training data set stored as a .csv file. Compute the accuracy of the classifier, considering few test data sets.



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		0	0	3	1.5
<b>4098222111</b>	<b>INTERNET OF THINGS LAB</b>				

**Course Objectives:**

Students will understand the concepts of Internet of Things and can able to build IoT applications

**Course Outcomes:**

1. Interpret the impact and challenges posed by IoT networks leading to new architectural models.
2. Compare and contrast the deployment of smart objects and the technologies to connect them to network.
3. Appraise the role of IoT protocols for efficient network communication.
4. Elaborate the need for Data Analytics and Security in IoT.
5. Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.

**List of Experiments:**

- 1) Familiarization with Arduino/Raspberry Pi and perform necessary software installation.
- 2) To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds.
- 3) To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to turn ON LED when push button is pressed or at sensor detection.
- 4) To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.
- 5) To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed.
- 6) To interface OLED with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it.
- 7) To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth.
- 8) To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when '1'/'0' is received from smartphone using Bluetooth.
- 9) To build a prototype for home automation
- 10) To build a prototype for smart agriculture
- 11) To build a model that detects air Pollution
- 12) To build a model that detects water Pollution



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		0	0	4	2
<b>4098222112</b>	<b>CASE TOOLS LAB</b>				

**COURSE OBJECTIVES:**

- Learn basic concepts of UML. Master the vocabulary, rules, and idioms of the UML and learn how to model it effectively.
- Understand how to apply the UML to solve a number of common modeling problems
- Model the systems, from concept to executable artifact, using object oriented techniques.
- Apply the knowledge of Software engineering and project management.

**COURSE OUTCOMES:**

- Sketch a Modeling with UML by Deploying Structural Modeling, Behavioral Modeling, Architectural Modeling.
- Recognize the difference between various object relationships: inheritance, association, whole-part, and dependency relationships
- Show the role and function of each UML model in developing object oriented software.
- Apply advanced behavioral modeling and architecture modelling for any case study.

**LIST OF EXPERIMENTS**

<b>S. NO</b>	<b>Name of the Experiment</b>	<b>Skill</b>
1	Familiarization with Rational Rose or Umbrello	Design software project in the form of Graphical representation
2	<b>CASE STUDY: CUSTOMER SUPPORTING SYSTEM (Online Book store)</b> a)Identify and analyze events b)Identify use cases c)Draw Event table d)Identify and analyze domain classes e)Represent domain class diagram using rational rose	Design customer supporting system in the form of Graphical representation
3	<b>CASE STUDY: POINT OF SALE TERMINAL</b> a)Identify and analyze events b)Identify Usecases c)Draw event table d)Identify and analyze domain classes e)Represent usecases and domain class diagram using rational rose	In point of sale terminal we can perform the operations like Bar code scanning, Process sale, Close sale, Pay Bill. Tax calculation, Buy product.
4	<b>CASE STUDY: LIBRARY MANAGEMENT SYSTEM</b> a)Identify and analyze events b)Identify usecases	Library Management System is a project which deals with how to register, accessing of book, issue of the books and renewal of the books from library.



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	c)Draw event table d)Identify and analyze domain classes e)Represent class diagram for library management system	
5	<b>CASE STUDY: RAILWAY RESERVATION SYSTEM</b>  a) Develop sequence diagrams for each use case b) Identify MVC classes / objects for each use case c) Communication diagrams for each use case showing interactions among all the three-layer objects Develop detailed design class diagram (use GRASP patterns for responsibility assignment)	Online Railway Reservation System is a project which deals with the process of online booking, cancellation of tickets and online payment will be done.
6	<b>CASE STUDY: HOSPITAL MANAGEMENT SYSTEM</b>  a) Develop sequence diagrams for each use case. b) Develop Communication diagrams for each use case showing interactions among all the three-layer objects. c) Develop detailed design class model (use GRASP patterns for responsibility assignment).	It deals with the collection of patient's information, diagnosis details, etc. Traditionally, it was done manually.
7	<b>CASE STUDY :ATM APPLICATION</b>  a) Draw usecase diagram b) Draw sequence diagram c) Activity diagram	ATM Application is a system which deals with performing all Banking Transactions like cash withdrawal, balance enquiry, taking a mini statement of the transactions performed by the user.
8	<b>CASE STUDY:AUCTION APPLICATION</b>  a)Draw sequence diagram b)Draw collaboration diagram c)Draw Activity diagram	The online auction system is a design about a website where sellers collect and prepare a list of items they want to sell and place it on the website for visualizing.
9	<b>CASE STUDY:MULTITHREADED AIRPORT SIMULATION</b>  a)Draw sequence diagram b)Draw collaboration diagram	The project is focused on controller and pilot assistance systems for approach and ground movements.
10	<b>CASE STUDY:SIMULATED COMPANY</b>  a) Draw use case diagram b) Draw sequence diagram c) Draw state chart diagram	Simulated company is an example that shows the documents produced when undertaking the analysis and design of an application that's simulates a small manufacturing company.



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		3	0	0	3
<b>4098222180</b>	<b>TECHNICAL SEMINAR</b>				



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		3	0	0	3
<b>4098222230</b>	<b>BIG DATA ANALYTICS</b> <b>(Professional Elective-III)</b>				

**Course Objectives:**

- Optimize business decisions and create competitive advantage with Big Data analytics
- Introducing Java concepts required for developing map reduce programs
- Derive business benefit from unstructured data
- Imparting the architectural concepts of Hadoop and introducing map reduce paradigm
- To introduce programming tools PIG & HIVE in Hadoop echo system.

**Course Outcomes (COs):** At the end of the course, student will be able to

- Preparing for data summarization, query, and analysis.
- Applying data modeling techniques to large data sets.
- Creating applications for Big Data analytics.
- Building a complete business data analytic solution.

### **UNIT- I**

Working with Big Data: Google File System, Hadoop Distributed File System (HDFS) – Building blocks of Hadoop (Namenode, Datanode, Secondary Namenode, JobTracker, TaskTracker), Introducing and Configuring Hadoop cluster (Local, Pseudo-distributed mode, Fully Distributed mode), Configuring XML files.

### **UNIT- II**

Writing Map Reduce Programs: A Weather Dataset, Understanding Hadoop API for Map Reduce Framework (Old and New), Basic programs of Hadoop Map Reduce: Driver code, Mapper code, Reducer code, Record Reader, Combiner, Partitioner.

### **UNIT- III**

Hadoop I/O: The Writable Interface, Writable Comparable and comparators, Writable Classes: Writable wrappers for Java primitives, Text, Bytes Writable, Null Writable, Object Writable and Generic Writable, Writable collections, Implementing a Custom Writable: Implementing a Raw Comparator for speed, Custom comparators.

### **UNIT- IV**

- 2) Admiring the Pig Architecture, Going with the Pig Latin Application Flow, Working through the ABCs of Pig Latin, Evaluating Local and Distributed Modes of Running Pig Scripts, Checking out the Pig Script Interfaces, Scripting with Pig Latin.



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**UNIT- V**

Applying Structure to Hadoop Data with Hive: Saying Hello to Hive, Seeing How the Hive is Put Together, Getting Started with Apache Hive, Examining the Hive Clients, Working with Hive Data Types, Creating and Managing Databases and Tables, Seeing How the Hive Data Manipulation Language Works, Querying and Analyzing Data.

**Text Books:**

1. Big Java 4th Edition, Cay Horstmann, Wiley John Wiley & Sons, INC
2. Hadoop: The Definitive Guide by Tom White, 3rd Edition, O'reilly
3. Hadoop in Action by Chuck Lam, MANNING Publ.
4. Hadoop for Dummies by Dirk deRoos, Paul C.Zikopoulos, Roman B.Melnyk,Bruce Brown, Rafael Coss

**Reference Books:**

1. Hadoop in Practice by Alex Holmes, MANNING Publ.
2. Hadoop MapReduce Cookbook, SrinathPerera, Thilina Gunarathne



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		3	0	0	3
<b>4098222231</b>	<b>OPTIMIZATION TECHNIQUES</b> <b>(Professional Elective-III)</b>				

**UNIT-I:**

**Development:** Definition, Characteristics and Phrases, scientific method. Types of models, general methods for solving, operations research modes.

**Allocation:** introduction linear programming formulation, graphical solution, simplex methods, artificial variable technique, duality principle.

**UNIT-II:**

Transportation problem: Formulation, optimal solution, unbalanced transportation, assignment problem: formulation, optimal solution, variations problem, degeneracy i.e. non square MXN) matrix, restrictions sequencing: Introduction, optimal solution for processing each of n jobs through three machines, travelling salesman problem(i.e. ) shortest acyclic route models.

**UNIT-III:**

**Replacement:** Introduction, replacement of items that deteriorate when money value is not counted and counted, and replacement of items that fail completely (i.e.) group replacements.

**Waiting lines:** Introduction , single channel, poisson arrivals, exponential service time infinite population and unrestricted queue.

**UNIT-VI:**

**Inventory:** Introduction, single item, deterministic models, production is instantaneous or at a constant rate , shortages are allowed or not allowed and with drawls from stock is continuous, purchase inventory model with one price break ,shortages are not allowed , instantaneous production demand production or purchase cost is relevant, stochastic models, simple problems.

**UNIT-V:**

**Theory of Games:** Introduction, minmax (maximum), criterion and optimal strategy solution of games with saddle points, rectangular without saddle points. Dynamic programming: Introduction, Bellman's Principle of optimality, solutions for simple problems.

**Project Management:** PERT and CPM , difference between PERT and CPM, PERT/CPM network components and precedence relations, Time Estimates for activities.

**TEXTBOOKS:**

1. Operations Research, S.D.Sharma, Ramnath, & Kedarnath co, Meerut.
2. Operations Research, An introduction , 8/e, Taha, Pearson.

**REFERENCES:**

1. Operations Research, P.K.Gupta, D.S. Hira, S.Chand.
2. Operations Research, R.D.Asrhedkar, R.V.Kulkarni.
3. Operations Research, Problems & solutons, 3/e, JKSharma, Macmillan.
4. Operations Research, 8/e, Hillier, Liberman, TMH.
5. Operations Research, 2/e, Panneerselvam.



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		3	0	0	3
<b>4098222232</b>	<b>SOFTWARE TESTING METHODOLOGIES</b> <b>(Professional Elective-III)</b>				

**Course Objectives:**

- Fundamentals for various testing methodologies.
- Describe the principles and procedures for designing test cases.
- Provide supports to debugging methods.
- Acts as the reference for software testing techniques and strategies.

**Course Outcomes:**

By the end of the course, the student should have the ability to:

- Understanding the purpose of Software Testing.
- Understand the Transaction Flow Testing and Dataflow testing
- Test the software using domain testing and Logic Based Testing
- Apply the software testing tools for real world applications

**UNIT I:**

**Introduction:**

Purpose of Testing, Dichotomies, Model for Testing, Consequences of Bugs, Taxonomy of Bugs.

**Flow graphs and Path testing:**

Basics Concepts of Path Testing, Predicates, Path Predicates and Achievable Paths, Path Sensitizing, Path Instrumentation, Application of Path Testing.

**UNIT II:**

**Transaction Flow Testing:**

Transaction Flows, Transaction Flow Testing Techniques.

**Dataflow testing:**

Basics of Dataflow Testing, Strategies in Dataflow Testing, Application of Dataflow Testing.

**Domain Testing:** Domains and Paths, Nice & Ugly Domains, Domain testing, Domains and Interfaces Testing, Domain and Interface Testing, Domains and Testability.

**UNIT III:**

**Paths, Path products and Regular expressions:**

Path Products & Path Expression, Reduction Procedure, Applications, Regular Expressions & Flow Anomaly Detection



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**UNIT IV:**

**Logic Based Testing:** Overview, Decision Tables, Path Expressions, KV Charts, and Specifications.

**State, State Graphs and Transition Testing:**

State Graphs, Good & Bad State Graphs, State Testing, and Testability Tips.

**UNIT V:**

**Graph Matrices and Application:**

Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm.

**Software Testing Tools:**

Introduction to Testing, Automated Testing, Concepts of Test Automation, Introduction to list of tools like Win runner, Load Runner, Jmeter, About Win Runner ,Using Win runner, Mapping the GUI, Recording Test, Working with Test, Enhancing Test, Checkpoints, Test Script Language, Putting it all together, Running and Debugging Tests, Analyzing Results, Batch Tests, Rapid Test Script Wizard.

**Text Books:**

1. Software testing techniques – Boris Beizer, Dreamtech, second edition.
2. Software Testing- Yogesh Singh, Camebridge

**Reference Books:**

1. The Craft of software testing - Brian Marick, Pearson Education.
2. Software Testing, 3<sup>rd</sup> edition, P.C. Jorgensen, Aurbach Publications (Dist. by SPD).
3. Software Testing, N. Chauhan, Oxford University Press.
4. Introduction to Software Testing, P.Ammann & J.Offutt, Cambridge Univ. Press.
5. Effective methods of Software Testing, Perry, John Wiley, 2<sup>nd</sup> Edition, 1999.
6. Software Testing Concepts and Tools, P. NageswaraRao, dreamtech Press
7. Win Runner in simple steps by Hakeem Shittu, 2007 Genixpress.
8. Foundations of Software Testing, D. Graham & Others, Cengage Learning



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		3	0	0	3
<b>4098222233</b>	<b>CYBER SECURITY</b> <b>(Professional Elective-III)</b>				

**Course Objectives:**

- To familiarize various types of cyber-attacks and cyber-crimes
- To give an overview of the cyber laws
- To study the defensive techniques against these attacks.

**Course Outcomes:** At the end of the course, student will be able to understand cyber-attacks, types of cybercrimes, cyber laws and also how to protect them self and ultimately the entire Internet community from such attacks.

**UNIT I:**

**Introduction to Cyber Security:** Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defense, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.

**UNIT II:**

**Cyberspace and the Law & Cyber Forensics:** Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy. Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing

**UNIT III:**

**Cybercrime: Mobile and Wireless Devices:** Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops

**UNIT IV:**



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**Cyber Security: Organizational Implications:** Introduction cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations. **Cybercrime and Cyber terrorism:** Introduction, intellectual property in the cyberspace, the ethical dimension of cybercrimes the psychology, mindset and skills of hackers and other cyber criminals.

**UNIT V:**

Privacy Issues: Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains- medical, financial, etc.

**Text Books:**

1. Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley
2. B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335, 2018.

**Reference Books:**

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security, Chwan-Hwa(john) Wu,J. David Irwin, CRC Press T&F Group



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		3	0	0	3
<b>4098222280</b>	<b>MOOCS-1</b> <b>(Professional Elective-III)</b>				



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		3	0	0	3
<b>4098222234</b>	<b>DATA SCIENCE USING PYTHON</b> <b>(Professional Elective-IV)</b>				

**Course Objectives:**

- To provide the basic knowledge of data science.
- To learn the essential concepts of data analytics and data visualization using python

**Course Outcomes (Cos):** At the end of the course, student will be able to

- Recognize and understand the significance of data science.
- Explain how data is collected, managed and stored for data science.
- Able to understand the features of Numpy library for analyzing the data. Make use of various file formats in loading and storage of data.
- Analyze Data using various Visualization techniques.

**UNIT-I:**

**About Data Science:** Computer Science, Data Science, and Real Science, Asking Interesting Questions from Data, Properties of Data, Classification and Regression, Data Science Television: The Quant Shop, Kaggle Challenges.

**UNIT II:**

**Data Munging:** Languages for Data Science, Collecting Data, Cleaning Data, Crowd sourcing (Text Book 1) Gradient Descent, Getting and working with data (Text book 2)

**UNIT III:**

**NumPy Basics:** The NumPy Nd array: A Multidimensional Array Object, Creating ndarrays, Data Types for ndarrays, Operations between Arrays and Scalars, Basic Indexing and Slicing, Boolean Indexing, Fancy Indexing, Data Processing Using Arrays, Expressing Conditional Logic as Array Operations, Methods for Boolean Arrays , Sorting , Unique.(Text Book 3)

**UNIT-IV:**

**Getting Started with pandas:** Introduction to pandas, Library Architecture, Features, Applications, Data Structures, Series, Data Frame, Index Objects, Essential Functionality Reindexing, Dropping entries from an axis, Indexing, selection, and filtering, Sorting and ranking, Summarizing and Computing Descriptive Statistics, Unique Values, Value Counts, Handling Missing Data, filtering out missing data.(Text Book 3)

**UNIT- V:**

Visualizing Data: Exploratory Data Analysis, Developing a Visualization Aesthetic, Chart Types, Great Visualizations Mathematical Models: Philosophies of Modeling, A Taxonomy of Models, Baseline Models, Evaluating Models, Evaluation Environments. (Text Book 1)



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**Plotting and Visualization:** A Brief matplotlib API Primer, Figures and Subplots, Colors, Markers, and Line Styles, Ticks, Labels, and Legends, Annotations and Drawing on a Subplot, Saving Plots to File, Plotting Functions in pandas, Line Plots, Bar Plots, Histograms and Density Plots, Scatter Plots. (Text Book 3)

**Activity:** Apply various plotting techniques using matplotlib for any case study.

**Text Books:**

1. The Data Science Design Manual, Steven S. Skiena, Springer 2017.
2. Data Science from Scratch First Edition, Joel Grus April 2015
3. Wes McKinney, —Python for Data Analysis,O'REILLY, ISBN:978-1-449-31979-3,1st edition, October 2012.
4. RachelSchutt & O'neil, —Doing Data Science, O'REILLY, ISBN: 978-1-449-35865-5, 1st edition, October 2013.

**Reference Books:**

1. Matt Harrison, —Learning the Pandas Library: Python Tools for Data Munging, Analysis, and Visualization, O'Reilly, 2016.
2. NumPy v1.20 Manual.



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		3	0	0	3
<b>4098222235</b>	<b>Principles and Practices of Management (Professional Elective-III)</b>				

**Course Description:**

This course presents the principles, techniques, and concepts needed for managerial analysis and decision-making. It highlights the effective management of planning, organizing, influencing, and controlling related to the internal and external environment and issues of ethics and social responsibility and aims at ensuring the overall efficiency of the business. Management principles provide guidelines as to how tasks are to be completed for increased efficiency.

**Course Outcomes (Cos):** At the end of the course, student will be able to

- Understand the basic functions of management and its role in business.
- To understand the decision making process, SWOT of business organization
- To able to know the directing skills and controlling techniques of business.
- To Understand the coordination its importance in the business

**UNIT-I:**

**MANAGEMENT:** Definition, nature, purpose and scope of management - Functions and Roles of a manager - an overview of planning, organizing and controlling - Is managing a science or art? Ethics in managing and social responsibility of managers - Evolution of management thought. Various approaches to Management - Decision Theory approach. Systems Approach

**UNIT-II: PLANNING & DECISION MAKING:** Types of plans, steps in planning, and process of planning. Nature of objectives, setting objectives. Concept and process of Managing by Objectives(MBO). Strategic planning process. SWOT analysis, Portfolio matrix, premising and forecasting. **Decision Making:** Meaning, Importance and steps in Decision Making - Traditional approaches to decision-making.

**UNIT-III:**

**ORGANIZING:** Concept of organization, process of organizing, bases of Departmentation, Authority& power - concept & distinction. Various types of organization structures -Delegation - concept of delegation; elements of delegation - authority, responsibility, accountability. Reasons for failure of delegation & how to make delegation effective. Decentralization - concept, reasons for decentralization. Span of Management - concept, early ideas on span of management.

**UNIT-IV:**

**DIRECTING:** Motivation and Motivators: Concept, Theories of Motivation: Hierarchy of Needs, Motivation-Hygiene Expectancy, Equity, Reinforcement, McClelland's needs - Leadership: Meaning, Definition, – Trait Approaches of Leadership – Leadership Behavior and Styles – Contingency Approaches to Leadership – Communication: Meaning, Process, and Importance in Functions of Organization – Barriers in Communication – Effective Communication.



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**UNIT-V:**

**CO-ORDINATION AND CONTROL:** Concept and importance of coordination; techniques or methods to ensure effective coordination. Control: Concept, planning-control relationship, process of control - setting objectives, establishing standards, measuring performance, correcting deviations. Dimensions or Types of Control: Feed forward control, Concurrent Control (Real Time Information & Control), Feedback Control - Techniques of Control: Brief review of Traditional and Modern Techniques of Control.

**Text Books:**

1. Stoner, Freeman and Gilbert, "Jr. Management", 6th Edition, Pearson Education, New Delhi, 2006.
2. Heinz Weihrich, Harold Koontz, "Management A Global Perspective", 10th Edition, Tata McGraw Hill, 2007.

**Reference Books:**

1. Harold Koontz, Heinz Weihrich, A. R. Aryasri, Principles of Management, TMH, 2010.
2. Dilip Kumar Bhattacharya, Principles of Management, Pearson, 2012.
3. Kumar, Rao, Chhaill — Introduction to Management Science Cengage Publications, New Delhi
4. V .S. P. Rao, Management Text and Cases, Excel, Second Edition, 2012.
5. K. Anbuvelan, Principles of Management, University Science Press, 2013.
6. K .Aswathappa — Organisational Behaviour-Text, Cases and Games, Himalaya Publishing House, New Delhi, 2008.
7. Steven L Mc Shane, Mary Ann Von Glinow, Radha R Sharma: —Organisational Behaviour, TMH Education, New Delhi, 2008
8. Daft, "The New Era of Management", 7th Edition, Thomson New Delhi, 2007.
9. "Schermerhorn: Management", 8th, Wiley India, 2006.



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		3	0	0	3
<b>4098222236</b>	<b>SOFTWARE QUALITY ASSURANCE (Professional Elective-IV)</b>				

**Course Overview:**

This course explores the activities and the challenges faced by test managers and how these challenges can be handled. This course explore topics for understanding the reasons for testing at several points during development. The course will explore the usage of automated tools. Definitions and theory is mostly based on industry accepted quality and testing practices.

**Course Objectives:**

- Describe approaches to quality assurance
- Understand quality models
- Evaluate the system based on the chosen quality model

**Course Outcomes:**

- Upon Completion of the course, the students will be able to
- Describe different approaches to testing software applications
- Analyze specifications and identify appropriate test generation strategies
- Develop an appropriate test design for a given test object

**Unit-I: Introduction:**

The Software Quality Challenge. What is Software Quality?

Software Quality Factors: The Components of the Software Quality Assurance System - Overview Pre-Project Software Quality Components

**Unit-II: SQA Components in the Project Life Cycle**

Integrating Quality Activities in the Project Life Cycle, Reviews Software Testing - Strategies Software Testing –Implementation, Assuring the Quality of Software Maintenance

**Unit-III: Software Quality Infrastructure Components**

Procedures and Work Instructions. Supporting Quality Devices Staff Training, Instructing and Certification. Preventive and Corrective Actions.

**Software Quality Management Components**

Project Progress Control: Software Quality Metrics, Software Quality Costs



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**Unit-IV: Standards, Certification and Assessment:** SQA Standards ISO 9001 Certification Software, Process Assessment, SEI CMM.

**Unit-V: Organizing for Quality Assurance**

Management and its Role in Quality Assurance, The Software Quality Assurance.

**Text Books:**

1. Software Quality Assurance, Theory of implementation-Daniel Galin, Pearson
2. Mauro Pezze and Michal Young, "Software Testing and Analysis. Process, Principles, and Techniques", John Wiley 2008

**Reference Books:**

1. Boriz Beizer, "Software Testing Techniques", 2nd Edition, DreamTech, 2009.
2. Aditya P. Mathur, "Foundations of Software Testing", Pearson, 2008
3. Mauro Pezze and Michal Young, "Software Testing and Analysis. Process, Principles, and Techniques", John Wiley 2008
4. Stephen H. Kan, "Metrics and Models in Software Quality Engineering", 2nd Edition, Pearson, 2003
5. Kshirasagar Naik and PriyadarshiTripathy (Eds), "Software Testing and Quality Assurance: Theory and Practice", John Wiley, 2008



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		3	0	0	3
<b>4098222237</b>	<b>BLOCKCHAIN TECHNOLOGIES</b> <b>(Professional Elective-IV)</b>				

**Course Objectives:**

- Impart strong technical understanding of Blockchain technologies
- Develop familiarity of current technologies, tools, and implementation strategies
- Introduce application areas, current practices, and research activity

**Course Outcomes (Cos):** At the end of the course, student will be able to

- Demonstrate the foundation of the Block chain technology and understand the processes in payment and funding.
- Identify the risks involved in building Block chain applications.
- Review of legal implications using smart contracts.
- Choose the present landscape of Block chain implementations and Understand Crypto currency markets.
- Examine how to profit from trading crypto currencies.

**UNIT I:**

The consensus problem, Asynchronous Byzantine Agreement, AAP protocol and its analysis, Nakamoto Consensus on permission-less, nameless, peer-to-peer network, Abstract Models for BLOCKCHAIN, GARAY model, RLA Model, Proof of Work (PoW) as random oracle, formal treatment of consistency, liveness and fairness - Proof of Stake (PoS) based Chains, Hybrid models (PoW + PoS).

**UNIT II:**

cryptographic basics for cryptocurrency, A short overview of Hashing, signature schemes, encryption schemes and elliptic curve cryptography

**UNIT III:**

Bitcoin, Wallet, Blocks, Merkle Tree, hardness of mining, transaction verifiability, anonymity, forks, double spending, mathematical analysis of properties of Bitcoin.

**UNIT IV:**

Ethereum: Ethereum Virtual Machine (EVM), Wallets for Ethereum, Solidity, Smart Contracts, some attacks on smart contracts

**UNIT V:**

(Trends and Topics): Zero Knowledge proofs and protocols in Blockchain, Succinct non interactive argument for Knowledge (SNARK), pairing on Elliptic curves ,Zcash.



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**Text Books:**

- 1) Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016. (Free download available)

**Reference Books:**

- 3) Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoin and cryptocurrency, IEEE Symposium on security and Privacy, 2015 (article available for free download) {curtain raiser kind of generic article, written by seasoned experts and pioneers}.
- 4) J.A.Garay et al, The bitcoin backbone protocol - analysis and applications EUROCRYPT 2015 LNCS VOI 9057, ( VOLII ), pp 281-310. (Also available at [eprint.iacr.org/2016/1048](http://eprint.iacr.org/2016/1048)). (serious beginning of discussions related to formal models for bitcoin protocols).
- 5) R.Pass et al, Analysis of Blockchain protocol in Asynchronous networks , EUROCRYPT 2017, ( [eprint.iacr.org/2016/454](http://eprint.iacr.org/2016/454) ) . A significant progress and consolidation of several principles).



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		3	0	0	3	
<b>4098222281</b>	<b>MOOCS-2</b> <b>(Professional Elective-III)</b>					



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		0	0	0	12
<b>4098222270</b>	<b>PROJECT</b>				