



Department of Computer Science & Engineering
University College of Engineering Kakinada(A), JNTU Kakinada

Academic Regulations

(R23) Course Structure & Syllabi

for

Two Year PG Programme

in

M. Tech.
(Computer Science and Engineering)

(Applicable for batches admitted from A.Y. 2019 - 20)



Department of Computer Science & Engineering
University College of Engineering Kakinada(A), JNTU Kakinada

VISION OF THE INSTITUTE

To be a premier institute of excellence developing highly talented holistic human capital that contributes to the nation through leadership in technology and innovation through engineering education.

MISSION OF THE INSTITUTE

1. To impart Personnel Skills and Ethical Values for Sustainable Development of the Nation.
2. To create Research & Industry oriented centers of excellence in all engineering disciplines.
3. To be a renowned IPR generator and repository for innovative technologies.
4. To develop Research and Industry oriented technical talent
5. To benchmark globally the academic & research output.



Department of Computer Science & Engineering
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VISION OF THE DEPARTMENT

Department of Computer Science and Engineering strives rigorously to impart intellectual environment with global standards that fosters the search for new knowledge in a highly dynamic computing-centric society through research & applied efforts.

MISSION OF THE DEPARTMENT

- To provide quality education in both theoretical and applied foundations of computer science and train the students to solve the real world problems effectively thus enhancing their potential for high quality careers.
- To facilitate the students and faculty to inculcate the research culture to advance the state art of computer science and integrate research innovations in multi- disciplinary fields.
- To equip student / faculty with excellent teaching learning capabilities through advanced learning tools and technologies.
- To produce students with critical thinking and lifelong learning capabilities to apply their knowledge to uplift the living standards of the society.
- To produce students with enriched skill set, professional behavior, strong ethical values and leadership capabilities so as to work with commitment for the progress of the nation.



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Programme Education Objectives (PEOs)

After completion of M.Tech (CSE) course students will become

Programme Educational Objectives

- PEO 1 To Empower Critical thinking and Innovative research In core and Multidisciplinary areas to solve real word problems through life-long learning skills.
- PEO 2 Augment Technological competence and self-learning capabilities and become adaptable computer science professionals in Academics, Research and Industry.
- PEO 3 Exposure to emerging technologies to handle complex challenges adhering to social ,legal and ethical responsibilities

Mapping of Mission Statements to PEOs:

Key components from Department Mission	PEO 1	PEO 2	PEO 3
Quality education	High	Medium	Medium
Research	High	Medium	Low
Teaching-Learning	Medium	Low	High
Sustained Learning	High	High	Medium
Social Responsibility with Ethics	High	Medium	Low



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Programme Outcomes (POs)

After completion of M.Tech (CSE) course students will attain the following programme outcomes

Programme Outcomes

PO1	An ability to independently carryout research / investigation & development work to solve practical problems.
PO2	An ability to work and present a substantial technical report / document.
PO3	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be a level higher than the requirements in the appropriate bachelor program.
PO4	Explore, select, learn and apply Mathematical foundations, algorithms, databases, networking and computer science principles in modeling and designing computing systems.
PO5	Ability to update skills with enhanced computing technologies for attaining professional excellence and serve in the Academia/Industry.
PO6	Apply state of the art computer science tools and techniques for solving engineering/societal problems by following ethical practices.



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UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (A)
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
(Established by Andhra Pradesh Act No.30 of 2008)

Kakinada – 533 003, Andhra Pradesh (India)

ACADEMIC REGULATIONS R23 FOR M. Tech (REGULAR) DEGREE
COURSE

Applicable for the students of M. Tech (Regular) Course from the Academic Year 2023-24 onwards. The M. Tech Degree of Jawaharlal Nehru Technological University Kakinada shall be conferred on candidates who are admitted to the program and who fulfill all the requirements for the award of the Degree.

1.0 ELIGIBILITY FOR ADMISSIONS

Admission to the above program shall be made subject to eligibility, qualification and specialization as prescribed by the University from time to time.

Admissions shall be made on the basis of merit/rank obtained by the candidates at the qualifying Entrance Test conducted by the University or on the basis of any other order of merit as approved by the University, subject to reservations as laid down by the Govt. from time to time.

2.0 AWARD OF M. Tech DEGREE

2.1 A student shall be declared eligible for the award of the M. Tech Degree, if he pursues a course of study in not less than two and not more than four academic years.

2.2 The student shall register for all 68 credits and secure all the 68 credits.

2.3 The minimum instruction days in each semester are 90.

3.0 A. PROGRAMMES OF STUDY

The following specializations are offered by various departments at present for the M. Tech Programme of study.

Department	Programme
Civil Engg.	1. M.Tech- Structural Engineering 2. M. Tech- Soil Mechanics and Foundation Engineering 3. M.Tech-Water Resource Engineering (UA)
EEE	1. M.Tech- High Voltage Engineering 2. M.Tech- Advanced Electrical Power System 3. M.Tech- Power Electronics and Drives



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ME	1. M.Tech- CAD/CAM 2. M.Tech- Machine Design 3. M.Tech-Thermal Engineering
ECE	1. M.Tech- Computer and Communication 2. M.Tech- VLSI and Embedded Systems 3. M.Tech- Instrumentation and Control Engineering (UA)
CSE	1. M.Tech- Computer Science and Engineering 2. M.Tech- Artificial Intelligence and Machine Learning 3. M.Tech-Cyber Security

4.0 ATTENDANCE

- 4.1 The faculty handling the course will finalise the attendance as per schedule / before the last instructional day of the course and submit to the Principal through the head of the department.
- 4.2 A student with less than 75% of consolidated attendance (and/or less than 50% in each **and every course**), **will not be permitted to appear for the end- semester examinations, irrespective of the reason for the shortfall of the attendance. Further, a student with less than 75% of attendance in Dissertation Phase-2 (IV Semester) will not be permitted to submit his project work.**
- 4.3 The student is however permitted to avail Academic/Medical Leave/ NCC / NSS / Cultural / Sports/ Minor Medical exigencies etc., up to 10% for attending academic related activities like, Industrial Visits, Seminars, Conferences, Competitions etc., with the prior approval of the HoD. After the event, the student should submit the relevant documents for proof to the HoD for approval of the Academic Leave.
- 4.4 **Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%, and minimum of 50% in each and every course including laboratory, Dissertation phase-1, Dissertation Phase-2) for a maximum of **ONE time** shall be granted by the College Academic Committee. A prescribed fee shall be payable towards condonation of shortage of attendance.**
- 4.5 Shortage of Attendance below 65% in aggregate shall not be condoned and not eligible to write their end semester examination of that class.
- 4.6 A student shall not be promoted to the next semester unless he satisfies the attendance requirement of the present semester, as applicable. They may seek readmission into that semester when offered next.
- 4.7 If any candidate fulfills the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.



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5.0 EVALUATION

The performance of the candidate in each semester shall be evaluated subject-wise, with a maximum of 100 marks for theory and 100 marks for practical's, on the basis of Internal Evaluation and End Semester Examination.

5.1 For the theory subjects 60 marks shall be awarded based on the performance in the End Semester Examination and 40 marks shall be awarded based on the Internal Evaluation. The weightage of Internal marks for 40 consists of Descriptive – 32 and Assignment – 08 (open book exam). Descriptive exam shall be conducted for a total duration of 120 minutes with 4 questions (without choice) each question for 8 marks. The descriptive examination conducted for 32 marks are to be added to the assignment 8 marks for finalizing internal marks for 40. The internal evaluation shall be made based on the average of the marks secured in the two Mid Term-Examinations conducted-one in the middle of the Semester and the other immediately after the completion of instruction. Semester End Exam Paper containing FIVE mandatory questions (one question from one unit) with internal choice, each carrying 12 marks gives for 60marks.

5.2 For practical subjects, 60 marks shall be awarded based on the performance in the End Semester Examinations and 40 marks shall be awarded as internal marks, based on the day to day work-10 marks, Record-10 marks and the remaining 20 marks to be awarded by conducting an internal laboratory test. The end examination shall be conducted by the examiners, with a breakup marks of Procedure-15, Experimentation-25, Results-10 ,Viva-voce-10.

5.3 For **Mini Project with seminar**, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the department in a report form and shall make an oral presentation before the Project Review Committee consisting of Head of the Department, Supervisor and two other senior faculty members of the department. For Mini Project with seminar, there will be only internal evaluation of 100 marks. A candidate has to secure a minimum of 50% of marks to be declared successful. Out of 100 marks, supervisor awards 40% marks and remaining 60% marks are awarded by the project review committee.

5.4 A candidate shall be deemed to have secured the minimum academic requirement in a subject if he secures a minimum of



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40% of marks in the End semester Examination and a minimum aggregate of 50% of the total marks in the End Semester Examination and Internal Evaluation taken together. **For integrated courses, student should secure the minimum academic requirements in both theory and practical together.**

- 5.5 In case the candidate does not secure the minimum academic requirement in any subject (as specified in 5.4) he has to reappear for the End semester Examination in that subject. A candidate shall be given a 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 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 stand cancelled. For re-registration the candidates have to apply to the college by paying the requisite fees before the start of the semester in which re-registration is required.
- 5.6 In case the candidate secures less than the required attendance in any re registered subject (s), he shall not be permitted to write the End Examination in that subject. He shall again re-register the subject when next offered.
- 5.7 Laboratory examination for M. Tech. programmes must be conducted with two Examiners, one of them being the Laboratory Class Teacher or teacher from the same **department and the second examiner shall be appointed by the Principal from the panel of examiners submitted by the respective HoD.**
- 5.8 Student is allowed to register for 12 week SWAYAM / NPTEL MOOC courses (recommended by HoD/BoS) and can obtain required credits during II Semester itself. In any case, if a student fails in obtaining credits, he is allowed to repeat the initially opted course / change to another MOOC course or regular course and will be considered as regular candidate only. After successful completion, by end of III/IV Semester, he needs to submit the course certificate (through HoD) to the exam section to perform credit transfer.
- In addition to credit courses, for completing the programme and obtaining degree, a student needs to complete audit courses. Audit courses will be conducted, evaluated as normal credit courses, and the assessment will be graded as Pass/Fail.



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5.9 Students shall undergo mandatory summer internships (2 credits) for a minimum of eight weeks duration at the end of second semester of the Programme/Summer Break. A student will be required to submit a summer internship report to the concerned department and appear for an oral presentation before the committee. The Committee comprises of Head of the Department and two faculty. The report and the oral presentation shall carry 40% and 60% weightages respectively. For internship, there will be only internal evaluation of 100 marks. A candidate has to secure a minimum of 50% of marks to be declared successful.

6.0 EVALUATION OF PROJECT/DISSERTATION (Phase-I and II):

Every candidate shall be required to submit a thesis or dissertation on a topic approved by the Project Review Committee.

- 6.1 A Project Review Committee (PRC) shall be constituted with Head of the Department and two other senior faculty members in the department.
- 6.2 Registration of Dissertation / Project Work: The work on the project shall be initiated at the beginning of the II year and the duration of the project is two semesters.
- 6.3 A candidate has to submit, in consultation with his project supervisor, the title, objective and plan of action of his project work (published base paper(s) / real time project / industry oriented) for approval. The student can initiate the Project work, only after obtaining the approval from the Project Review Committee (PRC).
- 6.4 If a candidate wishes to change his supervisor or topic of the project, he can do so with the approval of the Project Review Committee (PRC). However, the Project Review Committee (PRC) shall examine whether or not the change of topic/supervisor leads to a major change of his initial plans of project proposal. If yes, his date of registration for the project work starts from the date of change of Supervisor or topic as the case may be.
- 6.5 A candidate shall present seminar on his project work status in two stages at least with a gap of THREE months between them. If the candidate is absent to any seminar, he should again attend to seminar within two weeks by providing proper evidence to the Project Review Committee for earlier absence to the seminar.**
- 6.6 A candidate is permitted to submit Project Thesis (Dissertation) only after successful completion of theory and practical course **with the approval of PRC** not earlier than 40 weeks from the



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date of registration of the project work.

6.7 Continuous assessment of Dissertation-I and Dissertation-II during the Semester will be monitored by the PRC.

6.8 There will be pre-submission seminar at the end of academic term. **After the approval the student has to submit the detail report.**

6.9 The Candidate may be permitted to submit the Project Report If only the work is Published/Accepted to be Published in a National or International Journal / conference of reputed and relevance.

6.10 Three copies of the Project Thesis certified by the supervisor shall be submitted to the College along with plagiarism report (<40%).

6.11 The thesis shall be adjudicated by one examiner selected by the Principal, from the panel of 5 examiners, eminent in that field, submitted by the guide concerned and head of the department.

6.12 If the report of the examiner is not favorable, the candidate shall revise and resubmit the Thesis, in the time frame as decided by the PRC. If the report of the examiner is unfavorable again, the thesis shall be summarily rejected. The candidate has to re-register for the project and complete the project within the stipulated time after taking the approval from the Principal.

6.13 If the report of the examiner is favorable, Viva-Voce examination shall be conducted by a board consisting of the Supervisor/ Internal examiner, Head of the Department and the examiner who adjudicated the Thesis. The Board shall jointly report the candidate's work for a maximum of 100 Marks. **Out of 100 marks, supervisor awards 40 marks and remaining 60 marks are awarded by the board.**

6.14 The Head of the Department shall coordinate and make arrangements for the conduct of Viva-Voce examination.

6.15 If the report of the Viva-Voce is unsatisfactory (i.e., <50 marks), the candidate shall retake the Viva-Voce examination only after three months. If he fails to get a satisfactory report at the second Viva-Voce examination, the candidate has to re-register for the project and complete the project within the stipulated time after taking the approval from the Institution.



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7.0 Cumulative Grade Point Average (CGPA)

Marks Range (Max – 100)	Letter Grade	Level (G)	Grade Point
≥ 90	>90	Outstanding (O)	10
≥80 to <90	90-80	Excellent (S)	9
≥70 to <80	80-70	Very Good (A)	8
≥60 to <70	70-60	Good (B)	7
≥50 to <60	60-50	Fair (C)	6
<50	<50	Fail (F)	0
		Absent	0

Computation of SGPA

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

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 **SGPA (Si) = $\sum (Ci \times Gi) / \sum Ci$**

Where Ci is the number of credits of the ith course and Gi is the grade point scored by the student in the ith 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 semester of a programme, i.e. **CGPA = $\sum (Ci \times Si) / \sum Ci$**

Where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester. The SGPA and CGPA shall be rounded off to TWO decimal points and reported in the transcripts.

8.0 AWARD OF DEGREE AND CLASS

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



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Class Awarded	CGPA to be secured	From the CGPA secured from 68 Credits.
First Class with Distinction	≥ 7.75 without backlog history	
First Class	≥ 6.75	
Second Class	≥ 5.75 to < 6.75	

The secured grade, grade points, status and credits obtained will be shown separately in the memorandum of marks.

WITHHOLDING OF RESULTS

If the student has not paid the dues, if any, 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.

9.0 TRANSITORY REGULATIONS

- 9.1 Discontinued or detained candidates are eligible for re-admission into same or equivalent subjects at a time as and when offered.

10. GENERAL

- 10.1 Wherever the words “he”, “him”, “his”, occur in the regulations, they include “she”, “her”, “hers”.
- 10.2 The academic regulation should be read as a whole for the purpose of any interpretation.
- 10.3 In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.
- 10.4 The College may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the College.



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MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/ Improper conduct	Punishment
	<i>If the candidate:</i>	
1. (a)	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)	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	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.



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3.	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 practical and project work) already appeared and shall not be allowed to appear for Examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all External 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.	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 External examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	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.



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6.	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-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.	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 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.	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 External examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.



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8.	Possess 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.	<p>Student of the colleges 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.</p> <p>Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.</p>
10.	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.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.	



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Examination Branch
Appointment of Subject Expert for QP Setting

From
01.10.2023.
Dr U V Ratna Kumari
Vice-Principal

Date:

To

I am advised to inform you that you are appointed as subject expert to set the question paper(s) as per the details noted below. You are requested to set the question paper(s) in MS word document format and send a soft copy oiel.ucek@jntucek.ac.in. The hard copies of the question paper(s) shall be sent along with the remuneration bill.

You are requested to set the Question Paper(s) by following OBE pattern, as per the revised Bloom's Taxonomy herewith enclosed. Keep this appointment strictly confidential.

1. You are requested to prepare a balanced question paper within the prescribed syllabus covering the entire syllabus. The duration of the examination is **3-hours** and you are requested to prepare the questions in such a way that student must be able to answer each question for about 35-45 minutes time.
2. It is informed that the question paper covering the topics of all FIVE units for 60 marks. Also the question paper shall be set as per the format enclosed, containing ten main questions (two from each unit) over FIVE-units of syllabus with internal choice and **12marks** for each question. The main question shall contain sub questions like 1(a), 1(b) etc.
3. The student has to answer FIVE mandatory questions (One question from one unit).
4. The requirement of data books, codes, graphs etc. may please be indicated on the questionpaper.
5. You are requested to give the distribution of the marks for each question.
- 6. You are requested not to reproduce questions from previous question papers.**
7. Remuneration for setting of one question paper for M.Tech(PG) programme is **Rs. 1,200/-** per set.
8. You are requested to confirm your acceptance through e-mail.

You are requested to reject the offer and intimate the same to the Vice Principal, if any of your relatives are writing the examination or if you are involved in any extra assignment in any tutorial/coaching centers. Please send the question paper in the enclosed model (model is attached for reference).



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Question Paper Details		R19 OBE Pattern			
Course	M.Tech (PG)	Question No.	Unit/CO's	Bloom's Taxonomy Level	Marks
Name of the Examination	I-M.Tech, I-Sem (R23) Regular End Exams, Dec-2023	I	U1/CO1	L2/L3/L4	12
Subjects	XXXXXXXX	II	U2/CO2	L2/L3/L4	12
Branch	XXXXXXXXXX	III	U3/CO3	L2/L3/L4	12
No of Question Paper Sets	1 (Ono)	IV	U4/CO4	L2/L3/L4	12
Last Date for submission	14/11/2023	V	U5/CO5	L2/L3/L4	12

Note: U1: Unit 1, CO1: Course Outcome 1

L1: Level 1(Bloom's Cognitive Level) L2: Understanding Level; L3: Apply Level; L4: Analyze Level.

VICE-PRINCIPAL



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Course Code:

R23

University College of Engineering Kakinada
(Autonomous)
Jawaharlal Nehru Technological University Kakinada
() B. Tech. () Semester (R23) Regular Examinations, ()

COURSE NAME
(NAME OF BRACH)

Time: 3 hrs.

Max Marks: 70

Answer all five questions

5X14=70

Q.No	Question	Marks	CO	BL
UNIT-1				
1(a)				
1(b)				
(OR)				
2(a)				
2(b)				
UNIT-2				
3(a)				
3(b)				
(OR)				
4(a)				
4(b)				
UNIT-3				
5(a)				
5(b)				
(OR)				
6(a)				
6(b)				
UNIT-4				



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7(a)				
7(b)				
(OR)				
8(a)				
8(b)				
UNIT-5				
9(a)				
9(b)				
(OR)				
10(a)				
10(b)				

Note: CO: Course Outcome, BL: Bloom's Cognitive Level;



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REVISED Bloom's Taxonomy Action Verbs

Definitions	I. Remembering	II. Understanding	III. Applying	IV. Analyzing	V. Evaluating	VI. Creating
Bloom's Definition	Exhibit memory of previously learned material by recalling facts, terms, basic concepts, and answers.	Demonstrate understanding of facts and ideas by organizing, comparing, translating, interpreting, giving descriptions, and stating main ideas.	Solve problems to new situations by applying acquired knowledge, facts, techniques and rules in a different way.	Examine and break information into parts by identifying motives or causes. Make inferences and find evidence to support generalizations.	Present and defend opinions by making judgments about information, validity of ideas, or quality of work based on a set of criteria.	Compile information together in a different way by combining elements in a new pattern or proposing alternative solutions.
Verbs	<ul style="list-style-type: none"> Choose Define Find How Label List Match Name Omit Recall Relate Select Show Spell Tell What When Where Which Who Why 	<ul style="list-style-type: none"> Classify Compare Contrast Demonstrate Explain Extend Illustrate Infer Interpret Outline Relate Rephrase Show Summarize Translate 	<ul style="list-style-type: none"> Apply Build Choose Construct Develop Experiment with Identify Interview Make use of Model Organize Plan Select Solve Utilize 	<ul style="list-style-type: none"> Analyze Assume Categorize Classify Compare Conclusion Contrast Discover Dissect Distinguish Divide Examine Function Inference Inspect List Motive Relationships Simplify Survey Take part in Test for Theme 	<ul style="list-style-type: none"> Agree Appraise Assess Award Choose Compare Conclude Criteria Criticize Decide Deduct Defend Determine Disprove Estimate Evaluate Explain Importance Influence Interpret Judge Justify Mark Measure Opinion Perceive Prioritize Prove Rate Recommend Rule on Select Support Value 	<ul style="list-style-type: none"> Adapt Build Change Choose Combine Compile Compose Construct Create Delete Design Develop Discuss Elaborate Estimate Formulate Happen Imagine Improve Invent Make up Maximize Minimize Modify Original Originate Plan Predict Propose Solution Solve Suppose Test Theory



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M. Tech. (CSE) I SEMESTER							
S.No	Course Code	Courses	Category	L	T	P	C
1	R23MCS1151	Program Core-1 1. High Performance Computing 2. Mathematical Foundations of Computer Science	PC	3	0	0	3
2	R23MCS1152	Program Core-2 (Integrated Course- Theory & Laboratory Course) 1. Deep Learning 2. Advanced Data Structures & Algorithms.	PC	3	0	3	4.5
3	R23MCS1153	Program Elective-1 1. Computer Vision 2. Social Media Analytics 3. Elliptic Curve and Quantum Cryptography 4. Advanced Databases and Mining 5. Digital Image Processing 6. Advanced Operating Systems	PE	3	0	0	3
4	R23MCS1154	Program Elective-2 1. Internet of Things 2. Block Chain Technologies 3. Service Oriented Architecture 4. Advanced Software Engineering 5. Advanced Compiler Design 6. Advanced Computer Networks	PE	3	0	0	3
5	R23MCS1155	Research Methodology and IPR	CC	2	0	0	2
6	R23MCS1156	Laboartory-1 Software Lab-1	LB	0	0	3	1.5
7	R23MCS1157	Audit Course-1 1. English for Research Paper Writing 2. Disaster Management 3. Sanskrit for Technical Knowledge 4. Value Education	AC	2	0	0	0
Total Credits							17



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M. Tech. (CSE) II SEMESTER							
S.No	Course Code	Courses	Category	L	T	P	C
1	R23MCS1251	Program Core-3(Integrated Course-Theory & Laboratory Course) DevOps MEAN Stack Technologies	PC	3	0	3	4.5
2	R23MCS1252	Program Core-4 Reinforcement Learning Machine Learning	PC	3	0	0	3
3	R23MCS1253	Program Elective-3 1. Natural Language Processing 2. Cyber Security 3. Agile technologies 4. Big Data Analytics 5. Full Stack Technologies 6. Soft Computing	PE	3	0	0	3
4	R23MCS1254	Program Elective-4 1. Robotic Process Automation 2. Medical Image Data Analysis 3. Design of Secure Protocols 4. Cloud Computing 5. Information Security 6. Software Reliability	PE	3	0	0	3
5	R23MCS1255	Laboratory-2 Software Lab-2 (Experiments covering Program Core 4)	LB	0	0	3	1.5
6	R23MCS1256	Mini Project with Seminar	MP	2	0	0	2
7	R23MCS1257	Audit Course-2 1. Constitution of India 2. Pedagogy Studies 3. Stress Management by Yoga 4. Personality Development through Life Enlightenment Skills	AC	2	0	0	0
Total Credits							17

**Students are encouraged to go to Industrial Training/Internship for at least 2-3 months during semester break*



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M. Tech. (CSE) III SEMESTER							
S.No	Course Code	Courses	Category	L	T	P	C
1	R23MCS2351	Program Elective-5 1. Biometric Security 2. Mining Massive Data Sets 3. Generative AI 4. Software Defined Networks 5. Game Theory 6. Randomized and Approximation Algorithms / MOOCs-1 (12 week NPTEL / SWAYAM course)	PE	3	0	0	3
2	R23MCS2352	Open Elective 1. MOOCs-2 (12 week NPTEL / SWAYAM course) 2. A Course offered by other departments	OE	3	0	0	3
3	R23MCS2353	Internship (During II Sem to III Sem / Summer break in I Year - TWO months internship)					2
4	R23MCS2354	Dissertation-I/ Industrial Project	PJ	0	0	20	10
Total Credits							18

**Students going for Industrial Project/Thesis will complete these courses through MOOCs*

M. Tech. (CSE) IV SEMESTER							
S.No	Course Code	Courses	Category	L	T	P	C
1	R23MCS2451	Dissertation-II	PJ	0	0	32	16
Total Credits							16

Open Electives offered by the Department of CSE

1. Python Programming
2. Management Information System
3. Principles of Cyber Security
4. Internet of Things
5. Artificial Intelligence and Machine Learning



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I Year - I Semester	High Performance Computing (R23MCS1151)	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of the course is to study parallel computing hardware and programming models, performance analysis and modeling of parallel programs

Course Outcomes:

On completion of the course, student will be able to–

- Describe different parallel architectures, inter-connect networks, programming models
- Develop an efficient parallel algorithm to solve given problem
- Analyze and measure performance of modern parallel computing systems
- Build the logic to parallelize the programming task

Unit I Introduction:

Motivating Parallelism, Scope of Parallel Computing, Parallel Programming Platforms: Implicit Parallelism, Trends in Microprocessor and Architectures, Limitations of Memory, System Performance, Dichotomy of Parallel Computing Platforms, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines, Scalable design principles, Architectures: N-wide superscalar architectures, Multi-core architecture.

Unit II Parallel Programming :

Principles of Parallel Algorithm Design: Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads, Parallel Algorithm Models, The Age of Parallel Processing, the Rise of GPU Computing, A Brief History of GPUs, Early GPU.

Unit III Basic Communication:

Operations- One-to-All Broadcast and All-to-One Reduction, All-to-All Broadcast and Reduction, All-Reduce and Prefix-Sum Operations, Scatter and Gather, All-to-All Personalized Communication, Circular Shift, Improving the Speed of Some Communication Operations.

Programming shared address space platforms: threads- basics, synchronization, OpenMP programming

Unit IV

Analytical Models: Sources of overhead in Parallel Programs, Performance Metrics for Parallel Systems, and The effect of Granularity on Performance, Scalability of Parallel Systems, Minimum execution time and minimum cost, optimal execution time. Dense Matrix Algorithms: MatrixVector Multiplication, Matrix-Matrix Multiplication.



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Unit V :

Parallel Algorithms- Sorting and Graph : Issues in Sorting on Parallel Computers, Bubble Sort and its Variants, Parallelizing Quick sort, All-Pairs Shortest Paths, Algorithm for sparse graph, Parallel Depth-First Search, Parallel BestFirst Search.

CUDA Architecture : CUDA Architecture, Using the CUDA Architecture, Applications of CUDA Introduction to CUDA C-Write and launch CUDA C kernels, Manage GPU memory, Manage communication and synchronization, Parallel programming in CUDA- C.

Text Books:

1. Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, "Introduction to Parallel Computing", 2nd edition, Addison-Wesley, 2003, ISBN: 0-201-64865-2
2. Jason sanders, Edward Kandrot, "CUDA by Example", Addison-Wesley, ISBN-13: 978-0-13-138768-3

Reference Books :

1. Kai Hwang, "Scalable Parallel Computing", McGraw Hill 1998, ISBN:0070317984
2. Shane Cook, "CUDA Programming: A Developer's Guide to Parallel Computing with GPUs", Morgan Kaufmann Publishers Inc. San Francisco, CA, USA 2013 ISBN: 9780124159884
3. David Culler Jaswinder Pal Singh, "Parallel Computer Architecture: A Hardware/Software Approach", Morgan Kaufmann,1999, ISBN 978-1-55860-343-1
4. Rod Stephens, "Essential Algorithms", Wiley, ISBN: 978-1-118-61210-1



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I Year - I Semester	Mathematical Foundations of Computer Science (R23MCS1151)	L 3	T 0	P 0	C 3
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Course Objectives: This course is aimed at enabling the students to

- 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.
- To 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.
- To study various sampling and classification problems.

Course Outcomes:

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

CO	Course Outcomes	Knowledge Level (K)#
CO1	To apply the basic rules and theorems of probability theory such as Baye's Theorem, to determine probabilities that help to solve engineering problems and to determine the expectation and variance of a random variable from its distribution.	K3
CO2	Able to perform and analyze of sampling, means, proportions, variances and estimates the maximum likelihood based on population parameters.	K4
CO3	To learn how to formulate and test hypotheses about sample means, variances and proportions and to draw conclusions based on the results of statistical tests.	K6
CO4	Design various ciphers using number theory.	K6
CO5	Apply graph theory for real time problems like network routing problem.	K3

based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1						
CO2						
CO3						
CO4						
CO5						

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT I: 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



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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 II: Sampling and Estimation Theory: Population and Sample, Statistical Inference Sampling With and Without Replacement Random Samples, Random Numbers Population Parameters Sample Statistics Sampling Distributions, Frequency Distributions, Relative Frequency Distributions, Computation of Mean, Variance, and Moments for Grouped Data. Unbiased Estimates and Efficient Estimates Point Estimates and Interval Estimates. Reliability Confidence Interval Estimates of Population Parameters, Maximum Likelihood Estimates

UNIT III: Tests of Hypothesis and Significance: Statistical Decisions Statistical Hypotheses. Null Hypotheses Tests of Hypotheses and Significance Type I and Type II Errors Level of Significance Tests Involving the Normal Distribution One-Tailed and Two-Tailed Tests P Value Special Tests of Significance for Large Samples Special Tests of Significance for Small Samples Relationship between Estimation Theory and Hypothesis Testing Operating Characteristic Curves. Power of a Test Quality Control Charts Fitting Theoretical Distributions to Sample Frequency Distributions, The Chi-Square Test for Goodness of Fit Contingency Tables Yates' Correction for Continuity Coefficient of Contingency.

UNIT IV: Algebraic Structures and Number Theory: Algebraic Systems, Examples, General Properties, Semi Groups and Monoids, Homomorphism of Semi Groups and Monoids, Group, Subgroup, Abelian Group, Homomorphism, Isomorphism. 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)

UNIT V: Graph Theory: 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, Spanning Trees, Algorithms for Spanning Trees (Problems Only and Theorems without Proofs).

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



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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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I Year - I Semester	Deep Learning (R23MCS1152)	L	T	P	C
		3	0	3	4.5

Course Objectives:

The objective of this course is to cover the fundamentals of neural networks as well as some advanced topics such as recurrent neural networks, long short term memory cells and convolutional neural networks.

Course Outcomes

After completion of course, students would be able to:

- Explore feed forward networks and Deep Neural networks
- Mathematically understand the deep learning approaches and paradigms
- Apply the deep learning techniques for various applications

UNIT I:

Basics- Biological Neuron, Idea of computational units, McCulloch–Pitts unit and Thresholding logic, Linear Perceptron, Perceptron Learning Algorithm, Linear separability, Convergence theorem for Perceptron Learning Algorithm.

UNIT II:

Feedforward Networks- Multilayer Perceptron, Gradient Descent, Backpropagation, Empirical Risk Minimization, regularization, autoencoders.

Deep Neural Networks: Difficulty of training deep neural networks, Greedy layer wise training.

UNIT III:

Better Training of Neural Networks- Newer optimization methods for neural networks (Adagrad, adadelta, rmsprop, adam, NAG), second order methods for training, Saddle point problem in neural networks, Regularization methods (dropout, drop connect, batch normalization).

UNIT IV:

Recurrent Neural Networks- Back propagation through time, Long Short Term Memory, Gated Recurrent Units, Bidirectional LSTMs, Bidirectional RNNs.

Convolutional Neural Networks: LeNet, AlexNet. Generative models: Restrictive Boltzmann Machines (RBMs), Introduction to MCMC and Gibbs Sampling, gradient computations in RBMs, Deep Boltzmann Machines.

UNIT V:

Recent trends- Variational Autoencoders

Applications: Vision, NLP, Speech

Text Books:

1. Deep Learning, Ian Good fellow and YoshuaBengio and Aaron Courville, MIT Press, 2016.

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Reference Books:

1. Neural Networks: A Systematic Introduction, Raúl Rojas, 1996
2. Pattern Recognition and Machine Learning, Christopher Bishop, 2007
3. Deep Learning with Python, François Chollet, Manning Publications, 2017

Software Packages required:

- Keras
- Tensorflow
- PyTorch

List of Experiments:

1. Implement multilayer perceptron algorithm for MNIST Hand written Digit Classification.
2. Design a neural network for classifying movie reviews (Binary Classification) using IMDB dataset.
3. Design a neural Network for classifying news wires (Multi class classification) using Reuters dataset.
4. Design a neural network for predicting house prices using Boston Housing Price dataset.
5. Build a Convolution Neural Network for MNIST Hand written Digit Classification.
6. Build a Convolution Neural Network for simple image (dogs and Cats) Classification
7. Use a pre-trained convolution neural network (VGG16) for image classification.
8. Implement one hot encoding of words or characters.
9. Implement word embeddings for IMDB dataset.
10. Implement a Recurrent Neural Network for IMDB movie review classification problem.

Text Books:

1. Reza Zadeh and Bharath Ramsundar, "Tensorflow for Deep Learning", O'Reilly publishers, 2018

References:

1. <https://github.com/fchollet/deep-learning-with-python-notebooks>



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I Year - I Semester	Advanced Data Structures & Algorithms. (R23MCS1152)	L 3	T 0	P 3	C 4.5
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Course Objectives: From the course the student will learn

- Single Linked, Double Linked Lists, Stacks, Queues, Searching and Sorting techniques, Trees, Binary trees, representation, traversal, Graphs- storage, traversal.
- Hash table representation, Hash functions, Priority queues, Priority queues using heaps, Search trees.
- AVL trees, operations of AVL trees, Red- Black trees, Splay trees, comparison of search trees.

Course Outcomes:

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

CO	Course Outcomes	Knowledge Level (K)#
CO1	Ability to write and analyze algorithms for algorithm correctness and efficiency. Demonstrate various searching, sorting techniques and be able to apply and solve problems of real life	K4
CO2	Master a variety of advanced abstract data type (ADT) and data structures like linked list, stacks and queues and their Implementation	K3
CO3	Design and implement variety of data structures including binary trees, binary search tree and AVL Tree	K5
CO4	Design and implement variety of data structures including heaps, and search trees. Ability to compare various search trees and find solutions for IT related problems and demonstrate hash techniques.	K4
CO5	Design and implement graphs.	K5

#based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1						
CO2						
CO3						
CO4						
CO5						

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT I: Introduction, Classification of Data Structure, concept of Data Types, Algorithm, importance of Algorithm Analysis, Complexity of an algorithm, Asymptotic Analysis and Notations. (Ref-1)



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Searching-Linear and Binary, Search Methods, **Sorting**-Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort. (Text-1)

UNIT II:

Singly Linked Lists, Doubly Linked Lists, Circular Lists-Algorithms.

Stacks and Queues: Algorithm Implementation using Linked Lists and its applications (Text-1)

UNIT III:

Trees- Binary trees, Properties, Representation and Traversals (DFT, BFT), Expression Trees (Infix, prefix, postfix).

Search Trees- Binary Search Trees, Definition, ADT, Implementation, **Operations**-Searching, Insertion, Deletion.

Search Trees- AVL Trees, Definition, Height of AVL Tree, Operations-, Insertion, Deletion and Searching (Text-1)

UNIT IV:

Hashing: Hash Functions, Collision Resolution-Separate Chaining, **Open Addressing**-Linear Probing, Quadratic Probing, Double Hashing.

Priority queues- Definition, Insertion, Deletion.

Introduction to Red-Black and Splay Trees, B-Trees, Comparison of Search Trees. (Text-1)

UNIT V:

Graphs-Basic Concepts, Storage structures, Traversal Algorithms, shortest path algorithms: Minimum Spanning Trees, Prim's Algorithm. Kruskal's Algorithm, Dijkstra's algorithm, Warshall's Algorithm, Applications of Graphs (Text-2)

List of Experiments:

Experiment 1:

Write a java program to perform various operations on single linked list

Experiment 2:

Write a java program for the following

- a) Reverse a linked list
- b) Sort the data in a linked list
- c) Remove duplicates
- d) Merge two linked lists

Experiment 3:

Write a java program to perform various operations on doubly linked list.

Experiment 4:

Write a java program to perform various operations on circular linked list.

Experiment 5:



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Write a java program for performing various operations on stack using linked list.

Experiment 6:

Write a java program for performing various operations on queue using linked list.

Experiment 7:

Write a java program for the following using stack

- a) Infix to postfix conversion.
- b) Expression evaluation.
- c) Obtain the binary number for a given decimal number.

Experiment 8:

Write a java program to implement various operations on Binary Search Tree Using Recursive and Non-Recursive methods.

Experiment 9:

Write a java program to implement the following for a graph.

- a) BFS
- b) DFS

Experiment 10:

Write a java program to implement Merge & Heap Sort of given elements.

Experiment 11:

Write a java program to implement Quick Sort of given elements.

Experiment 12:

Write a java program to implement various operations on AVL trees.

Experiment 13:

Write a java program to perform the following operations:

- a) Insertion into a B-tree
- b) Searching in a B-tree

Experiment 14:

Write a java program to implementation of recursive and non-recursive functions to Binary tree Traversals

Experiment 15:

Write a java program to implement all the functions of Dictionary (ADT) using Hashing.

Text Books:

- 1. Data Structures and Algorithm Analysis, 3/e, Mark Allen Weiss, Pearson
- 2. Data Structures Using C, 2/e, Reema Thareja, Oxford

Reference Books:



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1. A simplified Approach to Data Structures, Vishal Goyal, Lalit Goyal, Pawan kumar, SPD.
2. Data Structures: A Pseudo Code Approach, 2/e, Richard F.Gilberg, Behrouz A. Forouzon and Cengage, 2005



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I Year - I Semester	Computer Vision (R23MCS1153)	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand the Fundamental Concepts related to sources, shadows and shading
- To understand the Geometry of Multiple Views

Course Outcomes:

1. Implement fundamental image processing techniques required for computer vision
2. Implement boundary tracking techniques
3. Apply chain codes and other region descriptors, Hough Transform for line, circle, and ellipse detections.
4. Apply 3D vision techniques and Implement motion related techniques.
5. Develop applications using computer vision techniques.

UNIT -I:

CAMERAS: Pinhole Cameras Radiometry – Measuring Light: Light in Space, Light Surfaces, Important Special Cases Sources, Shadows, And Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Interreflections: Global Shading Models Color: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.

UNIT-II:

Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Edge Detection: Noise, Estimating Derivatives, Detecting Edges Texture: Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.

UNIT-III:

The Geometry of Multiple Views: Two Views Stereopsis: Reconstruction, Human Stereopsis, Binocular Fusion, Using More Cameras Segmentation by Clustering: What Is Segmentation? Human Vision: Grouping and Gestalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering,

UNIT-IV:

Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness Segmentation and Fitting Using Probabilistic Methods: Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice, Tracking With Linear Dynamic Models: Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples



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UNIT- V:

Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations Geometric Camera Calibration: Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry,
Case study: Mobile Robot Localization Model- Based Vision: Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Case study: Registration In Medical Imaging Systems, Curved Surfaces and Alignment.

Text Books:

1. David A. Forsyth and Jean Ponce: Computer Vision – A Modern Approach, PHI Learning (Indian Edition), 2009.

Reference Books:

1. E. R. Davies: Computer and Machine Vision – Theory, Algorithms and Practicalities, Elsevier (Academic Press), 4th edition, 2013.
2. R. C. Gonzalez and R. E. Woods “Digital Image Processing” Addison Wesley 2008.
3. Richard Szeliski “Computer Vision: Algorithms and Applications” Springer-Verlag London Limited 2011.



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I Year - I Semester	Social Media Analytics (R23MCS1153)	L	T	P	C
		3	0	0	3

Course Objectives:

Knowledge on social media and its analytics Course

Course Outcomes:

1. Understanding characteristics and types of social media
2. Knowledge on layers of social media analytics
3. Apply text analysis tools on social media data
4. Understand the significance of action analytics
5. Detect viral topics on social media(YouTube)

Unit I:

Introduction To Social Media World Wide Web, Web 1.0, Web 2.0, Web 3.0, Social Media, Core Characteristics Of Social Media, Types Of Social Media, Social Networking Sites, Using Facebook For Business Purposes, Content Communities

Unit- II:

Social Media Analytics Overview Purpose Of Social Media Analytics, Social Media Vs. Traditional Business Analytics, Seven Layers Of Social Media Analytics, Types Of Social Media Analytics, Social Media Analytics Cycle, Challenges To Social Media Analytics, Social Media Analytics Tools. Case Study: The Underground Campaign That Scored Big

Unit III:

Social Media Text Analytics Types Of Social Media Text, Purpose Of Text Analytics, Steps In Text Analytics, Social Media Text Analysis Tools. Case Study: Tapping Into Online Customer Opinions

Unit IV:

Social Media Actions Analytics Introduction To Actions Analytics, Common Social Media Actions, Actions Analytics Tools. Case Study: Cover-More Group

Unit V:

Social Media Hyperlink Analytics Types Of Hyperlinks, Hyperlink Analytics, Types Of Hyperlink Analytics, Hyperlink Analytics Tools. Case Study: Hyperlinks And Viral YouTube Videos

Text Books:

1. Seven Layers Of Social Media Analytics Mining Business Insights From Social Media Text, Actions, Networks, Hyperlinks, Apps, Search Engine, And Location Data By Gohar F. Khan Isbn: 1507823207, Isbn-13: 9781507823200



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Reference Books:

1. Social Media Analytics: Techniques And Insights For Extracting Business Value Out Of Social Media By Matthew Ganis, Avinash Kohirkar, Pearson Education.
2. Social Media Analytics: Effective Tools for Building, Interpreting, and Using Metrics, Marshall Sponder, MGH.
3. Big Data And Analytics, Seema Acharya, Subhasinin Chellappan, Wiley Publications.
4. Big Data, Black Book tm , Dreamtech Press, 2015 Edition.



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I Year - I Semester	Elliptic Curve and Quantum Cryptography (R23MCS1153)	L	T	P	C
		3	0	0	3

Course Objectives:

Objective of the course is to build quantum-preparedness for the post quantum era.

Course Outcomes:

1. Basic understanding about Quantum Information and Computation.
2. Understand attack Strategies on QKD Protocols.
3. Analyze and understand statistical analysis of QKD Networks in Real-Life Environment.
4. Apply Quantum-cryptographic networks.

UNIT I:

Elliptic curves Introduction, Efficient computation, Isogenies and endomorphisms, Elliptic curves over finite fields, The discrete logarithm problem, Integer factorization and primality proving, Endomorphism rings, Elliptic curves over the complex numbers

UNIT II:

Quantum Information Theory, Unconditional Secure Authentication, Entropy, Quantum Key Distribution, Quantum Channel, Public Channel, QKD Gain, Finite Resources

Adaptive Cascade Introduction, Error Correction and the Cascade Protocol

UNIT III:

Adaptive Initial Block-Size Selection, Fixed Initial Block-Size, Dynamic Initial Block-Size

Attack Strategies on QKD Protocols: Introduction, Attack Strategies in an Ideal Environment, Individual Attacks in an Realistic Environment QKD Systems: Introduction, QKD Systems

UNIT IV:

Statistical Analysis of QKD Networks in Real-Life Environment: Statistical Methods, Statistical Analysis QKD Networks Based on Q3P: QKD Networks, PPP, Q3P, Routing, Transport

UNIT V:

Quantum-Cryptographic Networks from a Prototype to the Citizen: The SECOQC Project, How to Bring QKD into the “Real” Life The Ring of Trust Model: Introduction, Model of the Point of Trust, Communication in the Point of Trust Model, Exemplified Communications, A Medical Information System Based on the Ring of Trust

Text Book:



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1. Kollmitzer C., Pivk M. (Eds.), Applied Quantum Cryptography, Lect. Notes Phys. 797 (Springer, Berlin Heidelberg 2010).
2. Washington, Lawrence C. Elliptic Curves: Number Theory and Cryptography. Second edition. Chapman & Hall / CRC, 2008. ISBN: 9781420071467.

Reference Books:

1. Gerald B. Gilbert, Michael Hamrick, and Yaakov S. Weinstein, Quantum Cryptography, World Scientific Publishing.
2. Gilles Van Assche, Quantum Cryptography and Secret-Key Distillation, Cambridge University Press



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I Year - I Semester	Advanced Databases and Mining (R23MCS1153)	L	T	P	C
		3	0	0	3

Course Objectives:

- This subject provides an introduction to multidisciplinary field of data mining, the general data features, techniques for data preprocessing, general implementation of data warehouses and OLAP, the relationship between data warehousing and other generalization methods
- The concepts of data clustering includes a different methods of clustering such as k-means, k-medoids, db scan algorithm, role of data mining in web mining.

Course Outcomes:

CO	Description	Knowledge Level (K)#
CO1	Apply various normal forms for designing a database schema.	K3
CO2	Examine appropriate techniques for controlling the consequences of concurrent data access and to restrict unauthorized access, and also able to perform Query Optimization.	K2
CO3	Perform OLAP operations and apply data preprocessing strategies.	K3
CO4	Analyze data visualizations, and observe the patterns that can be discovered by association rule mining.	K4
CO5	Analyze and apply the appropriate classification/clustering techniques for solving real world problems.	K4

Mapping of course outcomes with program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	L					L
CO2	L				L	L
CO3	L			L	L	M
CO4	M	M	M	M	M	H
CO5	M	M	M	M	H	H



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(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT I:

An Overview of NoSQL: Review of the Relational Model, ACID Properties, Distributed Databases: Sharding and Replication, Consistency, The CAP Theorem, NoSQL Data Models. Four Types of NoSQL Database, Value of Relational Databases, Persistent Data, Concurrency, Integration, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, Key Points.

UNIT II:

MongoDB: The Document Data Model, Documents and Collections, MongoDB Use Cases, Embedded Data Models, Normalized Data, Replication via Replica Sets, MongoDB Design, MongoDB and the CAP Theorem, The MongoDB Data Manipulation Language, Transactions, Atomicity, and Documents, Durability and Journaling, Batch Processing and Aggregation, Indexing, Auto-Sharding, Shard Keys, and Horizontal Scalability, Writing to Shards, MongoDB as a File System

UNIT III:

Cassandra: The Column-Family Data Model, Databases and Tables, Columns, Types, and Keys, The Data Manipulation Language, Cassandra's Architecture, Key Spaces, Replication, and Column-Families, The CAP Theorem, Consistent Hashing, Managing Cluster Nodes

UNIT IV:

Data preprocessing: cleaning, transformation, reduction, filters and discretization (demonstration with weka). **Data mining algorithms:** association rules, mining weather data, generating item sets and rules efficiently, correlation analysis. visualization techniques (demonstration with weka)

UNIT V:

Classification & Clustering: ZeroR, OneR, Naïve Bayesian and Decision trees classification and evaluation (bootstrapping and k-fold cross validation) techniques. k-means, DBSCAN and Hierarchical clustering methods (demonstration with weka).

Text Books:

1. Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Wiley Publications, 1st Edition, 2019
2. Data Mining: Concepts and Techniques, J. Han and M. Kamber, Morgan Kaufmann C.J. Date, Database Systems, Pearson, 3rd edition

Reference Books:

1. MongoDB: The Definitive Guide, 3rd Edition, by Shannon Bradshaw, Eoin Brazil, Kristina Chodorow, 2019, O'Reilly Media, Inc.,
2. Cassandra: The Definitive Guide, 3rd Edition, by Jeff Carpenter, Eben Hewitt, 2020, O'Reilly Media, Inc.



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Weblinks :

https://www.saedsayad.com/data_mining_map.htm



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I Year - I Semester	Digital Image Processing (R23MCS1153)	L	T	P	C
		3	0	0	3

Course Objectives:

1. Provide a theoretical and mathematical foundation of fundamental Digital Image Processing concepts.
2. The topics include image acquisition, sampling and quantization, preprocessing, enhancement, restoration, segmentation, and compression.

Course Outcomes:

1. Demonstrate the knowledge of the basic concepts of two-dimensional signal acquisition, sampling, and quantization.
2. Demonstrate the knowledge of filtering techniques.
3. Demonstrate the knowledge of 2D transformation techniques.
4. Demonstrate the knowledge of image enhancement, segmentation, restoration and compression techniques.

UNIT – I:

Digital Image Fundamentals: Digital Image through Scanner, Digital Camera. Concept of Gray Levels.Gray Level to Binary Image Conversion. Sampling and Quantization. Relationship between Pixels.Imaging Geometry. 2D Transformations-DFT, DCT, KLT and SVD.

UNIT – II:

Image Enhancement in Spatial Domain Point Processing, Histogram Processing, Spatial Filtering, Enhancement in Frequency Domain, Image Smoothing, Image Sharpening.

UNIT – III:

Image Restoration Degradation Model, Algebraic Approach to Restoration, Inverse Filtering, Least Mean Square Filters, Constrained Least Squares Restoration, Interactive Restoration.

UNIT – IV:

Image Segmentation Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region Oriented Segmentation.

UNIT – V:

Image Compression Redundancies and their Removal Methods, Fidelity Criteria, Image Compression Models, Source Encoder and Decoder, Error Free Compression, Lossy Compression.

Text Book:

1. Digital Image Processing: R.C. Gonzalez & R. E. Woods, Addison Wesley/ Pearson Education, 2nd Ed, 2004.

Reference Books:



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1. Fundamentals of Digital Image Processing: A. K. Jain, PHI.
2. Digital Image Processing using MAT LAB: Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins: Pearson Education India, 2004.
3. Digital Image Processing: William K. Pratt, John Wiley, 3rd Edition, 2004



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I Year - I Semester	Advanced Operating Systems (R23MCS1153)	L	T	P	C
		3	0	0	3

Course Objectives: This course is aimed at enabling the students to provide comprehensive and up-to-date coverage of the major developments in distributed Operating System, Multi-processor Operating System and to cover important theoretical foundations including Process Synchronization, Concurrency, Event ordering, Mutual Exclusion, Deadlock.

Course Outcomes:

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

CO	Course Outcomes	Knowledge Level (K)#
CO1	Illustrate on the fundamental concepts of operating systems, its architecture and process management.	K2
CO2	Analyses on memory management concepts including page replacement algorithms.	K4
CO3	Elaborate on Process synchronisation mechanisms and deadlocks in operating systems.	K6
CO4	Make use of Distributed systems for implementing synchronisation.	K3
CO5	Apply protection and security in operating systems.	K3

#based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1						
CO2						
CO3						
CO4						
CO5						

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT-I:

Overview of Operating systems: Introduction, Operating system services, System calls, Types of operating systems. **Process Management:** Process Concepts, Process states, process control block, process scheduling, Operations on processes, Scheduling Algorithms.

UNIT-II:

Memory management concepts: Swapping, Contiguous memory allocation, Paging, Segmentation, Virtual memory, Demand Paging, Page-replacement Algorithms, Thrashing.

UNIT-III

Process Synchronization: Critical section problem, Semaphores, Readers-



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Writers problem. **Deadlocks:** System model, Deadlocks Characterization, Methods for handling deadlocks, Deadlock prevention, Avoidance, Detection and Recovery from Deadlocks.

UNIT-IV

Operating System Support in Distributed Systems : Introduction , Operating System layer, Role of protection processes and address space. **Distributed Systems and Synchronization:** Clock Synchronization, logical clocks, mutual exclusion, Data-Centric Consistency Models, Client-Centric Consistency Models, Consistency Protocols, Ricart-Agarwala Algorithm, Maekawa Algorithm.

UNIT- V

File systems and protection: The concept of file, Access methods, Directory structure, File system structure, File system implementation, File sharing, Protection, Directory implementation, Allocation methods, Free space management. Case studies of Android, and iOS.

Text Books:

1. Operating System Concepts, 8th edition, Silberschatz and Galvin, John Wiley, 2009.
2. Distributed Systems, 2nd edition, Andrew S. Tanenbaum, Maarten Vantien, 2007.

Reference Books:

1. Advanced Concepts in Operating Systems, Indian edition, Singhal, M and Shivaratri, N.. Tata McGraw Hill, 2001.
2. Distributed computing: Principles, Algorithms, and systems, 1st edition, Kskhemkalyani, A and Singhal M Cambridge university press, 2008.



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I Year - I Semester	Internet of Things (R23MCS1154)	L	T	P	C
		3	0	0	3

Course Objectives:

- To Understand Smart Objects and IoT Architectures.
- To learn about various IOT-related protocols
- To build simple IoT Systems using Arduino and Raspberry Pi.
- To understand data analytics and cloud in the context of IoT
- To develop IoT infrastructure for popular applications.

Course Outcomes:

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

CO	Course Outcomes	Knowledge Level (K)#
CO1	Summarize on the term 'internet of things' in different contexts.	K2
CO2	Analyze various protocols for IoT.	K4
CO3	Design a PoC of an IoT system using Raspberry Pi/Arduino	K6
CO4	Apply data analytics and use cloud offerings related to IoT.	K3
CO5	Analyze applications of IoT in real time scenario	K4

#based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1						
CO2						
CO3						
CO4						
CO5						

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT I: FUNDAMENTALS OF IoT: Evolution of Internet of Things, Enabling Technologies, IoT Architectures, oneM2M, IoT World Forum (IoTWF) and Alternative IoT models, Simplified IoT Architecture and Core IoT Functional Stack, Fog, Edge and Cloud in IoT, Functional blocks of an IoT ecosystem, Sensors, Actuators, Smart Objects and Connecting Smart Objects.

UNIT II: IoT PROTOCOLS: IT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and Lora WAN, Network Layer: IP versions, Constrained Nodes and Constrained Networks, Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks, Application Transport Methods: Supervisory Control and Data Acquisition, Application Layer Protocols: CoAP and MQTT.



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UNIT III: DESIGN AND DEVELOPMENT: Design Methodology, Embedded computing logic, Microcontroller, System on Chips, IoT system building blocks, Arduino, Board details, IDE programming, Raspberry Pi, Interfaces and Raspberry Pi with Python Programming.

UNIT IV: DATA ANALYTICS AND SUPPORTING SERVICES: Structured Vs Unstructured Data and Data in Motion Vs Data in Rest, Role of Machine Learning – No SQL Databases, Hadoop Ecosystem, Apache Kafka, Apache Spark, Edge Streaming Analytics and Network Analytics, Xively Cloud for IoT, Python Web Application Framework, Django, AWS for IoT, System Management with NETCONF-YANG.

UNIT V: CASE STUDIES/INDUSTRIAL APPLICATIONS: Cisco IoT system, IBM Watson IoT platform, Manufacturing, Converged Plant wide Ethernet Model (CPwE), Power Utility Industry, Grid Blocks Reference Model, Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control.

Text Books:

1. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, First Edition-2017

Reference Books:

1. Internet of Things – A hands-on approach, ArshdeepBahga, Vijay Madisetti, Universities Press, First Edition-2015
2. The Internet of Things – Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi and Wiley, 2nd Edition-2012 (for Unit 2).
3. “From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence”, Jan Ho” ller, VlasiosTsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle and Elsevier, 1st edition 2014.
4. Architecting the Internet of Things, Dieter Uckelmann, Mark Harrison, Michahelles and Florian (Eds), Springer, 2011.
5. Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, Michael Margolis, Arduino Cookbook and O'Reilly Media, 2011.



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I Year - I Semester	Block Chain Technologies (R23MCS1154)	L	T	P	C
		3	0	0	3

Course Objectives:

1. To learn the fundamentals of Block Chain and various types of block chain and consensus mechanism.
2. To understand public block chain system, Private block chain system and consortium block chain.
3. Able to know the security issues of blockchain technology.

Course Outcomes:

1. Able to work in the field of block chain technologies.

UNIT – I:

Fundamentals of Blockchain: Introduction, Origin of Blockchain, Blockchain Solution, Components of Blockchain, Block in a Blockchain, The Technology and the Future.

Blockchain Types and Consensus Mechanism: Introduction, Decentralization and Distribution, Types of Blockchain, Consensus Protocol.

Cryptocurrency: Bitcoin, Altcoin and Token: Introduction, Bitcoin and the Cryptocurrency, Cryptocurrency Basics, Types of Cryptocurrencies, Cryptocurrency Usage.

UNIT – II:

Public Blockchain System: Introduction, Public Blockchain, Popular Public Blockchains, The Bitcoin Blockchain, Ethereum Blockchain.

Smart Contracts: Introduction, Smart Contract, Characteristics of a Smart Contract, Types of Smart Contracts, Types of Oracles, Smart Contracts in Ethereum, Smart Contracts in Industry.

UNIT – III:

Private Blockchain System: Introduction, Key Characteristics of Private Blockchain, Private Blockchain, Private Blockchain Examples, Private Blockchain and Open Source, E-commerce Site Example, Various Commands (Instructions) in E-commerce Blockchain, Smart Contract in Private Environment, State Machine, Different Algorithms of Permissioned Blockchain, Byzantine Fault, Multichain.

Consortium Blockchain: Introduction, Key Characteristics of Consortium Blockchain, Need of Consortium Blockchain, Hyperledger Platform, Overview of Ripple, Overview of Corda.

Initial Coin Offering: Introduction, Blockchain Fundraising Methods, Launching an ICO, Investing in an ICO, Pros and Cons of Initial Coin Offering, Successful Initial Coin Offerings, Evolution of ICO, ICO Platforms.

UNIT – IV:

Security in Blockchain: Introduction, Security Aspects in Bitcoin, Security and Privacy Challenges of Blockchain in General, Performance and Scalability, Identity Management and Authentication, Regulatory Compliance and Assurance, Safeguarding Blockchain Smart Contract (DApp), Security Aspects



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in Hyperledger Fabric.

Applications of Blockchain: Introduction, Blockchain in Banking and Finance, Blockchain in Education, Blockchain in Energy, Blockchain in Healthcare, Blockchain in Real-estate, Blockchain in Supply Chain, The Blockchain and IoT. Limitations and Challenges of Blockchain.

UNIT – V:

Blockchain Case Studies:

Case Study 1 – Retail,

Case Study 2 – Banking and Financial Services,

Case Study 3 – Healthcare,

Case Study 4 – Energy and Utilities.

Blockchain Platform using Python: Introduction, Learn How to Use Python Online Editor, Basic Programming Using Python, Python Packages for Blockchain.

Blockchain platform using Hyperledger Fabric: Introduction, Components of Hyperledger Fabric Network, Chain codes from Developer.ibm.com, Blockchain Application Using Fabric Java SDK.

Text book:

1. “Block chain Technology”, Chandramouli Subramanian, Asha A.George, Abhilasj K A and Meena Karthikeyan , Universities Press.

Reference Books:

1. Blockchain Blue print for Economy, Melanie Swan, SPD Oreilly.
2. Blockchain for Business, Jai Singh Arun, Jerry Cuomo, Nitin Gauar, Pearson Addition Wesley



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I Year - I Semester	Service Oriented Architectures (R23MCS1154)	L	T	P	C
		3	0	0	3

Course Objectives:

- To learn fundamentals of XML.
- To provide an overview of Service Oriented Architecture and Web services and their importance.
- To learn web services standards and technologies.
- To learn service-oriented analysis and design for developing SOA based applications.

Course Outcomes:

Upon successful completion of the course, students should be able to:

1. Able to build applications based on XML.
2. Know the service orientation concepts, benefits of SOA.
3. Develop web services and WS standards.
4. Use web services extensions to develop solutions.
5. Apply service modeling, service oriented analysis and design for application development

UNIT-I:

INTRODUCTION TO XML: XML document structure, Well-formed and valid documents, DTD, XML Schema, Parsing XML using DOM, SAX, XPath, XML Transformation and XSL, X Query.

UNIT-II:

SERVICE ORIENTED ARCHITECTURE (SOA) Basics: Characteristics of SOA, Benefits of SOA, and Comparing SOA with Client-Server and Distributed architectures, Principles of Service Orientation, Service layers.

UNIT-III:

WEB SERVICES (WS) and STANDARDS: Web Services Platform, Service descriptions, WSDL, Messaging with SOAP, Service discovery, UDDI, Service-Level Interaction Patterns, Orchestration and Choreography.

UNIT-IV:

Web Services Extensions: WS Addressing, WS Reliable Messaging, WS Policy, WS Coordination, WS Transactions, WS Security, Examples.

UNIT-V:

Service Oriented Analysis and Design: SOA delivery strategies, Service oriented analysis, Service Modelling, Service oriented design, Standards and composition guidelines, Service design, Business process design, Case Study.

Text Books:

1. Thomas Erl, "Service Oriented Architecture: Concepts, Technology and Design", Pearson Education, 2005.



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2. Sandeep Chatterjee and James Webber, “Developing Enterprise Web Services: An Architect's Guide”, Prentice Hall, 2004.
3. James McGovern, Sameer Tyagi, Michael E Stevens and Sunil Mathew, “Java Web Services Architecture”, Elsevier, 2003.

Reference Books:

1. Ron Schmelzer et al. \ XML and Web Services., Pearson Education, 2002.
2. Frank P.Coyle, \XML, Web Services and the Data Revolution., Pearson Education, 2002
3. Thomas Erl, “Service Oriented Architecture: Concepts, Technology, and Design”, Pearson Education, 2005.



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I Year - I Semester	Advanced Software Engineering (R23MCS1154)	L	T	P	C
		3	0	0	3

Course Objectives: This course is designed to provide an in depth understanding of phases of Software Development, common process models including Waterfall, the Unified Process, hands-on experience with elements of the agile process, a variety of Software Engineering practices such as requirements analysis and specification, code analysis, code debugging, testing, and Software Design techniques

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

CO	Course Outcomes	Knowledge Level (K)#
CO1	Demonstrate software process, various models and Agile methodologies	K2
CO2	Analyze and Specify software requirements through a SRS documents	K3, K4
CO3	Design and Plan software solutions to problems	K6
CO4	Analyze the importance of Quality assurance and design, implement, and execute test cases at the Unit level	K4, K6
CO5	Design, implement, and execute test cases at Integration level and analyze the role of various metrics.	K6

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1						
CO2						
CO3						
CO4						
CO5						

(Please fill the above with Levels of Correlation, viz., L-1, M-2, H-3)

UNIT I:

Software and Software Engineering: Nature of software, Software Process, Software Engineering Practice.

Process Models: Generic process model, defining a framework activity, identifying task set, process assessment and improvement, perspective process models

Agility and process: Agility, Agile process, Scrum, other Agile frameworks, recommended process model



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UNIT II:

Human aspects of Software Engineering: characteristics and psychology of Software Engineer, software team, team structure

Principles that guide practice: core principles, principles that guide each framework activity

Understanding Requirements: Requirements engineering, establishing groundwork, requirements gathering, developing use cases, building analysis model, negotiating requirements, requirements monitoring, validating requirements

Requirements modeling: requirements analysis, class-based modeling, functional modeling, behavioural modeling

UNIT III:

Design: Design process, design concepts, design model

Architectural design: software architecture, architectural styles, architectural design, assessing alternative architectural designs

User experience design: elements, golden rules, User interface analysis and design, user experience analysis, user interface design, design evaluation, usability and accessibility

Design for mobility: mobile development life cycle, mobile architecture, web design pyramid, , mobility and design quality, best practices.

UNIT IV:

Quality: software quality, quality dilemma, achieving software quality

Reviews: review metrics, Informal reviews, Formal technical reviews

Software Quality Assurance: elements, SQA process, Product characteristics, SQA tasks, goals and metrics, statistical software quality assurance, software reliability, ISO 9000 quality standards, SQA plan

Software testing: strategic approach to software testing, planning and recordkeeping, test case design, white box testing, black box testing, object oriented testing

UNIT V:

Software testing- integration level: Software testing fundamentals, integration testing, regression testing, integration testing in OO context, validation testing

Software testing- testing for mobility: mobile testing guidelines, testing strategies, User experience testing issues, web application testing, Web testing strategies, security testing, performance testing

Software metrics and analytics: software measurement, software analytics, product metrics, metrics for testing, metrics for maintenance, process and project metrics, software measurement, metrics for software quality

Text Books:

1. "Software Engineering, A practitioner's Approach", Roger S. Pressman, Bruce R. Maxim, 9th Edition, Tata McGraw-Hill.
2. "Software Engineering", Ian Sommerville, 9th edition, Pearson education



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Reference Books:

1. Software Engineering : A Primer, Waman S Jawadekar, Tata McGraw-Hill, 2008
2. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.



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I Year - I Semester	Advanced Compiler Design (R23MCS1154)	L	T	P	C
		3	0	0	3

COURSE OUTCOMES: At the end of the course, student will be able to

CO	Course Outcomes	Knowledge Level (K)#
CO1	Demonstrate phases in the design of compiler	K2
CO2	Organize Syntax Analysis, Top Down and LL(1) grammars	K3
CO3	Design Bottom Up Parsing and Construction of LR parsers	K6
CO4	Analyze synthesized, inherited attributes and syntax directed translation schemes	K4
CO5	Determine algorithms to generate code for a target machine	K5

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1						
CO2						
CO3						
CO4						
CO5						

(Please fill the above with Levels of Correlation, viz., L-1, M-2, H-3)

SYLLABUS:

UNIT-1: Lexical Analysis: Language Processors, Structure of a Compiler, Lexical Analysis, The Role of the Lexical Analyzer, Bootstrapping, Input Buffering, Specification of Tokens, Recognition of Tokens, Lexical Analyzer Generator-LEX, Finite Automata, Regular Expressions and Finite Automata, Design of a Lexical Analyzer Generator.

UNIT-2: Syntax Analysis: The Role of the Parser, Context-Free Grammars, Derivations, Parse Trees, Ambiguity, Left Recursion, Left Factoring, **Top Down Parsing:** Pre Processing Steps of Top Down Parsing, Backtracking, Recursive Descent Parsing, LL (1) Grammars, Non-recursive Predictive Parsing, Error Recovery in Predictive Parsing.

UNIT-3: Bottom Up Parsing: Introduction, Difference between LR and LL Parsers, Types of LR Parsers, Shift Reduce Parsing, SLR Parsers, Construction of SLR Parsing Tables, More Powerful LR Parsers, Construction of CLR (1) and LALR Parsing Tables, Dangling Else Ambiguity, Error Recovery in LR Parsing, Handling Ambiguity Grammar with LR Parsers.

UNIT-4: Syntax Directed Translation: Syntax-Directed Definitions, Evaluation Orders for SDD's, Applications of Syntax Directed Translation, Syntax-Directed



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Translation Schemes, Implementing L-Attributed SDD's. **Intermediate Code Generation:** Variants of Syntax Trees, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking, Control Flow, Backpatching, Intermediate Code for Procedures.

UNIT-5: Run Time Environments: Storage Organization, Run Time Storage Allocation, Activation Records, Procedure Calls, Displays, **Code Optimization:** The Principle Sources of Optimization, Basic Blocks, Optimization of Basic Blocks, Structure Preserving Transformations, Flow Graphs, Loop Optimization, Data-Flow Analysis, Peephole Optimization, **Code Generation:** Issues in the Design of a Code Generator, Object Code Forms, Code Generation Algorithm, Register Allocation and Assignment.

Text Books:

1. Compilers: Principles, Techniques and Tools, Second Edition, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffry D. Ullman, Pearson Publishers, 2007.

Reference Books:

1. Compiler Construction, Principles and Practice, Kenneth C Loudon, Cengage Learning, 2006
2. Modern compiler implementation in C, Andrew W Appel, Revised edition, Cambridge University Press.
3. Optimizing Compilers for Modern Architectures, Randy Allen, Ken Kennedy, Morgan Kauffmann, 2001.
4. Levine, J.R., T. Mason and D. Brown, Lex and Yacc, edition, O'Reilly & Associates, 1990

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I Year - I Semester	Advanced Computer Networks (R23MCS1154)	L	T	P	C
		3	0	0	3

Course Objectives: This course is aimed at enabling the students to

- The course is aimed at providing basic understanding of Computer networks starting with OSI Reference Model, Protocols at different layers with special emphasis on IP, TCP & UDP and Routing algorithms.
- Some of the major topics which are included in this course are CSMA/CD, TCP/IP implementation, LANs/WANs, internetworking technologies, Routing and Addressing.
- Provide the mathematical background of routing protocols.
- Aim of this course is to develop some familiarity with current research problems and research methods in advance computer networks.

Course Outcomes:

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

CO	Course Outcomes	Knowledge Level (K)#
CO1	Illustrate reference models with layers, protocols and interfaces.	K2
CO2	Describe the routing algorithms, Sub netting and Addressing of IP V4 and IPV6.	K4
CO3	Describe and Analysis of basic protocols of computer networks, and how they can be used to assist in network design and implementation.	K3
CO4	Describe the concepts Wireless LANS, WIMAX, IEEE 802.11, Cellular telephony and Satellite networks	K6
CO5	Describe the emerging trends in networks-MANETS and WSN	K2

#based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1						
CO2						
CO3						
CO4						
CO5						

(Please fill the above with Levels of Correlation, viz., L, M, H)

Unit-I: Network layer: Network Layer design issues: store-and forward packet switching, services provided transport layers, implementation connection less services, implementation connection oriented services, comparison of virtual – circuit and datagram subnets, Routing Algorithms-shortest path routing, flooding, distance vector routing, link state routing, Hierarchical routing, **congestion control algorithms** : Approaches to congestion control, Traffic



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aware routing, Admission control, Traffic throttling, choke Packets, Load shedding, Random early detection, Quality of Service, Application requirements, Traffic shaping, Leaky and Token buckets

Unit-II: Internetworking and IP protocols: How networks differ, How networks can be connected, internetworking, tunneling, The network layer in the internet, IPv4 Protocol, IP addresses, Subnets, CIDR, classful and Special addressing, network address translation (NAT), IPv6 Address structure address space, IPv6 Advantages, packet format, extension Headers, Transition from IPv4 to IPv6, Internet Control Protocols-ICMP, ARP, DHCP

Unit-III: Transport Layer Protocols: Introduction, Services, Port numbers, User Datagram Protocol: User datagram, UDP services, UDP Applications, Transmission control Protocol: TCP services, TCP features, Segment, A TCP connection, State transition diagram, Windows in TCP, Flow control and error control, TCP Congestion control, TCP Timers, **SCTP:** SCTP services SCTP features, packet format, An SCTP association, flow control, error control.

Unit- IV: Wireless LANS: Introduction, Architectural comparison, Access control, The IEEE 802.11 Project: Architecture, MAC sub layer, Addressing Mechanism, Physical Layer, Bluetooth: Architecture, Bluetooth Layers

Other Wireless Networks: WIMAX: Services, IEEE project 802.16, Layers in project 802.16, Cellular Telephony: Operations, First Generation (1G), Second Generation (2G), Third Generation (3G), Fourth Generation (4G), Satellite Networks: Operation, GEO Satellites, MEO satellites, LEO satellites.

Unit-V: Emerging trends in Computer networks:

Mobile computing: Motivation for mobile computing, Protocol stack issues in mobile computing environment, mobility issues in mobile computing, security issues in mobile networks, MOBILE Ad Hoc Networks: Applications of Ad Hoc Networks, Challenges and Issues in MANETS, MAC Layer Issues Routing Protocols in MANET, Transport Layer Issues, Ad hoc Network Security

Wireless Sensor Networks: WSN functioning, Operating system support in sensor devices, WSN characteristics, sensor network operation, Sensor Architecture: Cluster management, Wireless Mesh Networks: WMN design, Issues in WMNs, Computational Grids, Grid Features, Issues in Grid construction design, Grid design features, P2P Networks: Characteristics of P2P Networks, Classification of P2P systems, Gnutella, BitTorrent, Session Initiation Protocol(SIP), Characteristics and addressing, Components of SIP, SIP establishment, SIP security.

Text Books:

1. Data communications and networking 4th edition Behrouz A Fourzan, TMH-2007
2. Computer networks 4th edition Andrew S Tanenbaum, Pearson, 2012
3. Computer networks, Mayank Dave, CENGAGE, First edition. 2012

Reference Books:



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1. Computer networks, A system Approach, 5thed, Larry L Peterson and Bruce S Davie, Elsevier-2012



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I Year - I Semester	Research Methodology and IPR (R23MCS1155)	L	T	P	C
		2	0	0	2

Course Objectives:

- Student able analyze the Effective literature studies approaches, analysis, Plagiarism, Research ethics.
- Student should able understand problem, Scope and objectives of research problem.
- **To learn and understand Traditional knowledge Case Studies, IPR and IITs**

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

Course Outcomes		Knowledge Level (K)#
CO1	Demonstrate the research and its types, Reviewing literature. Identifying and defining research problem.	K2
CO2	Explaining research design methods, sampling techniques	K5
CO3	Designing and development of measuring instruments, data collection and analysis methods	K6
CO4	Show the IPR protection provides an incentive to inventors for further research work and Investment in R & D, which leads to creation of new and better products, and in turn brings about, Economic growth and social benefits.	K1
CO5	Identify Research proposal, research report and evaluating research	K3

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1						
CO2						
CO3						
CO4						
CO5						

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT-I: Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem, Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT-II: Effective literature studies approaches, analysis, Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee



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UNIT-III: Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT

UNIT-IV: Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications

UNIT-V: New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Text Book:

1. Research methodology: an introduction for science & engineering students, 1st Edition, [Stuart Melville](#), [Wayne Goddard](#), 1996

Reference Books:

1. Research Methodology: A Step by Step Guide for beginners, 2nd Edition, Ranjit Kumar, 2011
2. Resisting Intellectual Property, 1st Edition, Halbert, Taylor & Francis Ltd., 2007



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I Year - I Semester	Software Lab-1 (R23MCS1156)	L	T	P	C
		0	0	3	1.5

Course Objectives:

Course Outcomes:

List of Experiments:

1. Get familiar with OpenMP environment
2. Executing simple programs with OpenMp (vector addition, dot product)
3. Design and implement parallel Breadth First Search and Depth First search based on existing algorithms using OpenMP. Use a Tree or an undirected graph for BFS and DFS.
4. Write a program to implement parallel Bubble sort and Merge sort using OpenMP. Use existing algorithms and measure the performance of sequential and parallel algorithms.
5. Implement Min, Max, Sum and Average operations using Parallel Reduction
6. Write a CUDA Program for
 - Addition of two large vectors
 - Matrix multiplication using CUDA C
7. Mini Project: Evaluate performance enhancement of parallel Quicksort Algorithm using MPI



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I Year - I Semester	English for Research Paper Writing (R23MCS1157)	L	T	P	C
		2	0	0	0

Course Objectives:

- Understand that how to improve your writing skills and level of Readability
- Learn about what to write in each section
- Understand the skills needed when writing a Title

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

Course Outcomes		Knowledge Level (K)#
CO1	How to improve your writing skills and level of readability	K1
CO2	Explain about what to write in each section	K3
CO3	Classify the skills needed when writing a Title	K2

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1						
CO2						
CO3						

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT-I: Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT-II: Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts Introduction

UNIT-III: Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

UNIT-IV: Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature

UNIT-V: Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

UNIT-VI: Useful phrases, how to ensure paper is as good as it could possibly be



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the first- time submission.

Text Books:

1. Writing for Science, 0th Edition, Yale University Press, Goldbort R 2006
2. How to Write and Publish a Scientific Paper, 7th Edition, Cambridge University Press, Day R 2006
3. Handbook of Writing for the Mathematical Sciences, 2nd Edition, SIAM, Highman's book, Highman N 1998



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I Year - I Semester	Disaster Management (R23MCS1157)	L	T	P	C
		2	0	0	0

Course Objectives:

- Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in

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

Course Outcomes		Knowledge Level (K)#
CO1	Demonstrate the critical understanding of key concepts in disaster risk reduction and humanitarian response.	K2
CO2	Evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.	K5
CO3	Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.	K6
CO4	Analyze the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in	K4
CO5	Describe disaster risk reduction and humanitarian response. Outline the disaster risk reduction and humanitarian response policy and practice from multiple perspectives.	K2,K3

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1						
CO2						
CO3						
CO4						
CO5						

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT-I: Introduction- Disaster- Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.



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UNIT-II: Repercussions Of Disasters And Hazards- Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters- Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

UNIT-III: Disaster Prone Areas In India- Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches, Areas Prone to Cyclonic and Coastal Hazards With Special Reference to Tsunami, Post-Disaster Diseases and Epidemics

UNIT-IV: Disaster Preparedness And Management- Preparedness: Monitoring of Phenomena Triggering A Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT-V: Risk Assessment- Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment, Strategies for Survival.

Disaster Mitigation- Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation, Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation In India.

Text Books:

1. Disaster Management in India: Perspectives, issues and strategies, R. Nishith, Singh AK, New Royal book Company
2. Disaster Mitigation Experiences and Reflections, Sahni, New Title Edition, Pardeep Et. Al. (Eds.), Prentice Hall Of India, New Delhi
3. Disaster Administration and Management Text and Case Studies, 1st Edition, Deep & Deep Publication Pvt. Ltd., Goel S. L., New Delhi

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I Year - I Semester	Sanskrit for Technical Knowledge (R23MCS1157)	L 2	T 0	P 0	C 0
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Course Objectives:

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world
- Learning of Sanskrit to improve brain functioning
- Learning of Sanskrit to develop the logic in mathematics, science & other subjects
- enhancing the memory power
- The engineering scholars equipped with Sanskrit will be able to explore the
- Huge knowledge from ancient literature

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

Course Outcomes		Knowledge Level (K)#
CO1	Demonstrate basic Sanskrit language	K2
CO2	Illustrate Ancient Sanskrit literature about science & technology	K2
CO3	Build a logical language will help to develop logic in students	K6

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1						
CO2						
CO3						

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT-I: Alphabets in Sanskrit, Past/Present/Future Tense.

UNIT-II: Simple Sentences forming in Sanskrit.

UNIT-III: Order of Sanskrit sentences, Introduction of roots in Sanskrit language.

UNIT-IV: Technical information about Sanskrit Literature.

UNIT-V: Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics.

Text Books:

1. Abhyaspustakam – Dr.Vishwas, 1st Edition, Samskrita-Bharti Publication, New Delhi



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2. Teach Yourself Sanskrit, Prathama Deeksha, VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. India's Glorious Scientific Tradition, 1st Edition, Suresh Soni, Ocean books (P) Ltd., New Delhi



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I Year - I Semester	Value Education (R23MCS1157)	L	T	P	C
		2	0	0	0

Course Objectives:

- Understand value of education and self- development
- Imbibe good values in students
- Let the should know about the importance of character

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

Course Outcomes		Knowledge Level (K)#
CO1	Infer the knowledge of self-development	K2
CO2	Describe the importance of Human values	K2
CO3	Developing the overall personality	K6

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1						
CO2						
CO3						

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT-I: Values and self-development- Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation, Standards and principles, Value judgments

UNIT-II: Importance of cultivation of values- Sense of duty, Devotion, Self-reliance, Confidence, Concentration. Truthfulness, Cleanliness, Honesty, Humanity, Power of faith, National Unity, Patriotism. Love for nature, Discipline.

UNIT-III: Personality and Behaviour Development-Soul and Scientific attitude, Positive Thinking, Integrity and discipline, Punctuality, Love and Kindness, Avoid fault Thinking.

UNIT – IV: Free from anger, Dignity of labour- Universal brotherhood and religious tolerance, True friendship, Happiness Vs suffering, love for truth, Aware of self-destructive habits, Association and Cooperation, Doing best for saving nature.

UNIT – V: Character and Competence- Holy books vs Blind faith, Self-management and Good health, Science of reincarnation, Equality, Nonviolence, Humility, Role of Women, All religions and same message, Mind your Mind, Self-control, Honesty, Studying effectively.



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Text Books:

1. Values and Ethics for organizations Theory and practice, Latest Edition, Chakroborty, S.K., Oxford University Press, New Delhi