



BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE
(AUTONOMOUS)
APPROVED BY AICTE-NEW DELHI, PERMANENTLY AFFILIATED TO JNTUK-KAKINADA
ODALAREVU-533210, Dr. BR Ambedkar Konaseema Dt., Andra Pradesh, INDIA.
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

ACADEMIC REGULATIONS -BR25 FOR M.Tech (REGULAR) PG DEGREE COURSE

Applicable for the students admitted to M. Tech (Regular) Course from the Academic Year 2025-26 and onwards. The M. Tech Degree of Bonam Venkata Chalamayya Engineering College (Autonomous) 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 Head of the Institution/affiliating bodies from time to time.

Admissions shall be made on the basis of merit/rank obtained by the candidates (i) in national level qualifying Entrance Test (GATE), (ii) AP PGECET conducted by the State Government and (iii) Few sponsored seats notified by university on the basis of any order of merit as approved by the State Govt./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. Under any circumstances, permission shall not be given to complete the course work beyond four years.

2.2 The student shall register for all 80 credits and secure all the 80 credits.

2.3 The minimum instruction days in each semester is 16 weeks.

3.0 PROGRAMME OF STUDY

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

M.Tech in

1. Structural Engineering (CIVIL)
2. Power Electronics (EEE)
3. Advanced Manufacturing Systems (MEC)

					
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4. Embedded Systems (ECE)

5. Computer Science & Engineering (CSE)

And any other course as approved by AICTE/ University from time to time.

4.0 ATTENDANCE (SUBJECT WISE PROMOTION IS INTRODUCED)

- 4.1 A student shall be eligible to write End examinations if he acquires a minimum of 75% of attendance in aggregate of all the subjects/courses, and with minimum 75% in each and every course including Laboratories.
- 4.2 Condonation of shortage of attendance in aggregate up to 10% for only hospitalization (65% and above and below 75%) in each course/semester shall be granted by the College Academic Committee.(ONLY ONE TIME in the entire course work)
- 4.3 Shortage of Attendance **below** 65% in aggregate shall not be condoned and not eligible to write their end semester examination of that course.
- 4.4 Students whose shortage of attendance is not condoned in any semester/course are not eligible to write their end semester/course examination of that class.
- 4.5 A prescribed fee shall be payable to wards Condonation of shortage of attendance.
- 4.6 A student shall not be permitted to appear for the Semester End Examination(SEE) in a course unless they meet the prescribed attendance requirements for that course. Such students may re-register for the course in the subsequent semester when it is offered. The college must obtain permission from the Head of the Institution by submitting the list of students eligible for re-registration at least 30 days prior to the commencement of class work
- 4.7 If any candidate fulfils the attendance requirement in the present semester/for the course, he/she shall not be eligible for re-admission/re-register into the same class.

5.0 EVALUATION

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

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5.1 For the theory courses **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 continuous / 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. Each mid term examination shall be conducted for a total duration of **120** minutes with **4 questions** (with out choice) each question for 10 marks. End semester examination is conducted for **60** marks for all **FIVE (5)** questions (one question from one unit) to be answered **(either or)**.

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 based on the day-to-day performance as Internal Marks. The internal evaluation 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 breakup marks of Procedure-20, Experimentation-20, Results-10, and Viva-voce-10.

5.3 For 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/mentor and two other senior faculty members of the department. For 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.

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

5.5 In case the candidate does not secure the minimum academic requirement in any subject (as specified in 5.4) he has to re-appear for the End semester Examination in that subject. A candidate shall be given **one** chance to re-register for each subject provided the internal marks secured by a candidate **are less than 50% and has failed in the end**

					
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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 shall stand cancelled. For re-registration the candidates have to apply to the Head of the Institute through the Head of the Department by paying the requisite fees and get approval from the Head of the Institution 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/she shall not be permitted to write the End Examination in that subject. He / She shall again re-register the subject when next offered.

5.7 Laboratory examination for M. Tech. courses must be conducted with two Examiners, one of them being the Laboratory Class Teacher or teacher of the respective college and the second examiner shall be appointed by the Head of the Institute from the panel of examiners submitted by the Head of the Department of concern department.

5.8 Students shall undergo mandatory summer internship / industrial training (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/industrial training report to the concerned department and appear for an oral presentation before the committee. The Committee comprises of a Professor of the department Head of the Department and two faculty. The report and the oral presentation shall carry 40% and 60% weightages respectively. For summer internship / industrial training, there will be only internal evaluation of 100 marks. A candidate has to secure a minimum of 50% of marks to be declared successful.

5.9 The objective of comprehensive viva-voce is to assess the over all knowledge of the student in the relevant field of Engineering/Specialization in the PG program. Viva will be conducted in 3rd semester. The duration of the viva will be around 30 min. The examination committee will be constituted by the HOD and consist of Professor of the department and two faculty. For comprehensive viva- voce, there will be only internal evaluation of 100 marks. A candidate has to secure a minimum of 50% of marks to be declared successful.

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6.0 EVALUATION OF PROJECT/DISSERTATION WORK

All the Students admitted under these regulations have to mandatorily comply the requirements of (i) Seminar-I, (ii) Seminar-II, (iii) Comprehensive Viva, (iv) Dissertation Part-A and (v) Dissertation Part-B Out these, (i) to (iv) are evaluates by internally by Project Review Committee (PRC) and (v) External Evaluation.

- 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 Students are required to appear for Seminar-I and Seminar-II in First and Second semester respectively. They shall present before PRC on the topic of their choice/interest preferably on the course listed in respective semesters. PRC shall advise the students in advance to select topics which strengthen their Dissertation Part-A and Dissertation Part-B.
- 6.3 Students shall undergo mandatory summer internship / industrial training (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/industrial training report to the concerned department and appear for an oral presentation before PRC. The report and the oral presentation shall carry 40% and 60% weightages respectively. For summer internship / industrial training, there will be only internal evaluation of 100 marks. A candidate has to secure a minimum of 50% of marks to be declared successful.
- 6.4 The objective of comprehensive viva-voce is to assess the overall knowledge of the student in the relevant field of Engineering/Specialization in the PG program. Viva will be conducted in 3rd semester. For comprehensive viva-voce, there will be only internal evaluation of 100 marks. A candidate has to secure a minimum of 50% of marks to be declared successful.
- 6.5 Registration of Dissertation/Project Work. A candidate is permitted to register for the project work after satisfying the attendance requirement of all the courses, both theory and practical and duly approved by PRC.
- 6.6 After satisfying 6.5, a candidate has to submit, in consultation with his project supervisor, the title, objective and plan of action of his project work for approval.
- 6.7 If a candidate wishes to change his supervisor or topic of the project, he can do so

					
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with the approval of the Project Review Committee (PRC). However, the 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.

- 6.8 Continuous assessment of Dissertation-Part A and Dissertation-Part B during the Semester(s) will be monitored by the PRC. *Dissertation-Part A* will be only internal evaluation by PRC for 100 marks. A candidate has to secure a minimum of 50% of marks to be declared successful.
- 6.9 The candidate shall submit a status report to the PRC in two stages, each accompanied by an oral presentation, with a minimum interval of three months between the two.
- 6.10 The work on the project shall be initiated at the beginning of the II year and the duration of the project is two semesters. A candidate is permitted to submit Project Thesis only with the approval of PRC not earlier than 40 weeks from the date of registration of the project work.
- 6.11 Three copies of the Project Thesis certified by the supervisor shall be submitted to the College/School/Institute.
- 6.12 The thesis shall be adjudicated by one examiner selected by the Head of the Institute. For this, the HOD of the Department shall submit a panel of 5 examiners, eminent in that field, with the help of the guide concerned and PRC.
- 6.13 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 not favorable again, the thesis shall be summarily rejected. The candidate has to reregister for the project and complete the project within the stipulated time after taking the approval from the Head of the Institute.
- 6.14 If the report of the examiner is favorable, Viva-Voce examination shall be conducted by a board consisting of the Supervisor, Head of the Department and the examiner who adjudicated the Thesis. The Head of the Department shall coordinate and make arrangements for the conduct of Viva-Voce examination. The Board shall jointly report the candidate's work for a maximum of 100 marks. Corresponding grade will be awarded by the University.
- 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-

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register for the project and completes the project within the stipulated time after taking the approval from the Head of the Institution.

					
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7.0 Cumulative Grade Point Average (CGPA)

Marks Range Theory/ Laboratory (Max – 100)	Marks Range Mini Project/ Project Work for Dissertation (Max – 100)	Letter Grade	Level	Grade Point
≥ 90	≥ 90	O	Outstanding	10
≥80 to<90	≥80 to<90	S	Excellent	9
≥70 to<80	≥70 to<80	A	Very Good	8
≥60 to<70	≥60 to<70	B	Good	7
≥50 to<60	≥50 to<60	C	Fair	6
<50	<50	F	Fail	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

$$SGPA(S_i) = \frac{\sum(C_i \times G_i)}{\sum C_i}$$

- Where C_i is the number of credits of the i th course and G_i is the grade point scored by the student in the i th course.

Computation of CGPA

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

$$CGPA = \frac{\sum(C_i \times S_i)}{\sum C_i}$$

- Where S_i is the SGPA of the i^{th} semester and C_i is the total number of credits in that semester.
- The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.
- Equivalent Percentage = $CGPA \times 10$

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8.0 AWARD OF DEGREE AND CLASS

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

Class Awarded	CGPA to be secured	From the CGPA secured from 80 credits
First Division with Distinction	≥ 7.75 (without supplementary History)	
First Class	≥ 6.75	
Second Class	≥ 5.0 to < 6.75	

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

If a student wants to leave the program/exit after successful completion of first two semesters, he/she will be awarded Post Graduate Diploma in the specialization concerned.

9.0 WITH HOLDING OF RESULTS

If the student is involved in indiscipline/malpractices/court cases, the result of the student will be withheld.

10.0 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 Head of the Institution is final with reference to JNTUK, Kakinada.

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 with reference to JNTUK, Kakinada.

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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.

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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. The Hall Ticket of the candidate is to be cancelled and sent to the Head of the Institution.
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's 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.

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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.
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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

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
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.

Dr. N Ramakrishnaiah, Professor and HOD-CSE UCEK, JNTUK Kakinada.	Dr. U.S.N. Raju, Assoc.Professor, Dept. of CSE, NIT, Warangal	Dr.V.Venkata Krishna, Dean of Computer Science, JBIET, Hyderabad	Mr. B. Jnaneswara Rao, Senior Machine Learning Expert HC Robotics Pvt. Ltd., Hyderabad	Dr. S.Rao Chintalapudi, Professor and HOD-CSE (AIML),CMR Technical campus, Hyderabad	Dr. Sheik Meera Sharif, Professor and Head of CSE
University Nominee	Subject Expert	Subject Expert	Industrial Expert	Alumni Expert	Chairman-BOS.



BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE
(AUTONOMOUS)

APPROVED BY AICTE-NEW DELHI, PERMANENTLY AFFILIATED TO JNTUK-KAKINADA
ODALAREVU-533210, Dr. BR Ambedkar Konaseema Dt., Andra Pradesh, INDIA.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the 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. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	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 Head of the Institution for further action to award suitable punishment.	

Dr. N Ramakrishnaiah, Professor and HOD-CSE UCEK, JNTUK Kakinada.	Dr. U.S.N. Raju, Assoc. Professor, Dept. of CSE, NIT, Warangal	Dr. V. Venkata Krishna, Dean of Computer Science, JBIET, Hyderabad	Mr. B. Jnaneswara Rao, Senior Machine Learning Expert HC Robotics Pvt. Ltd., Hyderabad	Dr. S. Rao Chintalapudi, Professor and HOD-CSE (AIML), CMR Technical campus, Hyderabad	Dr. Sheikh Meera Sharif, Professor and Head of CSE
University Nominee	Subject Expert	Subject Expert	Industrial Expert	Alumni Expert	Chairman-BOS.



BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE

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APPROVED BY AICTE-NEW DELHI, PERMANENTLY AFFILIATED TO JNTUK-KAKINADA
ODALAREVU-533210, Dr. BR Ambedkar Konaseema Dt., Andra Pradesh, INDIA.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Malpractices identified by squad or special invigilators:

1. Punishments to the candidates as per the above guidelines.
2. Punishment for institutions: (if the squad reports that the college is also involved in encouraging malpractices)
 - (i) A show cause notice shall be issued to the college.
 - (ii) Impose a suitable fine on the college.
 - (iii) Shifting the examination centre from the college to another college for a specific period of not less than one year.

					
Dr. N Ramakrishnaiah, Professor and HOD-CSE UCEK, JNTUK Kakinada.	Dr. U.S.N. Raju, Assoc.Professor, Dept. of CSE, NIT, Warangal	Dr.V.Venkata Krishna, Dean of Computer Science, JBIET, Hyderabad	Mr. B. Jnaneswara Rao, Senior Machine Learning Expert HC Robotics Pvt. Ltd., Hyderabad	Dr. S.Rao Chintalapudi, Professor and HOD-CSE (AIML),CMR Technical campus, Hyderabad	Dr. Sheik Meera Sharif, Professor and Head of CSE
University Nominee	Subject Expert	Subject Expert	Industrial Expert	Alumni Expert	Chairman-BOS.



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	- Choose - Define - Find - How - Label - List - Match - Name - Omit - Recall - Relate - Select - Show - Spell - Tell - What - When - Where - Which - Who - Why	- Classify - Compare - Contrast - Demonstrate - Explain - Extend - Illustrate - Infer - Interpret - Outline - Relate - Rephrase - Show - Summarize - Translate	- Apply - Build - Choose - Construct - Develop - Experiment with - Identify - Interview - Make use of - Model - Organize - Plan - Select - Solve - Utilize	- 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	- 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	- 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

Dr. N Ramakrishnaiah, Professor and HOD-CSE UCEK, JNTUK Kakinada.	Dr. U.S.N. Raju, Assoc.Professor, Dept. of CSE, NIT, Warangal	Dr.V.Venkata Krishna, Dean of Computer Science, JBIET, Hyderabad	Mr. B. Jnaneswara Rao, Senior Machine Learning Expert HC Robotics Pvt. Ltd., Hyderabad	Dr. S.Rao Chintalapudi, Professor and HOD-CSE (AIML),CMR Technical campus, Hyderabad	Dr. Sheik Meera Sharif, Professor and Head of CSE
University Nominee	Subject Expert	Subject Expert	Industrial Expert	Alumni Expert	Chairman-BOS.



**BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE
(AUTONOMOUS), ODALAREVU
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**

Date: 01.07.2025

Proposed External BoS Members for Approval:

Sl. No	Name	Designation	Expert
1	Dr. U.S.N. Raju	Associate Professor, Dept of CSE, NIT Warangal.	Subject Expert
2	Dr. V.Venkata Krishna	Professor & Dean Dept. of CSE, JBIET, Hyderabad.	Subject Expert
3	Mr. Jnaneswara Rao	Senior Machine Learning Expert , HC Robotics Pvt. Ltd., Hyderabad	Industry Expert
4	Dr. S.Rao Chintalapudi	Professor and HOD-CSE (AI & ML), CMR Technical campus, Hyderabad	Alumni Expert


(Dr. N. Ramakrishnaiah)
University Nominee
Professor & HOD- CSE,
UCEK, JNTUK, Kakinada.


(Dr. Sheik Meerasharif)
Chairman-BOS



ODALAREVU VENKATA CHALAMAYYA ENGINEERING COLLEGE
(AUTONOMOUS), ODALAREVU
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Date: 01.07.2025

Proposed External BoS Members for Approval:

Sl. No	Name	Designation	Expert
1	Dr. U.S.N. Raju	Associate Professor, Dept of CSE, NIT Warangal.	Subject Expert
2	Dr. V.Venkata Krishna	Professor & Dean Dept. of CSE, JBIET, Hyderabad.	Subject Expert
3	Mr. Jnaneswara Rao	Senior Machine Learning Expert , HC Robotics Pvt. Ltd., Hyderabad	Industry Expert
4	Dr. S.Rao Chintalapudi	Professor and HOD-CSE (AI & ML), CMR Technical campus, Hyderabad	Alumni Expert


(Dr. N. Ramakrishnaiah)
University Nominee
Professor & HOD- CSE,
UCEK, JNTUK, Kakinada.


(Dr. Sheik Meerasharif)
Chairman-BOS



BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE
(AUTONOMOUS), ODALAREVU
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Date: 14.10.2025

MINUTES OF MEETING-CSE

Chairman of Board of Studies (BOS) welcomed all the members of the BOS to the meeting of BOS for BR23 Regulation, conducted in Virtual mode on Wednesday, 2nd July 2025 from 11.00 A.M. Following are the Minutes of this meeting:

1. Chairman, BOS briefed the agenda for the BOS meeting for BR23 Regulation of the B.Tech. Programme in Computer Science and Engineering.

2. *Item-2: BR23 III Year Course Structure & Syllabus*

Presented the Course Structure and Syllabus of III B.Tech. I and II Semesters prepared in-line with JNTUK-R23 Regulation.

3. *Item-3: Course Structure & Syllabus for Honors in Computer Science and Engineering.*

Presented proposed Course Structure & Syllabus as per JNTUK_R23 for Honors Program

4. *Item-4: Course Structure & Syllabus for Minor in Computer Science and Engineering.*

Presented proposed Course Structure & Syllabus as per JNTUK_R23 for Minor Degree in Computer Science and Engineering

5. *Item-5: Academic Regulations for MOOCs through NPTEL/SWAYAM*

Discussed on the minimum & maximum number of credits to be earned through MOOCs (*Applicable for Professional Elective & Open Elective Courses only*). The student needs to complete minimum one course of 12 weeks duration for 3 credits compulsorily and has the provision to pursue and earn 20% of the total Credits (160), i.e. 32 credits.

RESOLUTIONS TAKEN:

1. The proposed course structure & syllabi of B.Tech. III year I and II Semesters is ratified.
2. The proposed Course Structure & Syllabi for Honors & Minor Degree Programs are ratified, which are *in toto* with JNTUK
3. Hon'ble JNTUK University Nominee Dr. N. Ramakrishnaiah has suggested to get the recent academic regulations on MOOCs courses from the affiliating University: JNTUK. It is resolved to follow the same academic regulations on MOOCs, Honors and Minor Degree Programs *in toto* with JNTUK.

Finally, Chairman of BOS thanked all the members for their active participation and valuable suggestions for possible implementation. The meeting was completed with the items stated as per the agenda.

-Chairman BOS of Computer Science
and Engineering.

External BoS Members:

Sl. No	Name	Designation	Signature
1	Dr. N. Ramakrishnaiah	Professor & HOD- CSE, UCEK,	

		JNTUK, Kakinada.	
2	Dr. U.S.N. Raju	Associate Professor, Dept of CSE, NIT Warangal.	
3	Dr. V.Venkata Krishna	Professor & Dean of CSE, JBIET, Hyderabad.	
4	Mr. Jnaneswara Rao	Senior Machine Learning Expert HC Robotics Pvt. Ltd., Hyderabad	
5	Dr. S.Rao Chintalapudi	Professor and HOD-CSE (AI & ML), CMR Technical campus, Hyderabad	

Copy to Internal BoS Members:

Sl.No	Name of the Faculty Member	Designation	Signature
1	Dr. MEERASHARIF SHEIK	PROFESSOR & HOD	
2	Mr. M.S.VENU GOPALARAO	ASSOCIATE PROFESSOR	
3	Mr. Y M S D SASTRY	ASSOCIATE PROFESSOR	
4	Mrs. BILLA GANGA BHAVANI	ASSOCIATE PROFESSOR	
5	Mrs. BONAM SIRISHA	ASSISTANT PROFESSOR	
6	Mr. M V.KRISHNA SUBASH	ASSISTANT PROFESSOR	
7	Mr. T V L SRINIVASA RAO	ASSISTANT PROFESSOR	
8	Mrs. A.SAI KRISHNA VENI	ASSISTANT PROFESSOR	
9	Mr. A.LAKSHMI PRASAD	ASSISTANT PROFESSOR	
10	Mrs. G.SANTOSHI LAKSHMI	ASSISTANT PROFESSOR	
11	Ms. CH.SRIDEVI	ASSISTANT PROFESSOR	
12	Mr. S.SURESH KUMAR	ASSISTANT PROFESSOR	
13	Ms. SHIVA KEERTHI	ASSISTANT PROFESSOR	
14	Mrs. B.REVATHI	ASSISTANT PROFESSOR	

(Dr. SK Meerasharif)
Chairperson-BOS



**BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE
(AUTONOMOUS), ODALAREVU
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**

Date: 13.10.2025

AGENDA for PG BOS Meeting (BR25 Regulation)

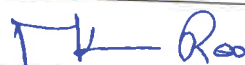
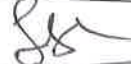
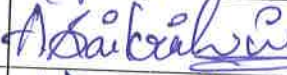
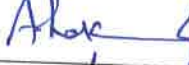
1. Welcome Address by BOS Chairperson.
2. Presentation of I & II Year M.Tech. CSE Course Structures and its Ratification.
3. Discussion on the detailed syllabus, text/reference Books for the Professional Core Courses, Professional Electives and Audit Courses & Ratification of the same after incorporating suggested Changes.
4. Any other item.

Copy Circulation through e-mail:

External BoS Members:

Sl. No	Name	Designation	Signature
1	Dr. N. Ramakrishnaiah	Professor & HOD- CSE, UCEK, JNTUK, Kakinada.	<i>N. Ramakrishnaiah</i>
2	Dr. U.S.N. Raju	Associate Professor, Dept of CSE, NIT Warangal.	
3	Dr. V.Venkata Krishna	Professor & Dean of CSE, JBIET, Hyderabad.	
4	Mr. Jnaneswara Rao	Senior Machine Learning Expert HC Robotics Pvt. Ltd., Hyderabad	
5	Dr. S.Rao Chintalapudi	Professor and HOD-CSE (AI & ML), CMR Technical campus, Hyderabad	

Copy to Internal BoS Members:

Sl.No	Name of the Faculty Member	Designation	Signature
1	Dr. MEERASHARIF SHEIK	PROFESSOR & HOD	
2	Mr. M.S.VENU GOPALARAO	ASSOCIATE PROFESSOR	
3	Mr. Y M S D SASTRY	ASSOCIATE PROFESSOR	
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8	Mrs. A.SAI KRISHNA VENI	ASSISTANT PROFESSOR	
9	Mr. A.LAKSHMI PRASAD	ASSISTANT PROFESSOR	
10	Mrs. G.SANTOSHI LAKSHMI	ASSISTANT PROFESSOR	
11	Ms. CH.SRIDEVI	ASSISTANT PROFESSOR	
12	Mr. S.SURESH KUMAR	ASSISTANT PROFESSOR	
13	Ms. SHIVA KEERTHI	ASSISTANT PROFESSOR	
14	Mrs. B.REVATHI	ASSISTANT PROFESSOR	



(Dr. SK Meerasharif)

Chairperson-BOS



BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE
(AUTONOMOUS), ODALAREVU
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Date: 14.10.2025

MINUTES OF MEETING-PG-BOS-CSE

Chairman of Board of Studies (BOS) welcomed all the members of the BOS to the meeting of PG BOS for BR25 Regulation, conducted in Virtual mode on Monday, 13th October 2025 from 11.00 A.M. Following are the Minutes of this meeting:

1. Chairman, BOS briefed the agenda for the PG BOS meeting for BR25 Regulation of the M.Tech. Programme in Computer Science and Engineering.

2. *Item-1: BR25 I & II Year Course Structure & Syllabus*

Presented the Course Structure and Syllabus of I & II M.Tech. I and II Semesters prepared in-line with JNTUK-R25 Regulation.

3. *Item-2: Academic Regulations for MOOCs through NPTEL/SWAYAM*

Discussed on the credits to be earned through MOOCs (*Applicable for Elective Courses only*).

RESOLUTIONS TAKEN:

1. The proposed course structure & syllabi of M.Tech. I & II year I and II Semesters are ratified.

2. Hon'ble JNTUK University Nominee Dr. N. Ramakrishnaiah has suggested to get the recent academic regulations on MOOCs courses from the affiliating University: JNTUK. It is resolved to follow the same academic regulations on MOOCs in toto with JNTUK.

Finally, Chairman of BOS thanked all the members for their active participation and valuable suggestions for possible implementation. The meeting was completed with the items stated as per the agenda.

-Chairman BOS of Computer Science and Engineering.

External BoS Members:

Sl. No	Name	Designation	Signature
1	Dr. N. Ramakrishnaiah	Professor & HOD- CSE, UCEK, JNTUK, Kakinada.	
2	Dr. U.S.N. Raju	Associate Professor, Dept of CSE, NIT Warangal.	
3	Dr. V.Venkata Krishna	Professor & Dean of CSE, JBIET, Hyderabad.	
4	Mr. Jnaneswara Rao	Senior Machine Learning Expert HC Robotics Pvt. Ltd., Hyderabad	
5	Dr. S.Rao Chintalapudi	Professor and HOD-CSE (AI & ML), CMR Technical campus, Hyderabad	

Sl.No	Name of the Faculty Member	Designation	Signature
1	Dr. MEERASHARIF SHEIK	PROFESSOR & HOD	
2	Mr. M.S.VENU GOPALARAO	ASSOCIATE PROFESSOR	
3	Mr. Y M S D SASTRY	ASSOCIATE PROFESSOR	
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13	Ms. SHIVA KEERTHI	ASSISTANT PROFESSOR	
14	Mrs. B.REVATHI	ASSISTANT PROFESSOR	


(Dr. SK Meerasharif)
Chairperson-BOS



**BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE
(AUTONOMOUS), ODALAREVU
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**

Date: 13.10.2025

AGENDA for PG BOS Meeting (BR25 Regulation)

1. Welcome Address by BOS Chairperson.
2. Presentation of I & II Year M.Tech. CSE Course Structures and its Ratification.
3. Discussion on the detailed syllabus, text/reference Books for the Professional Core Courses, Professional Electives and Audit Courses & Ratification of the same after incorporating suggested Changes.
4. Any other item.

Copy Circulation through e-mail:

External BoS Members:

Sl. No	Name	Designation
1	Dr. N. Ramakrishnaiah	Professor & HOD- CSE, UCEK, JNTUK, Kakinada.
2	Dr. U.S.N. Raju	Associate Professor, Dept of CSE, NIT Warangal.
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4	Mr.Jnaneswara Rao	Senior Machine Learning Expert HC Robotics Pvt. Ltd., Hyderabad
5	Dr.S.Rao Chintalapudi	Professor and HOD-CSE (AI & ML), CMR Technical campus, Hyderabad



HOD CSE BVC Engineering College Odalarevu <hodcse.bvce@bvcgroup.in>

BVCEC-CSE-PG-BoS-Meeting Minutes of Meeting Reg..,

6 messages

HOD CSE BVC Engineering College Odalarevu <hodcse.bvce@bvcgroup.in>

To: "N. Ramakrishnaiah" <nkrishna27@gmail.com>, venkata krishna <vakula.krishna@gmail.com>, Subhash Ch <srao.chintalapudi@gmail.com>, usnraju@nitw.ac.in, Gnanesh Bammidi <gnanesh.bammidi320@gmail.com>

Tue, Oct 14, 2025 at 1:42 PM

Dear sir(s),

we have conducted a PG BoS meeting for the department of computer science and engineering on 13.10.2025 and approved course structures and detailed syllabus of I & II M. Tech of CSE. I am here with attaching minutes of meeting. I request you to kindly give approval for the same through this mail.

MINUTES OF MEETING-CSE

Chairman of Board of Studies (BOS) welcomed all the members of the BOS to the meeting of PG BOS for BR25 Regulation, conducted in Virtual mode on Monday, 13th October 2025 from 11.00 A.M. Following are the Minutes of this meeting:

1. Chairman, BOS briefed the agenda for the PG BOS meeting for BR25 Regulation of the M.Tech. Programme in Computer Science and Engineering.

2. **Item-1: BR25 I & II Year Course Structure & Syllabus**

Presented the Course Structure and Syllabus of I & II M. Tech. I and II Semesters prepared in-line with JNTUK-R25 Regulation.

3. **Item-2: Academic Regulations for MOOCs through NPTEL/SWAYAM**

Discussed on the credits to be earned through MOOCs (*Applicable for Elective Courses only*).

RESOLUTIONS TAKEN:

1. The proposed course structure & syllabi of M.Tech. I & II year I and II Semesters are ratified.

2. Hon'ble JNTUK University Nominee Dr. N. Ramakrishnaiah has suggested to get the recent academic regulations on MOOCs courses from the affiliating University: JNTUK. It is resolved to follow the same academic regulations on MOOCs in toto with JNTUK.

Finally, Chairman of BOS thanked all the members for their active participation and valuable suggestions for possible implementation. The meeting was completed with the items stated as per the agenda.

-Chairman BOS of Computer Science and Engineering.

 Agenda and Course Structure with Syllabus M.Tech-CSE BR 25.pdf
2376K

U.S.N. Raju <usnraju@nitw.ac.in>

To: HOD CSE BVC Engineering College Odalarevu <hodcse.bvce@bvcgroup.in>

Cc: "N. Ramakrishnaiah" <nkrishna27@gmail.com>, venkata krishna <vakula.krishna@gmail.com>, Subhash Ch <srao.chintalapudi@gmail.com>, Gnanesh Bammidi <gnanesh.bammidi320@gmail.com>

Tue, Oct 14, 2025 at 2:21 PM

Dear Sir,

The course structures and detailed syllabus of I & II M.Tech of CSE, are approved.

Thanks and Regards,

Dr.U.S.N.Raju

[Quoted text hidden]

Gnanesh Bammidi <gnanesh.bammidi320@gmail.com>

To: "U.S.N. Raju" <usnraju@nitw.ac.in>

Cc: HOD CSE BVC Engineering College Odalarevu <hodcse.bvce@bvcgroup.in>, "N. Ramakrishnaiah" <nkrishna27@gmail.com>, venkata krishna <vakula.krishna@gmail.com>, Subhash Ch <srao.chintalapudi@gmail.com>

Tue, Oct 14, 2025 at 2:23 PM

Approved.

Thanks & Regards,

Jnaneswara Rao Bammidi

Ph: +91-9800164220

[Quoted text hidden]

Subhash Ch <srao.chintalapudi@gmail.com>

To: HOD CSE BVC Engineering College Odalarevu <hodcse.bvce@bvcgroup.in>

Tue, Oct 14, 2025 at 2:31 PM

Dear Sir,

The minutes of BoS Minutes of Meeting for M.Tech CSE are approved.

Thank you

On Tue, Oct 14, 2025 at 1:43 PM HOD CSE BVC Engineering College Odalarevu <hodcse.bvce@bvcgroup.in> wrote:

[Quoted text hidden]

--
With Regards,

Dr. S Rao Chintalapudi

B.Tech,M.Tech, Ph.D (FullTime-JNTUK), LMCSI

Professor & HoD,

Department of CSE (AI&ML),

10/15/25, 2:56 PM

BVC Group Mail - BVCEC-CSE-PG-BoS-Meeting Minutes of Meeting Reg..

**CMR Technical Campus (Autonomous),
Kandlakoya (V), Hyderabad
Mobile No: +91-9949379392**

website: <https://sites.google.com/site/sraochintalapudi>

N. Ramakrishnaiah <nkrishna27@gmail.com>

To: HOD CSE BVC Engineering College Odalarevu <hodcse.bvce@bvcgroup.in>

Wed, Oct 15, 2025 at 1:14 PM

Sir,

The Course Structure and its detailed syllabus of M.Tech CSE is approved from my side.

with Thanks & Regards,
Dr. N. RAMAKRISHNAIAH

B. Tech., M. Tech., Ph.D.

Professor of Computer Science & Engineering
University College of Engineering Kakinada (A)

Jawaharlal Nehru Technological University Kakinada

Kakinada - 533003, Andhra Pradesh, India

Mobile No: + 91 9652730019

On Tue, Oct 14, 2025 at 1:43 PM HOD CSE BVC Engineering College Odalarevu <hodcse.bvce@bvcgroup.in> wrote:

[Quoted text hidden]

venkata krishna <vakula.krishna@gmail.com>

To: Gnanesh Bammidi <gnanesh.bammidi320@gmail.com>

Cc: "U.S.N. Raju" <usnraju@nitw.ac.in>, HOD CSE BVC Engineering College Odalarevu <hodcse.bvce@bvcgroup.in>, "N. Ramakrishnaiah" <nkrishna27@gmail.com>, Subhash Ch <srao.chintalapudi@gmail.com>

Wed, Oct 15, 2025 at 2:41 PM

Dear sir,

The course structure and the syllabus discussed in the BOS meeting for CSE - M.Tech course are approved.

Regards

Dr V Venakata Krishna

Dean CS JBIET.

[Quoted text hidden]



BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE
ODALAREVU – 533 210, Andhra Pradesh, India

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Structure – BR25 Regulations
For PG - M.Tech: Computer Science and Engineering
I Year Course Structure

Semester-I							
S.No.	Course Category	Course Code	Course Name	L	T	P	Credits
1.	PCC	25CO1T01	Data Structures and Algorithm Analysis	3	1	0	4
2.	PCC	25CO1T02	Advanced Data warehousing and Data Mining	3	1	0	4
3.	PCC	25CO1T03	Mathematical foundations of computer science	3	1	0	4
4.	PEC	25CO1D01 25CO1D02 25CO1D03 25CO1D04 25CO1D05	PROFESSIONAL ELECTIVE-I 1. Image Processing 2. Soft computing 3. Advanced Computer Networks 4. Advanced Software Engineering 5. Time Series Analysis	3	0	0	3
5	PEC	25CO1D06 25CO1D07 25CO1D08	PROFESSIONAL ELECTIVE-II 1. High Performance Computing 2. Agile Methodologies 3. Advanced Compiler Design 4. Any minimum 12 weeks MOOCS/NPTEL courses suggested by BOS	3	0	0	3
6.	PCC	25CO1L01	Data Structures and Algorithm Analysis lab	0	1	2	2
7.	PCC	25CO1L02	Advanced Data warehousing and Data Mining lab	0	1	2	2
8	AUDIT COURSE	25CO1S01	Seminar-I	0	0	2	1
Total				15	5	6	23

Dr. N Ramakrishnaiah, Professor and HOD-CSE UCEK, JNTUK Kakinada.	Dr. U.S.N. Raju, Assoc. Professor, Dept. of CSE, NIT, Warangal	Dr. V. Venkata Krishna, Dean of Computer Science, JBIET, Hyderabad	Mr. Jnaneswara Rao, Senior Machine Learning Expert HC Robotics Pvt. Ltd., Hyderabad	Dr. S. Rao Chintalapudi, Professor and HOD-CSE (AIML), CMR Technical campus, Hyderabad	Dr. Meera Sharif, Professor and Head of CSE
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Course Structure – R25 Regulations

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I Year Course Structure

Semester–II							
S.No	Course Category	Course Code	Course Name	L	T	P	Credits
1.	PCC	25CO2T04	Machine Learning	3	1	0	4
2.	PCC	25CO2T05	Natural Language Processing	3	1	0	4
3.	PCC	25CO2T06	Introduction to Quantum computing	3	1	0	4
4.	PEC	25CO2D09 25CO2D10 25CO2D11 25CO2D12 25CO2D13	PROFESSIONAL ELECTIVE-III 1. Feature Engineering 2. Generative AI 3. Adhoc Sensor Networks 4. Cryptography & Network Security 5. Block Chain Technologies	3	0	0	3
5	PEC	25CO2D14 25CO2D15 25CO2D16	PROFESSIONAL ELECTIVE-IV 1. DevOps 2. Secure Coding 3. Design Patterns 4. Any minimum 12 weeks MOOCS/NPTEL courses suggested by BOS	3	0	0	3
6.	PCC	25CO2L03	Machine Learning Lab	0	1	2	2
7.	PCC	25CO2L04	Natural Language Processing Lab	0	1	2	2
8	AUDIT COURSE	25CO2S02	Seminar-II	0	0	2	1
Total				15	5	6	23

<i>K. Ravi</i>					<i>Dr. S. Rao</i>
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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Structure – BR25 Regulations
For PG - M.Tech: Computer Science and Engineering
II Year Course Structure

Semester-I							
S.No.	Course Category	Course Code	Course Name	L	T	P	Credits
1.	PCC	25HM3D01	Research Methodology and IPR / Swayam 12 week MOOC course – RM&IPR	3	0	0	3
2.	PCC	25CO3P01	Summer Internship/ Industrial Training (8-10 weeks)*	-	-	-	3
3.	PCC	25CO3V01	Comprehensive Viva#	-	-	-	2
4.	PEC	25CO3P02	Dissertation Part – A\$	-	-	20	10
Total				3	-	20	18

* Student attended during summer / year break and assessment will be done in II nd year I Sem.

Comprehensive viva can be conducted course

\$ Dissertation – Part A, internal assessment

Semester-II							
S.No.	Course Category	Course Code	Course Name	L	T	P	Credits
1.	PCC	25CO4P03	Dissertation Part – B%	-	-	32	16
Total				-	-	32	16

% External Assessment

<i>N. R. Ven</i>					<i>SL</i>
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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

I Year - I Semester	Code: 25CO1T01	L	T	P	C
		3	1	0	4

**DATA STRUCTURES & ALGORITHMS
ANALYSIS**

Course Objectives:

The main objectives of the course is to

- To impart knowledge of fundamental data structures such as arrays, stacks, queues, linked lists, trees, and graphs, and their applications in problem-solving
- To enable students to evaluate algorithm efficiency in terms of time and space complexity and apply asymptotic analysis for performance comparison.
- To introduce advanced data structures (e.g., balanced search trees, heaps, hash tables) and demonstrate their role in efficient data organization and retrieval.

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

CO Number	Course Outcome	Blooms Level
CO 1	Ability to write and analyze algorithms for algorithm correctness and efficiency.	BL2
CO 2	Master a variety of advanced abstract data type (ADT) and data structures and their Implementation	BL4
CO 3	Demonstrate various searching, sorting and hash techniques and be able to apply and solve problems of real life	BL4
CO 4	Design and implement variety of data structures including linked lists, binary trees, heaps, graphs and search trees	BL3
CO 5	Ability to compare various search trees and find solutions for IT related problems	BL6

UNIT I

Introduction to Data Structures- Singly Linked Lists, Doubly Linked Lists, Circular Lists-Algorithms, Stacks and Queues- Algorithm Implementation using Linked Lists.

UNIT II

Searching- Linear and Binary, Search Methods, Sorting- Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort, Trees- Binary trees, Operations- Insertion, Deletion, Properties, Representation and Traversals (DFT, BFT), Expression Trees (Infix, prefix, postfix), Graphs- Basic Concepts, Storage structures and Traversals.

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**UNIT III**

Dictionaries, ADT, The List ADT, Stack ADT, Queue ADT, Hash Table, Representation, Hash Functions, Collision Resolution-Separate Chaining, Open Addressing- Linear Probing, Double Hashing.

UNIT-IV

Priority queues- Definition, ADT, Realising a Priority Queue Using Heaps, Definition, Insertion, Deletion, Search Trees- Binary Search Trees, Definition, ADT, Implementation, Operations- Searching, Insertion, Deletion.

UNIT-V

Search Trees- AVL Trees, Definition, Height of AVL Tree, Operations- Insertion, Deletion and Searching. Introduction to Red-Black and Splay Trees, B-Trees, Height of B-Tree, Insertion, Deletion and Searching, Comparison of Search Trees.

Text Books:

1. Data Structures: A Pseudocode Approach with C, 2 nd Edition, Richard F. Gilberg, Behrouz A. Forouzon, Cengage Learning, 2004
2. Data Structures, Algorithms and Applications in java, 2 nd Edition, Sartaj Sahni, University Press/Orient BlackSwan, 2005

Reference Books:

1. Data Structures And Algorithm Analysis, 2 nd Edition, Mark Allen Weiss, Pearson, 2002.
2. Data Structures And Algorithms in C++, 3 rd Edition, Adam Drozdek, Cengage Learning, 2005.
3. C and Data Structures: A Snap Shot Oriented Treatise Using Live Engineering Examples, 1st Edition, N.B. Venkateswarulu, E.V. Prasad, S Chand & Co, 2009
4. Classic Data Structures, 2 nd Edition, Debasis Samanta, PHI Learning, 2009

					
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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

I Year - I Semester	Code: 25CO1T02	L	T	P	C
		3	1	0	4

**ADVANCED DATA WAREHOUSING
AND DATA MINING**

Course Objectives:

The main objectives of the course is to

- Understand Data Warehousing and OLAP
- Master Data Preprocessing and Statistical Techniques
- Apply Classification Techniques and Model Evaluation
- Perform Association and Sequential Pattern Mining
- Explore Clustering and Advanced Data Mining

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

CO Number	Course Outcome	Blooms Level
CO 1	Describe the architecture, modeling techniques, and implementation strategies of data warehouses and OLAP systems, including modern cloud-based approaches.	BL2
CO 2	Apply statistical and visualization techniques to describe datasets and perform data preprocessing tasks such as cleaning, integration, reduction, and transformation.	BL3
CO 3	Develop and evaluate classification models using decision trees, Bayesian classifiers, and rule-based methods for solving predictive analytics problems	BL4
CO 4	Discover meaningful associations and sequential patterns in data using algorithms like Apriori, FP-Growth, and sequential pattern mining techniques	BL3
CO 5	Implement clustering techniques such as K-means, hierarchical clustering, and DBSCAN, and analyze advanced data mining for text, spatial, and graph data	BL4

UNIT I

Data Warehousing and Online Analytical Processing: Basic concepts, Data Warehouse Modeling: Data Cube and OLAP, Data Warehouse Design and Usage, Data Warehouse Implementation, Cloud Data Warehouse; Data Mining Methodologies: CRISP-DM and SEMMA, Comparison of Data Mining Methodologies. Statistical Limits on Data Mining, Introduction to Predictive Analytics, Technologies, Applications, Major issues

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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

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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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

I Year - I Semester	Code: 25CO1T03	L	T	P	C
		3	1	0	4

**MATHEMATICAL FOUNDATIONS OF
COMPUTER SCIENCE**

Course Objectives:

The main objectives of the course is to

- **To provide a strong foundation in mathematical logic and proof techniques** essential for computer science problem solving and theoretical analysis.
- **To familiarize students with set theory, relations, functions, and algebraic structures** that form the basis for various computer science concepts.
- **To introduce combinatorics, counting principles, and discrete probability** for analyzing algorithms and solving computational problems.
- **To develop an understanding of graph theory and trees** as mathematical tools for modeling networks, hierarchical structures, and data organization.

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

CO Number	Course Outcome	Blooms Level
CO 1	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.	BL3
CO 2	Able to perform and analyze of sampling, means, proportions, variances and estimates the maximum likelihood based on population parameters.	BL5
CO 3	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	BL2

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 Events, Bayes Theorem or Rule. Random Variables, Discrete Probability Distributions, Distribution Functions for Random Variables, Distribution Functions for Discrete Random Variables, Continuous Random Variables

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UNIT II

Data Objects & Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity and Dissimilarity. Data Preprocessing: An Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization. (Text Book- 1)

UNIT III

Classification: Basic Concepts, General Approach to solving a classification problem, Decision Tree Induction: Attribute Selection Measures, Tree Pruning, Scalability and Decision Tree Induction, Visual Mining for Decision Tree Induction, Bayesian Classification Methods: Bayes Theorem, Naïve Bayes Classification, Rule-Based Classification, Model Evaluation and Selection. (Text Book- 2)

UNIT-IV

Association Analysis: Problem Definition, Frequent Itemset Generation, Rule Generation: Confident Based Pruning, Rule Generation in Apriori Algorithm, Compact Representation of frequent item sets, FP-Growth Algorithm, Sequential Patterns: Preliminaries, Sequential Pattern Discovery (Text Book- 2)

UNIT-V

Cluster Analysis: Clustering techniques, Different Types of Clusters; Kmeans: The Basic K-means Algorithm, K-means Additional Issues, Bisecting K Means, Agglomerative Hierarchical Clustering: Basic Agglomerative Hierarchical Clustering Algorithm DBSCAN: Traditional Density Center-Based Approach, DBSCAN Algorithm, Strengths and Weaknesses. Mining rich data types: Mining text data, Spatial-temporal data, Graph and networks. (Text Book- 2)

Text Books:

1. Data Mining concepts and Techniques, 3rd edition, Jiawei Han, Michel Kamber, Elsevier, 2011.
2. Introduction to Data Mining: Pang-Ning Tan & Michael Steinbach, Vipin Kumar, Pearson, 2012.

Reference Books:

1. Data Mining: VikramPudi and P. Radha Krishna, Oxford Publisher.
2. Data Mining Techniques, Arun K Pujari, 3rd edition, Universities Press, 2013.

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I Year - I Semester	Code: 25CO1D01	L	T	P	C
		3	0	0	3

IMAGE PROCESSING
(PROGRAM ELECTIVE-I)

Course Objectives:

The main objectives of the course is to

- To introduce the fundamentals of digital image processing, including image representation, acquisition, and storage.
- To familiarize students with image enhancement techniques in both spatial and frequency domains for improving image quality.
- To impart knowledge of image restoration and reconstruction techniques for reducing noise and recovering degraded images.
- To study image segmentation, feature extraction, and representation methods for object detection and recognition.
- To explore compression techniques and transformations used for efficient image storage and transmission.

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

CO Number	Course Outcome	Blooms Level
CO 1	Describe and explain basic principles of digital image processing	BL3
CO 2	Design and implement algorithms that perform basic image processing (e.g. noise removal and image enhancement).	BL3
CO 3	Design and implement algorithms for advanced image analysis (e.g. image compression, image segmentation).	BL4
CO 4	Assess the performance of image processing algorithms and systems	BL6

UNIT I

Introduction: Fundamental steps in Image Processing System, Components of Image Processing System, Elements of Visual Perception, Image Sensing and acquisition, Image sampling & Quantization, Basic Relationship between pixels. Image Enhancement Techniques: Spatial Domain Methods: Basic grey level transformation, Histogram equalization, Image subtraction, image averaging

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**UNIT II**

Spatial filtering: Smoothing, sharpening filters, Laplacian filters, Frequency domain filters, Smoothing and sharpening filters, Homomorphism is filtering. Image Restoration & Reconstruction: Model of Image Degradation/restoration process, Noise models, Spatial filtering, Inverse filtering, Minimum mean square Error filtering, constrained least square filtering. Geometric mean filter, Image reconstruction from projections. Color Fundamentals, Color Models, Color Transformations.

UNIT III

Image Compression: Redundancies- Coding, Interpixel, Psycho visual; Fidelity, Source and Channel Encoding, Elements of Information Theory; Loss Less and Lossy Compression; Run length coding, Differential encoding, DCT, Vector quantization, Entropy coding, LZW coding; Image Compression Standards-JPEG, JPEG 2000, MPEG; Video compression..

UNIT-IV

Wavelet Based Image Compression: Expansion of functions, Multi-resolution analysis, Scaling functions, MRA refinement equation, Wavelet series expansion, Discrete Wavelet Transform (DWT), Continuous, Wavelet Transform, Fast Wavelet Transform, 2-D wavelet Transform, JPEG-2000 encoding

UNIT-V

Image Segmentation: Discontinuities, Edge Linking and boundary detection, Thresholding, Region Based Segmentation, Watersheds; Introduction to morphological operations; binary morphology- erosion, dilation, opening and closing operations, applications; basic gray-scale morphology operations; Feature extraction; Classification; Object recognition. Digital Image Watermarking: Introduction, need of Digital Image Watermarking, applications of watermarking in copyright protection and Image quality analysis.

Text Books:

1.Digital Image Processing. 2nd ed. Gonzalez, R.C. and Woods, R.E. India: Person Education,2009

Reference Books:

1. Digital Image Processing. John Wiley, Pratt, W. K, Fourth Edition-2001
2. Digital Image Processing, Jayaraman, S., Veerakumar, T. and Esakkiranjana, S.,Tata McGraw-Hill, Edition-3,2009

					
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		3	0	0	3

SOFT COMPUTING
(Program Elective-I)

Course Objectives:

The main objectives of the course is to

- To introduce the concepts in Soft Computing such as Artificial Neural Networks, Fuzzy logicbased systems, genetic algorithm-based systems and their hybrids.

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

CO Number	Course Outcome	Blooms Level
CO 1	Learn soft computing techniques and their applications.	
CO 2	Analyze various neural network architectures.	BL2
CO 3	Define the fuzzy systems	BL3
CO 4	Understand the genetic algorithm concepts and their applications.	BL2
CO 5	Identify and select a suitable Soft Computing technology to solve the problem; construct a solution and implement a Soft Computing solution	BL2
		BL4

UNIT I

Introduction to Soft Computing, Artificial neural networks, biological neurons, Basic models of artificial neural networks, Connections, Learning, Activation Functions, McCulloch and Pitts Neuron, Hebb network.

UNIT II

Perceptron networks, Learning rule, Training and testing algorithm, Adaptive Linear Neuron, Back propagation Network, Architecture, Training algorithm.

UNIT III

Fuzzy logic, fuzzy sets, properties, operations on fuzzy sets, fuzzy relations, operations on fuzzy relations, Fuzzy membership functions, fuzzification, Methods of membership, value assignments, intuition, inference, rank ordering, Lambda –Cuts for fuzzy sets , Defuzzification methods

UNIT-IV

Truth values and Tables in Fuzzy Logic, Fuzzy propositions, Formation of fuzzy rules, Decomposition of rules, Aggregation of rules, Fuzzy Inference Systems, Mamdani and Sugeno types, Neuro-fuzzy hybrid systems, characteristics, classification.

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**UNIT-V**

Introduction to genetic algorithm, operators in genetic algorithm, coding, selection, crossover, mutation, stopping condition for genetic algorithm flow, Genetic-neuro hybrid systems, Genetic Fuzzy rule based system

Text Books:

- 1 S. N. Sivanandam and S. N. Deepa, Principles of soft computing–John Wiley & Sons, 2007.
2. Timothy J. Ross, Fuzzy Logic with engineering applications, John Wiley & Sons, 2016.

Reference Books:

- 1.N.K. Sinha and M.M. Gupta, Soft Computing & Intelligent Systems: Theory & Applications-Academic Press /Elsevier. 2009.
2. Simon Haykin, Neural Network-A Comprehensive Foundation-Prentice Hall International, Inc. 1998
3. R. Eberhart and Y. Shi, Computational Intelligence: Concepts to Implementation, Morgan Kaufman/Elsevier, 2007.
3. Driankov D., Hellendoorn H. and Reinfrank M., An Introduction to Fuzzy Control Narosa Pub., 2001.
4. Bart Kosko, Neural Network and Fuzzy Systems-Prentice Hall, Inc., Englewood Cliffs, 1992
5. Goldberg D.E, Genetic Algorithms in Search , Optimization , and Machine Learning Addison Wesley, 1989

					
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University Nominee	Subject Expert	Subject Expert	Industrial Expert	Alumni Expert	Chairperson-BOS.



BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE
ODALAREVU – 533 210, Andhra Pradesh, India

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

I Year - I Semester	Code: 25CO1D03	L	T	P	C
		3	0	0	3

ADVANCED COMPUTER NETWORKS
(Program Elective-I)

Course Objectives:

The main objectives of the course is to

1. 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.
2. Some of the major topics which are included in this course are CSMA/CD, TCP/IP implementation, LANs/WANs, internetworking technologies, Routing and Addressing.
3. Provide the mathematical background of routing protocols.
4. Aim of this course is to develop some familiarity with current research problems and research methods in advance computer networks

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

CO Number	Course Outcome	Blooms Level
CO 1	Illustrate reference models with layers, protocols, and interfaces.	
CO 2	Describe routing algorithms, subnetting, and addressing in IPv4 and IPv6.	BL4
CO 3	Analyze basic network protocols and their use in network design and implementation.	BL3
CO 4	Describe concepts related to wireless networks such as WLANs, WiMAX, IEEE 802.11, cellular and satellite systems.	BL4
CO 5	Describe emerging network trends such as MANETs and Wireless Sensor Networks (WSNs).	BL2

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

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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- IMCP, 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.

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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:

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

					
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I Year - I Semester	Code: 25CO1D04	L	T	P	C
		3	0	0	3

**ADVANCED SOFTWARE ENGINEERING
(PROGRAM ELECTIVE-I)**

Course Objectives:

The main objectives of the course is to

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 Number	Course Outcome	Blooms Level
CO 1	Demonstrate software process, various models and Agile methodologies	BL4
CO 2	Analyze and Specify software requirements through a SRS documents.	BL3
CO 3	Design and Plan software solutions to problems	BL3
CO 4	Analyze the importance of Quality assurance and design, implement, and execute test cases at the Unit level.	BL4
CO 5	Design, implement, and execute test cases at Integration level and analyze the role of various metrics	BL2

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

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

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monitoring, validating Requirements Requirements modeling: requirements analysis, class-based modeling, functional modeling, behavioral 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

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**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

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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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

I Year - I Semester	Code: 25CO1D05	L	T	P	C
		3	0	0	3

**TIME SERIES ANALYSIS
(PROGRAM ELECTIVE-I)**

Course Objectives:

This course is aimed at enabling the students to

The main objective of the course is to introduce a variety of statistical models for time series and cover the main methods for analyzing these models

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

CO Number	Course Outcome	Blooms Level
CO 1	formulate real life problems using time series models	BL1
CO 2	Describe the statistical software to estimate the models from real data, and draw conclusions and develop solutions from the estimated models.	BL3
CO 3	Explain the visual and numerical diagnostics to assess the soundness of their models	BL2
CO 4	Develop to communicate the statistical analyses of substantial data sets through explanatory text, tables and graphs	BL5
CO 5	combine and adapt different statistical models to analyse larger and more complex data	BL2

UNIT I

INTRODUCTION OF TIMESERIES ANALYSIS: Introduction to Time Series and Forecasting, Different types of data, Internal structures of time series. Models for time series analysis, Autocorrelation and Partial autocorrelation. Examples of Time series Nature and uses of forecasting, Forecasting Process, Data for forecasting, Resources for forecasting

UNIT II

STATISTICS BACKGROUND FOR FORECASTING: Graphical Displays, Time Series Plots, Plotting Smoothed Data, Numerical Description of Time Series Data, Use of Data Transformations and Adjustments, General Approach to Time Series Modeling and Forecasting, Evaluating and Monitoring Forecasting Model Performance.

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UNIT III

TIME SERIES REGRESSION MODEL: Introduction Least Squares Estimation in Linear Regression Models, Statistical Inference in Linear Regression, Prediction of New Observations, Model Adequacy Checking, Variable Selection Methods in Regression, Generalized and Weighted Least Squares, Regression Models for General Time Series Data, Exponential Smoothing, First order and Second order.

UNIT-IV

AUTOREGRESSIVE INTEGRATED MOVING AVERAGE (ARIMA) MODELS: Autoregressive Moving Average (ARMA) Models, Stationarity and Invertibility of ARMA Models, Checking for Stationarity using Variogram, Detecting Nonstationarity, Autoregressive Integrated Moving Average (ARIMA) Models, Forecasting using ARIMA, Seasonal Data, Seasonal ARIMA Models Forecasting using Seasonal ARIMA Models Introduction, Finding the “BEST” Model. Example: Internet Users Data Model Selection Criteria, Impulse Response Function to Study the Differences in Models Comparing Impulse Response Functions for Competing Models.

UNIT-V

MULTIVARIATE TIME SERIES MODELS AND FORECASTING: Multivariate Time Series Models and Forecasting, Multivariate Stationary Process, Vector ARIMA Models, Vector AR (VAR) Models, Neural Networks and Forecasting Spectral Analysis, Bayesian Methods in Forecasting.

Text Books:

1. Introduction To Time Series Analysis And Forecasting, 2nd Edition, Wiley Series In Probability And Statistics, By Douglas C. Montgomery, Cheryl L. Jen(2015)
2. Master Time Series Data Processing, Visualization, And Modeling Using Python Dr. Avishek PalDr. PksPrakash (2017)

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

I Year - I Semester	Code: 25CO1D06	L	T	P	C
		3	0	0	3

HIGH PERFORMANCE COMPUTING
(PROGRAM ELECTIVE-II)

Course Objectives: This course is aimed at enabling the students to
The main objective of the course is to introduce a variety of statistical models for time series and cover the main methods for analyzing these models.

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

CO Number	Course Outcome	Blooms Level
CO 1	Describe different parallel architectures, inter-connect networks, programming models	BL3
CO 2	Develop an efficient parallel algorithm to solve given problem	BL4
CO 3	Analyze and measure performance of modern parallel computing systems	BL5
CO 4	Build the logic to parallelize the programming task	BL2

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

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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: Matrix Vector Multiplication, Matrix-Matrix Multiplication..

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 Best First 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: 780124159884
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: ISBN: 978-1-118-61210-1

					
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ODALAREVU – 533 210, Andhra Pradesh, India

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

I Year - I Semester	Code:25CO1D07	L	T	P	C
		3	0	0	3

AGILE METHODOLOGIES
(PROGRAM ELECTIVE-II)

Course Objectives: This course is aimed at enabling the students to
 The main objectives of this course are to introduce the important concepts of Agile software development Process, emphasize the role of stand-up meetings in software collaboration, impart the knowledge on values and principles in understanding agility

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

CO Number	Course Outcome	Blooms Level
CO 1	Understand the core values and mindset of Agile Methodology for effective project development	BL1
CO 2	Explain Agile Principles and apply them in Agile Project management practices	BL3
CO 3	Describe Key concepts of XP, Simplicity, and Incremental Design	BL2
CO 4	Apply Lean Principles to identify and Eliminating Waste in software processes	BL4

UNIT I

Learning Agile: Getting Agile into your brain, Understanding Agile values, No Silver Bullet, Agile to the Rescue, adding Agile makes a difference. A fractured perspective, How a fractured perspective causes project problems. The Agile Manifesto, Purpose behind Each Practice. Individuals and Interactions Over Processes and Tools, Working Software over Comprehensive Documentation, Customer Collaboration over Contract Negotiation, Responding to Change over Following a Plan, Principles over Practices. Understanding the Elephant, Methodologies Help You Get It All in Place at Once, Where to Start with a New Methodology

UNIT II

The Agile Principles: The 12 Principles of Agile Software, The Customer Is Always Right, "Do As I Say, Not As I Said". Delivering the Project, Better Project Delivery for the Ebook Reader Project. Communicating and Working Together, Better Communication for the Ebook Reader Project. Project Execution—Moving the Project Along, A Better Working Environment for the Ebook Reader Project Team. Constantly Improving the Project and the Team. The Agile Project: Bringing All the Principles Together

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UNIT III

SCRUM and Self-Organizing Teams: The Rules of Scrum, Act I: I Can Haz Scrum?, Everyone on a Scrum Team owns the Project, The Scrum Master Guides the Team's Decisions, The Product Owner Helps the Team Understand the Value of the Software, Everyone Owns the Project, Scrum Has Its Own Set of Values ,Status Updates Are for Social Networks!, The Whole Team Uses the Daily Scrum, Feedback and the Visibility-Inspection-Adaptation Cycle, The Last Responsible Moment, How to Hold an Effective Daily Scrum. Sprinting into a Wall, Sprints, Planning, and Retrospectives, Iterative or Incremental?, The Product Owner Makes or Breaks the Sprint, Visibility and Value, How to Plan and Run an Effective Scrum Sprint Scrum Planning And Collective Commitment: Not Quite Expecting the Unexpected, User Stories, Velocity, and Generally Accepted Scrum Practices, Make Your Software Useful, User Stories Help Build Features Your Users Will Use, Conditions of Satisfaction, Story Points and Velocity, Burndown Charts, Planning and Running a Sprint Using Stories, Points, Tasks, and a Task Board. Victory Lap, Scrum Values Revisited, Practices Do Work Without the Values (Just Don't Call It Scrum), Is Your Company's Culture Compatible with Scrum Values.

UNIT-IV

XP And Embracing Change: Going into Overtime, The Primary Practices of XP, Programming Practices, Integration Practices, Planning Practices, Team Practices, Why Teams Resist Changes, and How the Practices Help. The Game Plan Changed, but We're Still Losing, The XP Values Help the Team Change Their Mindset, XP Helps Developers Learn to Work with Users, Practices Only "Stick" When the Team Truly Believes in Them, An Effective Mindset Starts with the XP Values, The XP Values, Paved with Good Intentions. The Momentum Shifts, Understanding the XP Principles Helps You Embrace Change, The Principles of XP, XP Principles Help You Understand Planning, XP Principles Help You Understand Practices—and Vice Versa, Feedback Loops. XP, Simplicity, and Incremental Design: Code and Design, Code Smells and Antipatterns (or, How to Tell If You're Being Too Clever), XP Teams Look for Code Smells and Fix Them, Hooks, Edge Cases, and Code That Does Too Much. Make Code and Design Decisions at the Last Responsible Moment, Fix Technical Debt by Refactoring Mercilessly, Use Continuous Integration to Find Design Problems, Avoid Monolithic Design, Incremental Design and the Holistic XP Practices. Teams Work Best When They Feel Like They Have Time to Think, Team Members Trust Each Other and Make Decisions Together. The XP Design, Planning, Team, and Holistic Practices Form an Ecosystem Incremental Design Versus Designing for Reuse, When Units Interact in a Simple Way, the System Can Grow Incrementally, Great Design Emerges from Simple Interactions, Final Score.

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UNIT-V

Lean, Eliminating Waste, and Seeing the whole; Lean Thinking, Commitment, Options Thinking, and Set-Based Development, Creating Heroes and Magical Thinking. Eliminate Waste, Use a Value Stream Map to Help See Waste Clearly, Gain a Deeper Understanding of the Product, See the Whole, Find the Root Cause of Problems That You Discover. Deliver As Fast As Possible, Use an Area Chart to Visualize Work in Progress, Control Bottlenecks by Limiting Work in Progress. Kanban, Flow, and Constantly Improving: The Principles of Kanban, Find a Starting Point and Evolve Experimentally from There. Stories Go into the System; Code Comes Out, Improving Your Process with Kanban, Visualize the Workflow, Limit Work in Progress. Measure and Manage Flow, Managing Flow with WIP Limits Naturally Creates Slack. Make Process Policies Explicit So Everyone Is on the Same Page. Emergent Behavior with Kanban. The Agile Coach: Coaches Understand Why People Don't Always Want to Change. The Principles of Coaching.

Text Books:

1. Andrew Stellman, Jill Alison Hart, Learning Agile, O'Reilly, 2015.

Reference Books

1. Andrew stellman, Jennifer Green, Head first Agile, O'Reilly, 2017.
2. Rubin K , Essential Scrum : A practical guide to the most popular Agile process, Addison-Wesley, 2013

					
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ODALAREVU – 533 210, Andhra Pradesh, India

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

I Year - I Semester	Code: 25CO1D08	L	T	P	C
		3	0	0	3

ADVANCED COMPILER DESIGN
(PROGRAM ELECTIVE-II)

Course Objectives: This course is aimed at enabling the students to
The main objectives of this course are to introduce the important concepts of Agile software development Process, emphasize the role of stand-up meetings in software collaboration, impart the knowledge on values and principles in understanding agility

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

CO Number	Course Outcome	Blooms Level
CO 1	Demonstrate various phases involved in the design of compiler	BL4
CO 2	Organize and apply Syntax Analysis Techniques such as Top Down Parsing and LL(1) grammars	BL3
CO 3	Design Bottom Up Parsing and Construct LR parsers	BL4
CO 4	Analyse synthesized, inherited attributes and syntax directed translation schemes	BL5
CO 5	Determine appropriate algorithms for a target code generation	BL6

UNIT I

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 II

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 III

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

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UNIT-IV

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

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:

Compilers: Principles, Techniques and Tools, Second Edition, Alfred V. Aho, Monica S.

1. 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 Kaufmann, 2001.
4. Levine, J.R., T. Mason and D. Brown, Lex and Yacc, edition, O'Reilly & Associates, 1990

					
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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

I Year - I Semester	Code: 25CO1L01	L	T	P	C
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**DATA STRUCTURES ALGORITHM &
ANALYSIS LAB**

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

- **To provide hands-on experience in implementing fundamental data structures** such as arrays, stacks, queues, linked lists, trees, heaps, and graphs.
- **To develop skills in writing efficient algorithms** and implementing them using appropriate programming languages.
- **To enable students to analyze the performance of algorithms** in terms of time and space complexity through experiments.
- **To strengthen problem-solving abilities** by applying data structures and algorithmic techniques (e.g., divide-and-conquer, greedy, dynamic programming, backtracking) in coding exercises.
- **To enhance debugging, testing, and validation skills** in program development for reliable and optimized solutions.

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

CO Number	Course Outcome	Blooms Level
CO 1	Ability to write and analyze algorithms for algorithm correctness and efficiency	BL2
CO 2	Master a variety of advanced abstract data type (ADT) and data structures and their Implementation.	BL4
CO 3	Demonstrate various searching, sorting and hash techniques and be able to apply and solve problems of real life	BL4
CO 4	Design and implement variety of data structures including linked lists, binary trees, heaps, graphs and search trees	BL3
CO 5	Ability to compare various search trees and find solutions for IT related problems	BL6

Experiment-1

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

Experiment-2

Write a java program for the following

- Reverse a linked list
- Sort the data in a linked list
- Remove duplicates
- Merge two linked lists

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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 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

					
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Experiment-14

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

Experiment-15

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

					
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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

I Year - I Semester	Code: 25CO1L02	L	T	P	C
		0	1	2	2

**ADVANCED DATA WAREHOUSING AND
DATA MINING LAB**

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

- Inculcate Conceptual, Logical, and Physical design of Data Warehouses OLAP applications and OLAP deployment
- Design a data warehouse or data mart to present information needed by management in a form that is usable
- Emphasize hands-on experience working with all real data sets.
- Test real data sets using popular data mining tools such as WEKA, Python Libraries
- Develop ability to design various algorithms based on data mining tools.

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

CO Number	Course Outcome	Blooms Level
CO 1	Implement data preprocessing techniques such as cleaning, integration, transformation, and reduction on raw datasets.	BL2
CO 2	Design and execute data warehouse schemas (star, snowflake) and perform OLAP operations (roll-up, drill-down, slice, dice, pivot).	BL4
CO 3	Develop classification models using Decision Trees, Naïve Bayes, k-NN, SVM, and evaluate their predictive performance.	BL4
CO 4	Implement clustering techniques (k-Means, Hierarchical, DBSCAN) to partition datasets into meaningful groups.	BL3
CO 5	Use data mining and warehousing tools/software (e.g., Weka, Python, R, SQL-based tools) to solve domain-specific problems in business, healthcare, or finance.	BL6

Experiment-1

Creation of a Data Warehouse.

- Build Data Warehouse/Data Mart (using open source tools like Pentaho Data Integration Tool, Pentaho Business Analytics; or other data warehouse tools like Microsoft-SSIS, Informatica, Business Objects, etc.,)
- Design multi-dimensional data models namely Star, Snowflake and Fact Constellation schemas for any one

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- enterprise (ex. Banking, Insurance, Finance, Healthcare, manufacturing, Automobiles, sales etc).
- Write ETL scripts and implement using data warehouse tools.
- Perform Various OLAP operations such slice, dice, roll up, drill up and pivot

Experiment-2

Explore machine learning tool “WEKA”

- Explore WEKA Data Mining/Machine Learning Toolkit.
- Downloading and/or installation of WEKA data mining toolkit.
- Understand the features of WEKA toolkit such as Explorer, Knowledge Flow interface, Experimenter, command-line interface.
- Navigate the options available in the WEKA (ex. Select attributes panel, Preprocess panel, Classify panel, Cluster panel, Associate panel and Visualize panel)
- Study the arff file format Explore the available data sets in WEKA. Load a data set (ex. Weather dataset, Iris dataset, etc.)
- Load each dataset and observe the following:
 - List the attribute names and they types
 - Number of records in each dataset
 - Identify the class attribute (if any)
 - Plot Histogram
 - Determine the number of records for each class.
- 6. Visualize the data in various dimensions

Experiment-3

Perform data preprocessing tasks and Demonstrate performing association rule mining on data sets

- ☐ Explore various options available in Weka for preprocessing data and apply

Unsupervised filters like Discretization, Resample filter, etc. on each dataset

- ☐ Load weather, nominal, Iris, Glass datasets into Weka and run Apriori

Algorithm with different support and confidence values.

- ☐ Study the rules generated. Apply different discretization filters on numerical attributes and run the Apriori association rule algorithm. Study the rules generated.

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- ☐ Derive interesting insights and observe the effect of discretization in the rule generation process.

Experiment-4

Demonstrate performing classification on data sets Weka/R

- ☐ Load each dataset and run 1d3, J48 classification algorithm. Study the classifier output. Compute entropy values, Kappa statistic.

- ☐ Extract if-then rules from the decision tree generated by the classifier, Observe the confusion matrix.

- ☐ Load each dataset into Weka/R and perform Naïve-bayes classification and k-Nearest Neighbour classification.

Interpret the results obtained.

- ☐ Plot RoC Curves

- ☐ Compare classification results of ID3, J48, Naïve-Bayes and k-NN classifiers for each dataset, and deduce which classifier is performing best and poor for each dataset and justify.

Experiment-5

Demonstrate performing clustering of data sets

- ☐ Load each dataset into Weka/R and run simple k-means clustering algorithm with different values of k (number of desired clusters).

- ☐ Study the clusters formed. Observe the sum of squared errors and centroids, and derive insights.

- ☐ Explore other clustering techniques available in Weka/R.

Explore visualization features of Weka/R to visualize the clusters.

Derive interesting insights and explain

Experiment-6

Demonstrate knowledge flow application on data sets into Weka/R

- ☐ Develop a knowledge flow layout for finding strong association rules by using Apriori, FP Growth algorithms

- ☐ Set up the knowledge flow to load an ARFF (batch mode) and perform a cross validation using J48 algorithm

Demonstrate plotting multiple ROC curves in the same plot window by using j48 and Random forest tree

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Experiment-7

Demonstrate ZeroR technique on Iris dataset (by using necessary preprocessing technique(s)) and share your observations

Experiment-8

Write a java program to prepare a simulated data set with unique instances

Experiment-9

Write a Python program to generate frequent item sets / association rules using Apriori algorithm

Experiment-10

Write a program to calculate chi-square value using Python/R. Report your observation.

Experiment-11

Implement a Java/R program to perform Apriori algorithm

Experiment-12

Write a R program to cluster your choice of data using simple k-means algorithm using JDK

Experiment-13

Write a program of cluster analysis using simple k-means algorithm Python/R programming language

Experiment-14

Write a program to compute/display dissimilarity matrix (for your own dataset containing at least four instances with two attributes) using Python

Experiment-15

Visualize the datasets using matplotlib in python/R.(Histogram, Box plot, Bar chart, Pie chart etc.,)

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I Year - II Semester	Code: 25CO2T04	L	T	P	C
		3	1	0	4

MACHINE LEARNING

Course Objectives:

The main objectives of the course is to

- Define machine learning and its different types (supervised and unsupervised) and understand their applications.
- Apply supervised learning algorithms including decision trees and k-nearest neighbours (k-NN).
- Implement unsupervised learning techniques, such as K-means clustering.

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

CO Number	Course Outcome	Blooms Level
CO 1	Enumerate the Fundamentals of Machine Learning.	BL2
CO 2	Build Nearest Neighbour based models.	BL2
CO 3	Apply Models based on decision trees and Bayes rule.	BL4
CO 4	Choose appropriate clustering technique.	BL2
CO 5	Apply and analyze clustering methods such as K-Means, Fuzzy C-Means, Rough, EM, and Spectral clustering.	BL3

UNIT I

Introduction to Machine Learning: Evolution of Machine Learning, Paradigms for ML, Learning by Rote, Learning by Induction, Reinforcement Learning, Types of Data, Matching, Stages in Machine Learning, Data Acquisition, Feature Engineering, Data Representation, Model Selection, Model Learning, Model Evaluation, Model Prediction, Search and Learning, Data Sets.

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**UNIT II**

Nearest Neighbor-Based Models: Introduction to Proximity Measures, Distance Measures, Non-Metric Similarity Functions, Proximity Between Binary Patterns, Different Classification Algorithms Based on the Distance Measures, K-Nearest Neighbor Classifier, Radius Distance Nearest Neighbor Algorithm, KNN Regression, Performance of Classifiers, Performance of Regression Algorithms.

UNIT III

Models Based on Decision Trees: Decision Trees for Classification, Impurity Measures, Properties, Regression Based on Decision Trees, Bias–Variance Trade-off, Random Forests for Classification and Regression.

The Bayes Classifier: Introduction to the Bayes Classifier, Bayes' Rule and Inference, The Bayes Classifier and its Optimality, Multi-Class Classification Class Conditional Independence and Naive Bayes Classifier (NBC)

UNIT-IV

Linear Discriminants for Machine Learning: Introduction to Linear Discriminants, Linear Discriminants for Classification, Perceptron Classifier, Perceptron Learning Algorithm, Support Vector Machines, Linearly Non-Separable Case, Non-linear SVM, Kernel Trick, Logistic Regression, Linear Regression, Multi-Layer Perceptron's (MLPs), Backpropagation for Training an MLP

UNIT-V

Clustering : Introduction to Clustering, Partitioning of Data, Matrix Factorization Clustering of Patterns, Divisive Clustering, Agglomerative Clustering, Partitional Clustering, K-Means Clustering, Soft Partitioning, Soft Clustering, Fuzzy C-Means Clustering, Rough Clustering, Rough KMeans Clustering Algorithm, Expectation Maximization-Based Clustering, Spectral Clustering

Text Books:

1. Machine Learning Theory and Practice”, M N Murthy, V S Ananthanarayana, Universities Press (India), 2024.

					
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Reference Books:

1. Machine Learning”, Tom M. Mitchell, McGraw-Hill Publication, 2017.
2. “Machine Learning in Action”, Peter Harrington, Dream Tech.
3. “Introduction to Data Mining”, Pang-Ning Tan, Michel Stenbach, Vipin Kumar, 7th Edition, 2019.

					
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NATURAL LANGUAGE PROCESSING

Course Objectives:

This course introduces the fundamental concepts and techniques of natural language processing (NLP).

- Students will gain an in-depth understanding of the computational properties of natural languages and the commonly used algorithms for processing linguistic information.
- The course examines NLP models and algorithms using both the traditional symbolic and the more recent statistical approaches.
- Enable students to be capable to describe the application based on natural language processing and to show the points of syntactic, semantic and pragmatic processing.

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

CO Number	Course Outcome	Blooms Level
CO 1	Demonstrate a given text with basic Language features.	BL5
CO 2	Design an innovative application using NLP components.	BL3
CO 3	Explain a rule based system to tackle morphology/syntax of a language.	BL3
CO 4	Design a tag set to be used for statistical processing for real-time applications.	BL3
CO 5	compare and contrast the use of different statistical approaches for different types of NLP applications.	BL5

UNIT I

INTRODUCTION: Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM – Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance.

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UNIT II

WORD LEVEL ANALYSIS: Unsmoothed N-grams, Evaluating Ngrams, Smoothing, Interpolation and Backoff – Word Classes, Part- of- Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

UNIT III

SYNTACTIC ANALYSIS: Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized, CFGs – Feature structures, Unification of feature structures

UNIT-IV

SEMANTICS AND PRAGMATICS: Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

UNIT-V

DISCOURSE ANALYSIS AND LEXICAL RESOURCES: Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus(BNC).

Text Books:

1. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, 2nd Edition, Daniel Jurafsky, James H. Martin - Pearson Publication, 2014.
2. Natural Language Processing with Python, First Edition, Steven Bird, Ewan Klein and Edward Loper, O'Reilly Media, 2009.

					
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Reference Books:

1. Language Processing with Java and Ling Pipe Cookbook, 1st Edition, Breck Baldwin, Atlantic Publisher, 2015.
2. Natural Language Processing with Java, 2nd Edition, Richard M Reese, OReilly Media, 2015.
3. Handbook of Natural Language Processing, Second, Nitin Indurkha and Fred J. Damerau, Chapman and Hall/CRC Press, 2010. Edition Natural Language Processing and Information Retrieval, 3rd Edition, Tanveer Siddiqui, U.S. Tiwary, Oxford University Press, 2008.

					
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ODALAREVU – 533 210, Andhra Pradesh, India

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

		L	T	P	C
	Code: 25CO2T06				
I Year -II Semester		3	1	0	4

INTRODUCTION TO QUANTUM COMPUTING

Course Objectives:

1. Introduce the fundamentals of quantum computing and highlight its interdisciplinary foundations in mathematics, physics, and biology.
2. Provide the mathematical and physical background necessary to understand the principles of quantum computation.
3. Develop understanding of qubits, Bloch sphere representation, and quantum circuits using quantum logic gates.
4. Familiarize students with major quantum algorithms and their relation to classical computation and complexity classes.
5. Explore noise, error correction, quantum cryptography, and teleportation, emphasizing their role in fault-tolerant quantum computation and secure information transfer.

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

CO Number	Course Outcome	Blooms Level
CO 1	Learn soft computing techniques and their applications. Describe the Historical development of quantum theory and its relevance to modern computing.	BL2
CO 2	Define Qubits and Compare the Classical vs. quantum information.	BL4
CO 3	Explain the Classical computing review and limitations.	BL3
CO 4	Demonstrate the principles and techniques of Quantum error correction.	BL4
CO 5	Discuss the working, applications and potential of Quantum sensors in real-world scenarios.	BL3

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

UNIT I History of Quantum Computing: Importance of Mathematics, Physics and Biology. Introduction to Quantum Computing: Bits Vs Qubits, Classical Vs Quantum logical operations.
UNIT II Background Mathematics: Basics of Linear Algebra, Hilbert space, Probabilities and measurements. Background Physics: Paul's exclusion Principle, Superposition, Entanglement and super-symmetry, density operators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis. Background Biology: Basic concepts of Genomics and Proteomics (Central Dogma).
UNIT III Qubit: Physical implementations of Qubit. Qubit as a quantum unit of information. The Bloch sphere Quantum Circuits: single qubit gates, multiple qubit gates, designing the quantum circuits. Bell states.
UNIT-IV Quantum Algorithms: Classical computation on quantum computers. Relationship between quantum and classical complexity classes. Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor's factorization algorithm, Grover's search algorithm
UNIT-V Noise and error correction: Graph states and codes, Quantum error correction, fault-tolerant computation. Quantum Information and Cryptography: Comparison between classical and quantum information theory. Quantum Cryptography, Quantum teleportation.
Text Books: 1 Nielsen M. A., Quantum Computation and Quantum Information, Cambridge.
Reference Books: 1. Quantum Computing for Computer Scientists by Noson S. Yanofsky and Mirco A. Mannucci 2. Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol.I: Basic Concepts, Vol II 3. Basic Tools and Special Topics, World Scientific. Pittenger A. O., An Introduction to Quantum Computing Algorithms

					
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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

I Year - II Semester	Code: 25CO2D09	L	T	P	C
		3	0	0	3

**FEATURE ENGINEERING
(PROGRAM ELECTIVE-III)**

Course Objectives:

The main objectives of the course is to

- Provide an understanding of the machine learning pipeline and the role of feature engineering in improving model performance.
- Develop knowledge of mathematical transformations such as scaling, normalization, binning, and feature selection for effective data preprocessing.
- Introduce methods to process and transform textual and categorical data into meaningful numerical features for machine learning models.
- Familiarize students with dimensionality reduction techniques such as PCA and nonlinear featurization methods to simplify high-dimensional data.
- Explore the use of clustering, model stacking, and recommender system techniques to enhance predictive modeling and decision-making.

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

CO Number	Course Outcome	Blooms Level
CO 1	Describe the Basic concepts of Data, Tasks, Models, Features and Model building.	BL2
CO 2	Explain the concept of converting Text into Flat Vectors using Bag- of Words, and Bag-of-n-Grams.	BL3
CO 3	Demonstrate techniques for Dimensionality Reduction.	BL4
CO 4	Discuss non linear Featurization.	BL4
CO 5	Explain the concept of Item-Based Collaborative Filtering.	BL3

UNIT I

The Machine Learning Pipeline: Data, Tasks, Models, Features, Model Evaluation Fancy Tricks with Simple Numbers: Scalars, Vectors, and Spaces, Dealing with Counts, Binarization, Quantization or Binning, Log Transformation, Log Transform in Action, Power Transforms: Generalization of the Log Transform, Feature Scaling or Normalization, Min-Max Scaling, Standardization (Variance Scaling), ℓ_2 Normalization, Interaction Features, Feature Selection

UNIT II

Text Data: Flattening, Filtering, and Chunking: Bag-of-X: Turning Natural Text into Flat Vectors, Bag- of Words, Bag-of-n-Grams, Filtering for Cleaner Features: Stopwords, Frequency-Based Filtering, Stemming; Atoms of Meaning: From Words to n-Grams to Phrases: Parsing and Tokenization, Collocation Extraction for Phrase

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Detection The Effects of Feature Scaling: From Bag-of-Words to Tf-Idf :Tf-Idf : A Simple Twist on Bag-of- Words, Putting It to the Test : Creating a Classification Dataset, Scaling Bag-of-Words with Tf-Idf Transformation, Classification with Logistic Regression, Tuning Logistic Regression with Regularization.

UNIT III

Categorical Variables: Counting Eggs in the Age of Robotic Chickens; Encoding Categorical Variables: One-Hot Encoding, Dummy Coding, Effect Coding, Pros and Cons of Categorical Variable Encodings; Dealing with Large Categorical Variables: Feature Hashing, Bin Counting. Dimensionality Reduction: Squashing the Data Pancake with PCA: Intuition, Derivation: Linear Projection, Variance and Empirical Variance, Principal Components: First Formulation, Principal Components: Matrix Vector Formulation, General Solution of the Principal Components; Transforming Features, Implementing PCA: PCA in Action, Whitening and ZCA, Considerations and Limitations of PCA.

UNIT-IV

Nonlinear Featurization via K-Means Model Stacking: k-Means Clustering, Clustering as Surface Tiling, k-Means Featurization for Classification: Alternative Dense Featurization, Pros, Cons, and Gotchas

UNIT-V

Item-Based Collaborative Filtering, First Pass: Data Import, Cleaning, and Feature Parsing, Academic Paper Recommender: Naive Approach, Second Pass: More Engineering and a Smarter Model, Academic Paper Recommender: Take 2, Third Pass: More Features is More Information, Academic Paper Recommender: Take 3

Text Books:

1. “Feature Engineering for Machine Learning Principles and Techniques for Data Scientists”, Alice Zheng & Amanda Casari, O’REILLY, 2018.
2. “Feature Engineering and Selection: A Practical Approach for Predictive Models”, Max Kuhn, Kjell Johnson, CRC Press, 2019.

Reference Books:

1. Feature Engineering for Machine Learning: Principles and Techniques for Data Scientists — Alice Zheng & Amanda Casari, O’Reilly, 2018.
2. Feature Engineering and Selection: A Practical Approach for Predictive Models — Max Kuhn & Kjell Johnson, CRC Press, 2019.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

I Year - II Semester	Code: 25CO2D10	L	T	P	C
		3	0	0	3

GENERATIVE AI
(PROGRAM ELECTIVE-III)

Course Objectives:

1. To learn Python and Tensor Flow skills for Generative AI.
2. To study techniques for cleaning and preparing data for Generative AI tasks.
3. To implement generative AI models 4. To develop innovative applications using generative AI tools and techniques.

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

CO Number	Course Outcome	Blooms Level
CO 1	Implement Python and Tensor Flow basics, including data handling and preprocessing techniques.	BL5
CO 2	Implement Generative AI models such as GANs, VAEs, LSTM networks, and Transformer models for image text, and music generation tasks.	BL4
CO 3	Evaluate model performance and experiment with hyper parameters and optimization techniques to enhance Generative AI outcomes.	BL6
CO 4	Develop innovative applications in image, text, and music generation, showcasing practical skills	BL5
CO 5	Apply ethical principles, responsible AI practices, and address issues like hallucination, bias, and stability in generative models.	BL3

UNIT I

Introduction To Gen Ai: Historical Overview of Generative modelling, Difference between Gen AI and Discriminative Modeling, Importance of generative models in AI and Machine Learning, Types of Generative models, GANs, VAEs, autoregressive models and Vector quantized Diffusion models, Understanding if probabilistic modeling and generative process, Challenges of Generative Modeling, Future of Gen AI, Ethical Aspects of AI, Responsible AI, Use Cases

UNIT II

Generative Models For Text: Language Models Basics, Building blocks of Language models, Transformer Architecture, Encoder and Decoder, Attention mechanisms, Generation of Text, Models like BERT and GPT models, Generation of Text, Autoencoding, Regression Models, Exploring ChatGPT, Prompt Engineering: Designing Prompts, Revising Prompts using Reinforcement Learning from Human Feedback (RLHF), Retrieval

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Augmented Generation, Multimodal LLM, Issues of LLM like hallucination.

UNIT III

Generation of Images: Introduction to Generative Adversarial Networks, Adversarial Training Process, Nash Equilibrium, Variational Autoencoders, Encoder-Decoder Architectures, Stable Diffusion Models, Introduction to Transformer-based Image Generation, CLIP, Visual Transformers ViT- Dall-E2 and Dall-E3, GPT-4V, Issues of Image Generation models like Mode Collapse and Stability.

UNIT-IV

Generation of Painting, Music, and Play: Variants of GAN, Types of GAN, Cyclic GAN, Using Cyclic GAN to Generate Paintings, Neural Style Transfer, Style Transfer, Music Generating RNN, MuseGAN, Autonomous agents, Deep Q Algorithm, Actor-critic Network.

UNIT-V

Open Source Models And Programming Frameworks: Training and Fine tuning of Generative models, GPT 4 All, Transfer learning and Pretrained models, Training vision models, Google Copilot, Programming LLM, LangChain, Open Source Models, Llama, Programming for TimeSformer, Deployment, Hugging Face.

Text Books:

1 Denis Rothman, "Transformers for Natural Language Processing and Computer Vision", Third Edition , Packt Books, 2024.

Reference Books:

1. David Foster, "Generative Deep Learning", O'Reilly Books, 2024.
2. Altaf Rehmani, "Generative AI for Everyone", BlueRose One, 2024.

					
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ODALAREVU – 533 210, Andhra Pradesh, India

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

I Year - II Semester	Code:25CO2D11	L	T	P	C
		3	0	0	3

ADHOC SENSOR NETWORKS
(PROGRAM ELECTIVE-III)

Course Objectives:

Architect sensor networks for various application setups.

- Devise appropriate data dissemination protocols and model links cost.
- Understandings of the fundamental concepts of wireless sensor networks and have a basic knowledge of the various protocols at various layers.
- Evaluate the performance of sensor networks and identify bottlenecks

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

CO Number	Course Outcome	Blooms Level
CO 1	Describe fundamentals of wireless communication, wireless propagation, and challenges in adhoc and sensor networks	BL2
CO 2	Analyze MAC layer issues and protocols in adhoc networks including IEEE 802.11	BL4
CO 3	Evaluate routing and transport layer protocols in adhoc wireless networks and explain their security considerations	BL5
CO 4	Explain WSN architecture, sensor node components and MAC protocols including IEEE 802.15.4	BL3
CO 5	Design and assess routing, localization, synchronization, and QoS strategies for energy-efficient wireless sensor networks.	BL6

UNIT I

Introduction: Fundamentals of Wireless Communication Technology, The Electromagnetic Spectrum, Radio propagation Mechanisms, Characteristics of the Wireless channel mobile ad hoc networks (MANETs), Wireless Sensor Networks (WSNs): concepts and architectures, Applications of Ad Hoc and Sensor Networks, Design Challenges in Ad hoc and Sensor Networks

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

UNIT II

MAC Protocols for Ad Hoc Wireless Networks: Issues in designing a MAC Protocol, Issues in Designing a MAC Protocol for Ad Hoc Wireless Networks, Design Goals of a MAC Protocol for Ad Hoc Wireless Networks, Classification of MAC Protocols, Contention based protocols, Contention based protocols with Reservation Mechanisms, Contention based protocols with Scheduling Mechanisms, Multi-channel MAC - IEEE 802.11.

UNIT III

Routing Protocols and Transport Layer In Ad Hoc Wireless Networks: Routing Protocol: Issues in designing a routing protocol for Adhoc networks, Classification, proactive routing, reactive routing (ondemand), hybrid routing, Transport Layer protocol for Ad hoc networks, Design Goals of a Transport Layer Protocol for AdHoc Wireless Networks, Classification of Transport Layer solutions-TCP over Ad hoc wireless, Network Security, Security in Ad Hoc Wireless Networks, Network Security Requirements.

UNIT-IV

Wireless Sensor Networks (WSNS) And Mac Protocols: Single node architecture - hardware and software components of a sensor node, WSN Network architecture: typical network architectures, data relaying and aggregation strategies, MAC layer protocols: self-organizing, Hybrid TDMA/FDMA and CSMA based MAC -IEEE 802.15.4.

UNIT-V

WSN Routing, Localization & Qos: Issues in WSN routing, OLSR, Localization, Indoor and Sensor Network Localization, absolute and relative localization, triangulation, QOS in WSN, Energy Efficient Design, Synchronization.

Text Books:

1. Ad Hoc Wireless Networks: Architectures and Protocols ", C. Siva Ram Murthy, and B. S. Manoj, Pearson Education, 2008.
2. "Wireless Adhoc and Sensor Networks", Labiod. H, Wiley, 1 st edition-2008
3. "Wireless ad -hoc and sensor Networks: theory and applications", Li, X, Cambridge University Press, fifth edition-2008.

Reference Books:

1. "Ad Hoc & Sensor Networks: Theory and Applications", 2nd edition, Carlos De Moraes Cordeiro, Dharma Prakash Agrawal, World Scientific Publishing Company, 2011
2. Wireless Sensor Networks Feng Zhao and Leonides Guibas, Elsevier Publication 2nd edition-2004
3. "Protocols and Architectures for Wireless Sensor Networks", Holger Karl and Andreas Willig, Wiley, 2005 (soft copy available).

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I Year - II Semester	Code: 25CO2D12	L	T	P	C
		3	0	0	3

**CRYPTOGRAPHY & NETWORK SECURITY
(PROGRAM ELECTIVE-III)**

Course Objectives:

1. Explain the objectives of information security.
2. Explain the importance and application of each of confidentiality, integrity, authentication and availability
3. Understand the basic categories of threats to computers and networks
4. Discusses the Mathematics of Cryptography
5. Discuss the fundamental ideas of Symmetric and Asymmetric Cryptographic Algorithms
6. Discusses the Network layer, Transport Layer and Application Layer Protocols Enhanced security mechanisms

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

CO Number	Course Outcome	Blooms Level
CO 1	Understand security issues related to computer networks and learn different symmetric key techniques.	BL2
CO 2	Apply mathematic of cryptography for symmetric and Asymmetric algorithms and apply this knowledge to understand the Cryptographic algorithms.	BL3
CO 3	Understand and Compare different types of symmetric and Asymmetric algorithms.	BL2
CO 4	Explain Hash functions, message authentication and digital signature and their importance to the security.	BL2
CO 5	Analyze enhanced security protocols at various network layer.	BL4

UNIT I

Security Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security Cryptography. Classical Encryption Techniques-symmetric cipher model, Substitution techniques, Transposition techniques, Rotor Machines, Steganography.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

UNIT II

Introduction to Symmetric Cryptography: Algebraic Structures-Groups, Rings, Fields, $GF(2^n)$ fields, Polynomials. Mathematics of Asymmetric cryptography: Primes, Checking For Primness, Eulers phi functions, Fermat's Little Theorem, Euler's Theorem, Generating Primes, Primality Testing, Factorization, Chinese Remainder Theorem, Quadratic Congruence, Exponentiation And Logarithm.

UNIT III

Symmetric key Ciphers: Block Cipher principles, DES, AES, Blowfish, IDEA, Block cipher operation, Stream ciphers: RC4, RC5 **Asymmetric key Ciphers:** Principles of public key cryptosystems, RSA algorithm, Diffie-Hellman Key Exchange, Elgamal Cryptographic system, Elliptic Curve Arithmetic, Elliptic Curve Cryptography.

UNIT-IV

Cryptographic Hash Functions: Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Requirements and Security, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithms (SHA) **Message Authentication Codes:** Message Authentication Requirements, Message Authentication Functions, Requirements for Message Authentication Codes, Security of MAC'S, MAC'S Based On Hash Functions: HMAC, MAC'S Based On Block Ciphers: DAA And CMAC **Digital Signatures:** Digital Signatures, Elgamal Digital Signature Scheme, Elliptic Curve Digital Signature Algorithm, RSA-PSS Digital Signature Algorithm.

UNIT-V

Network and Internet Security: Transport-Level Security: Web Security Considerations, Transport Level Security, HTTPS, SSH. IP Security: IP Security Overview, IP Security Policy, Encapsulating Security Payload, Authentication Header Protocol. Electronic-Mail Security: Internet-mail Security, Email Format, Email Threats and Comprehensive Email Security, S/MIME, PGP.

Text Books:

1. Cryptography and Network Security - Principles and Practice: William Stallings, Pearson Education, 7th Edition, 2017.
2. Cryptography and Network Security: Behrouz A. Forouzan Debdeep, Mc Graw Hill, 3rd Edition, 2015.

Reference Books:

1. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition
2. Introduction to Cryptography with Coding Theory: Wade Trappe, Lawrence C. Washington, Pearson.
3. Modern Cryptography: Theory and Practice By Wenbo Mao. Pearson.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

I Year - II Semester	Code:25CO2D13	L	T	P	C
		3	0	0	3

BLOCK CHAIN TECHNOLOGIES
(PROGRAM ELECTIVE-III)

Course Objectives:

1. Architect sensor networks for various application setups.
2. Devise appropriate data dissemination protocols and model links cost.
3. Understandings of the fundamental concepts of wireless sensor networks and have a basic knowledge of the various protocols at various layers.
4. Evaluate the performance of sensor networks and identify bottlenecks.

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

CO Number	Course Outcome	Blooms Level
CO 1	Discuss the Cryptographic primitives used in Blockchain	BL2
CO 2	Discuss about various technologies borrowed in blockchain	BL2
CO 3	Illustrate various models for blockchain	BL2
CO 4	Discuss about Ethereum.	BL2
CO 5	Discuss about Hyperledger Fabric	BL2

UNIT I

INTRODUCTION TO BLOCKCHAIN: Introduction, history of Bitcoin and origins of Blockchain, Fundamentals of Blockchain and key components (Chapter 1-book1), Permission and Permission-less platforms(Chapter 1-book2), Introduction to Cryptography, SHA256 and ECDSA, Hashing and Encryption, Symmetric/ Asymmetric keys, Private and Public Keys(Chapter 3-book2).

UNIT II

TECHNOLOGIES BORROWED IN BLOCKCHAIN: Technologies Borrowed in Blockchain - hash pointers- - Digital cash etc.- Bitcoin blockchain - Wallet - Blocks Merkle Tree - hardness of mining -

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Transaction verifiability - Anonymity - forks - Double spending -Mathematical analysis of properties of Bitcoin - Bitcoin- the challenges and solutions. (Chapter 3-book2).

UNIT III

CONSENSUS MECHANISMS : Consensus Algorithms: Proof of Work (PoW) as random oracle - Formal treatment of consistency- Liveness and Fairness - Proof of Stake (PoS) based Chains -Hybrid models (PoW +PoS), Byzantine Models of fault tolerance. ((Chapter 1-book2))

UNIT-IV

ETHEREUM: Ethereum -Ethereum Virtual Machine (EVM) -Wallets for Ethereum -Solidity - Smart Contracts (Chapter 5-book1), - The Turing Completeness of Smart Contract Languages and verification challenges-Using smart contracts to enforce legal contracts- Comparing Bitcoin scripting vs. Ethereum Smart Contracts-Some attacks on smart contracts (Chapter 6 and Chapter 7-book2)

UNIT-V

HYPERLEDGER FABRIC: Hyperledger fabric- the plug and play platform and mechanisms in permissioned blockchain – Beyond Cryptocurrency – applications of blockchain in cyber security- integrity of information- E-Governance and other contract enforcement mechanisms - Limitations of blockchain as a technology and myths vs reality of blockchain technology (Chapter 16-book1), (Chapter 9 -book2)

Text Books:

1. Blockchain Technology Chandramouli Subramanian, Asha A George, Abhilash K A and Meena Karthikeyan, University Press, 2020.
2. Mastering Blockchain - Distributed ledger technology, decentralization, and smart contracts explained, Imran Bashir, 2nd ed. Edition, 2018, pakct publication

Reference Books:

- 1 Shukla, M.Dhawan, S.Sharma, S. Venkatesan “Blockchain Technology: Cryptocurrency and Applications” ,Oxford University Press 2019 .
2. Cryptography and network security principles and practice, William Stallings, Pearson, 8th edition.

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ODALAREVU – 533 210, Andhra Pradesh, India

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

I Year - II Semester				L	T	P	C
				3	0	0	3
Code: 25CO2D14							
DEVOPS							
(PROGRAM ELECTIVE-IV)							
Course Objectives:							
The main objectives of this course are to:							
1. Describe the agile relationship between development and IT operations.							
2. Understand the skill sets and high-functioning teams involved in DevOps and related methods to reach a continuous delivery capability.							
3. Implement automated system update and DevOps lifecycle.							
Course Outcomes: At the end of the course, student will be able to							
CO Number	Course Outcome						Blooms Level
CO 1	Explain DevOps Life cycle process						
CO 2	Demonstrate the concept of Code coverage						BL2
CO 3	Explain Jenkins , jenkins workflow, jenkins master slave architecture, Jenkins Pipelines						BL3
CO 4	Discuss the concept of Dockers Command and running containers						BL2
CO 5	Implement configuration management and container orchestration using Ansible, Kubernetes/OpenShift, Puppet, and Chef.						BL2
UNIT I							
Introduction to DevOps: Introduction to SDLC, Agile Model.Introduction to DevOps. DevOps Features, DevOps Architecture, DevOps Lifecycle, Understanding Workflow and principles, Introduction to DevOps tools, Build Automation, Delivery Automation, Understanding Code Quality, Automation of CI/ CD. Release management, Scrum, Kanban, delivery pipeline, bottlenecks, examples.							
UNIT II							
Source Code Management (GIT): The need for source code control, The history of source code management, Roles and code, source code management system and migrations. What is Version Control and GIT, GIT Installation, GIT features, GIT workflow, working with remote repository, GIT commands,							
							
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GIT branching, GIT staging and collaboration. UNIT TESTING-CODECOVERAGE: Junit, nUnit & Code Coverage with Sonar Qube, SonarQube - Code Quality Analysis.

UNIT III

Build Automation - Continuous Integration (CI): Build Automation, What is CI Why CI is Required, CI tools, Introduction to Jenkins (With Architecture), Jenkins workflow, Jenkins master slave architecture, Jenkins Pipelines, PIPELINE BASICS - Jenkins Master, Node, Agent, and Executor Freestyle Projects & Pipelines, Jenkins for Continuous Integration, Create and Manage Builds, User Management in Jenkins Schedule Builds, Launch Builds on Slave Nodes.

UNIT-IV

Continuous Delivery: Importance of Continuous Delivery, CONTINUOUS DEPLOYMENT CD Flow, Containerization with Docker: Introduction to Docker, Docker installation, Docker commands, Images & Containers, Docker File, running containers, working with containers and publish to Docker Hub.

Testing Tools: Introduction to Selenium and its features, Java Script testing

UNIT-V

Configuration Management - ANSIBLE: Introduction to Ansible, Ansible tasks Roles, Jinja2 templating, Vaults, Deployments using Ansible. **CONTAINERIZATION USING UBERNETES(OPENSHIFT):** Introduction to Kubernetes Namespace & Resources, CI/CD - On OCP, BC, DC & Config Maps, Deploying Apps on Open shift Container Pods. Introduction to Puppet master and Chef

Text Books:

1. Joyner, Joseph., DevOps for Beginners: DevOps Software Development Method Guide for Software Developers and IT Professionals, 1st Edition Mihails Konoplow, 2015.
2. Alisson Machado de Menezes., Hands-on DevOps with Linux, 1st Edition, BPB Publications, India, 2021.

Reference Books:

1. Len Bass, Ingo Weber, Liming Zhu. DevOps: A Software Architect's Perspective. Addison Wesley; ISBN-10
2. Gene Kim Je Humble, Patrick Debois, John Willis. The DevOps Handbook, 1st Edition, IT Revolution Press, 2016.
3. Verona, Joakim Practical DevOps, 1st Edition, Packt Publishing, 2016.
4. Joakim Verona. Practical Devops, Second Edition. In gram short title; 2nd edition (2018). ISBN10: 1788392574
5. Deepak Gaikwad, Viral Thakkar. DevOps Tools from Practitioner's View point. Wiley publications. ISBN:9788126579952

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I Year - II Semester	Code: 25CO2D15	L	T	P	C
		3	0	0	3

SECURE CODING
(PROGRAM ELECTIVE-IV)

Course Objectives:

- Understanding of the various security attacks and knowledge to recognize and remove common coding errors that lead to vulnerabilities.
- Knowledge of outline of the techniques for developing a secure application.
- Recognize opportunities to apply secure coding principles

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

CO Number	Course Outcome	Blooms Level
CO 1	Demonstrate the development of process of software leads to secure coding practices	
CO 2	Apply Secure programs and various risk in the software's	BL3
CO 3	Classify various errors that lead to vulnerabilities	BL3
CO 4	Design Real time software and vulnerabilities	BL4
	Evaluate secure software engineering practices, including misuse/abuse cases and the SQUARE process model for building secure architectures.	BL6
CO 5		BL5

UNIT I

Introduction- Need for secure systems, Proactive security development process, Security principles to live by and threat modelling.

UNIT II

Secure Coding in C- Character strings- String manipulation errors, String Vulnerabilities and exploits Mitigation strategies for strings, Pointers, Mitigation strategies in pointer based vulnerabilities Buffer Overflow based vulnerabilities

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UNIT III

Secure Coding in C++ and Java- Dynamic memory management, Common errors in dynamic memory management, Memory managers, Double –free vulnerabilities, Integer security, Mitigation strategies

UNIT-IV

Database and Web Specific Input Issues- Quoting the Input, Use of stored procedures, Building SQL statements securely, XSS related attacks and remedies

UNIT-V

Software Security Engineering- Requirements engineering for secure software: Misuse and abuse cases, SQUARE process model Software security practices and knowledge for architecture and design

Text Books:

1. Writing Secure Code, 2 nd Edition, Michael Howard, David LeBlanc, Microsoft Press, 2003

Reference Books:

- 1 Secure Coding in C and C++, Robert C. Seacord, 2 nd edition, Pearson Education, 2013
2. Software Security Engineering: A guide for Project Managers, 1 st ed, Julia H. Allen, Sean J. Barnum, Robert J. Ellison, Gary McGraw, Nancy R. Mead, Addison-Wesley Professional, 2008

					
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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

I Year - II Semester		L	T	P	C
		3	0	0	3

Code: 25CO2D16

DESIGN PATTERNS
(PROGRAM ELECTIVE-IV)

Course Objectives:

1. Demonstration of patterns related to object oriented design.
2. Describe the design patterns that are common in software applications.
3. Analyze a software development problem and express it.
4. Design a module structure to solve a problem, and evaluate alternatives.
5. Implement a module so that it executes efficiently and correctly

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

CO Number	Course Outcome	Blooms Level
CO 1	Construct a design consisting of a collection of modules	BL6
CO 2	Exploit well-known design patterns (such as Iterator, Observer, Factory and Visitor). Analyze	BL4
CO 3	Distinguish between different categories of design patterns. Analyze	BL4
CO 4	Ability to understand and apply common design patterns to incremental/iterative development.	BL3
CO 5	identify appropriate patterns for design of given problem	BL3

UNIT I

What is a Design Pattern, Design Patterns in Smalltalk MVC, Describing Design Patterns, The Catalogue of Design Patterns, Organizing The Catalog, How Design Patterns solve Design Problems, How to Select a Design pattern, How to Use a Design Pattern..

UNIT II

A Case Study: Designing a Document Editor, Design Problems , Document Structure, Formatting , Embellishing the User Interface, Supporting Multiple Look-and-Feel Standards, Supporting Multiple Window Systems, User Operations Spelling Checking and Hyphenation, Summary, Creational Patterns, Abstract Factory, Builder , Factory Method, Prototype, Singleton, Discussion of Creational Patterns.

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UNIT III
Structural Pattern Part-I , Adapter, Bridge, Composite. Structural Pattern Part-II , Decorator, Facade, Flyweight, Proxy.
UNIT-IV
Behavioral Patterns Part: I , Chain of Responsibility, Command, Interpreter, Iterator. Behavioral Patterns Part: II , Mediator, Memento, Observer, Discussion of Behavioral Patterns
UNIT-V
Behavioral Patterns Part: III , State, Strategy, Template Method, Visitor, Discussion of Behavioral Patterns. What to Expect from Design Patterns, A Brief History, The Pattern Community, An Invitation, A Parting Thought.
Text Books: 1. Design Patterns By Erich Gamma, Pearson Education
Reference Books: 1 Patterns in JAVA Vol-I (or) Vol-II By Mark Grand, Wiley Dream Tech. 2. Java Enterprise Design Patterns Vol-III By Mark Grand Wiley Dream Tech

					
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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

I Year - II Semester	Code:25CO2LO3 MACHINE LEARNINGLAB	L	T	P	C
		0	1	2	2

Pre-requisites: Data Base Management Systems, Python Programming

COURSE OBJECTIVES: The main objective of the course is to

- To learn about computing central tendency measures and Data pre-processing techniques
- To learn about classification and regression algorithms
- To apply different clustering algorithms for a problem.

Software's Required: Python/R/Weka

UNIT	CONTENTS
Experiment-1	Compute Central Tendency Measures:Mean,Median,ModeMeasure ofDispersion:Variance,StandardDeviation.
Experiment-2	ApplythefollowingPre-processingtechniquesforagivendataset. Attributeselection HandlingMissingValues Discretization EliminationofOutliers
Experiment-3	ApplyKNNalgorithmforclassificationandregression
Experiment-4	Demonstratedecisiontreealgorithmforaclassificationproblem and performparametertuningforbetterresults
Experiment-5	Demonstratedecisiontreealgorithmforaregressionproblem
Experiment-6	ApplyRandomForestalgorithmforclassificationandregression
Experiment-7	DemonstrateNaïveBayesClassificationalgorithm

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Experiment–8	ApplySupportVectoralgorithmforclassification
Experiment–9	Demonstratesimplelinearregressionalgorithmforaregression problem
Experiment–10	ApplyLogisticregressionalgorithmforaclassificationproblem
Experiment– 11	DemonstrateMulti-layerPerceptronalgorithmforaclassification problem
Experiment– 12	ImplementtheK-meansalgorithmmandapplyittothedatayou selected.Evaluateperformancebymeasuringthesumofthe

					
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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

I Year - II Semester	Code:25CO2LO4 NATURAL LANGUAGE PROCESSING LAB	L	T	P	C
		0	1	2	2

Pre-requisites: DataBase Management Systems, Python Programming

COURSE OUTCOMES: On completion of this course, the student will be able to

- Design Neural networks to solve real world problems
- Build RNN, CNN models for classification
- Choose appropriate pre-trained model to solve real time problem
- Apply different NLP techniques using NLTK package.
- Design solution to real-world problems using NLP

Software Packages Required:

- Keras
- Tensorflow
- PyTorch
- NLTK

UNIT	CONTENTS
Experiment-1	Implement Multilayer Perceptron algorithm for MNIST Handwritten Digit Classification.
Experiment-2	Design Neural Network for following problems i). Movie reviews classification (Binary Classification) using IMDB dataset. ii). News Wires classification (Multiclass Classification) using Reuters dataset.
Experiment-3	Implement a Recurrent Neural Network (RNN) and LSTM for IMDB movie review classification problem

					
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Experiment-4	Build a Convolution Neural Network for simple image (dogs and Cats) Classification
Experiment-5	Use a Pre-trained Convolution Neural Network LeNet, AlexNet for image classification
Experiment-6	Implement One Hot Encoding and Word Embeddings on any real world dataset
Experiment-7	Create Sample list at least 10 words POS tagging and find the POS for any given word
Experiment-8	Write a Python program to i). Perform Morphological Analysis using NLTK library ii). Generate n-grams using NLTK N-Grams library iii). Implement N-Grams Smoothing
Experiment-9	Write a program to implement Named Entity Recognition (NER) for any corpus
Experiment-10	Using NLTK package to convert audio file to text and text file to audio files
Experiment-11	Write a program to perform Auto-Correction of spellings for any text
Experiment-12	Implement twitter sentiment analysis using NLP.

					
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