Academic Regulations
Programme Structure
and
Detailed Syllabus

Bachelor of Technology (B.Tech)
in
Computer Science and Business Systems

(Four Year Regular Programme)

(Applicable for Batches admitted from 2024-25)

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
Bachupally, Kukatpally, Hyderabad- 500 090

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
HYDERABAD

Academic Regulations for B.Tech (Regular) under GR24

(Applicable for Batches Admitted from 2024-25)

Under Graduate Degree Programme in Engineering and Technology (UG)

Gokaraju Rangaraju Institute of Engineering and Technology (GRIET) offers a 4-year (8 Semesters) Bachelor of Technology (B.Tech) degree programme. The following programmes are offered in GRIET.

S.No	Department	Programme Code	Programme
1	Civil Engineering	01	B.Tech Civil Engineering
2	Electrical and Electronics Engineering	02	B.Tech Electrical and Electronics Engineering
3	Mechanical Engineering	03	B.Tech Mechanical Engineering
4	Electronics and Communication Engineering	04	B.Tech Electronics and Communication Engineering
5	Computer Science and Engineering	05	B.Tech Computer Science and Engineering
6	Computer Science and Business System	32	B.Tech Computer Science & Business System
7	Computer Science and Engineering (AIML)	66	B.Tech Computer Science and Engineering (Artificial Intelligence & Machine Learning)
8	Computer Science and Engineering (Data Science)	67	B.Tech Computer Science and Engineering (Data Science)

GR24 Regulations shall govern the above programmes offered by the Departments with effect from the students admitted to the programmes in 2024-25 academic year is given below.

1. **Medium of Instruction:** The medium of instruction (including examinations and reports) is English.

2. **Admissions:** Admission to the undergraduate (UG) Programme shall be made subject to the eligibility, qualifications and specialization prescribed by the Telangana State Government/JNTUH University from time to time. Admissions shall be made either on the basis of the merit rank obtained by the student in the common entrance examination conducted by the Government/University or on the basis of any other order of merit approved by the Government/University, subject to reservations as prescribed by the Government/University from time to time.

3. **Programme Pattern:**

a) Each Academic Year of study is divided into two semesters.

b) Minimum number of instruction days in each semester is 90.

c) Grade points, based on percentage of marks awarded for each course will form the basis for calculation of SGPA (Semester Grade Point Average) and CGPA (Cumulative Grade Point Average).

d) The total credits for the Programme are 160.

e) A student has a choice to register for all courses in a semester / one less or one additional course from other semesters provided the student satisfies prerequisites.

f) All the registered credits except Mandatory and Value-added Courses will be considered for the calculation of final CGPA.

g) Each semester has 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)'. Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as indicated by UGC, and course structure as suggested by AICTE are followed. The terms 'subject' and 'course' imply the same meaning.

h) All courses are to be registered by the student in a semester to earn credits which shall be assigned to each subject/ course in an L: T: P: C (lecture periods: tutorial periods: practical periods: credits) structure based on the following general pattern.

- One credit for one hour/week/semester for Theory/Lecture (L) courses and Tutorials (T).
- One credit for two hours/week/semester for Laboratory/Practical (P) courses.
- Mandatory Courses will not carry any credits.

i) **Course Classification:** All courses offered for all undergraduate programmes in B.Tech degree programmes are broadly classified as follows.

S. No.	Broad Course Classification	Course Group/ Category	Course Description
1	BS	Basic Science	Includes Basic Science Courses
2	ES	Engineering Science	Includes Engineering Courses
3	HS	Humanities and Social Sciences	Includes Management Courses
4	PC	Professional Core	Includes Core Courses related to the parent discipline/department/ branch of Engineering
5	PE	Professional Elective	Includes Elective Courses related to the parent discipline/ department/ branch of Engineering
6	OE	Open Elective	Elective Courses from other technical and/or emerging subjects
7	PW	Project Work	Project work, seminar and internship in industry or elsewhere
8	MC	Mandatory Courses	Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge, Co and Extra Curricular Activities
9	VAC	Value Added Courses	Courses on current industry relevant topics improving breadth and depth in domain

4. **Award of B.Tech Degree:** The Undergraduate Degree of B.Tech shall be conferred by Jawaharlal Nehru Technological University Hyderabad (JNTUH), Hyderabad, on the students who are admitted to the programme and fulfill all the following academic requirements for the award of the degree

a) A student pursues the course of study and completes it successfully in not less than four academic years and not more than eight academic years.

b) A student has to register for all the 160 credits and secure all credits (with CGPA ≥ 5).

c) A student must fulfill all the academic requirements for the award of the degree.

5. Courses to be offered

a) **Open Electives:** Students are to register an Open Elective (OE-I) during III year I semester, an Open Elective (OE-II) during III-year II semester, and a Open Elective (OE–III) in IV year I semester from the list of Open Electives given. OE-I and OE-II are to be selected from SWAYAM courses (MOOCs platform).

b) **Professional Electives:** The students have to choose six Professional Electives from the list of Professional Electives given in the course structure.

c) A course may be offered to the students, only if a minimum of 15 students opts for it.

d) More than one faculty member may offer the same subject.

e) A lab/practical may be included with the corresponding theory subject in the same semester) in any semester.

f) If more students opt for a particular course, then the priority shall be given to students firstly on 'first come first serve' basis and secondly based on CGPA (student who has higher CGPA is given more preference).

g) If more students opt for a particular course, then the concerned Head of the Department shall decide whether or not to offer such a course for two or more sections.

h) In case of options coming from students of other departments, priority shall be given to the student of the 'parent department'.

6. Attendance Requirements:

a) A student shall be eligible to appear for the semester-end examinations if he/she puts in a minimum of 75% of attendance in aggregate in all the courses concerned in the semester.

b) Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in a semester may be granted. A committee headed by Dean (Academic Affairs) shall be the deciding authority for granting the condonation.

c) Students who have been granted condonation shall pay a fee as decided by the Finance Committee.

d) Shortage of Attendance more than 10% (attendance less than 65% in aggregate) shall in no case be condoned.

e) Students whose shortage of attendance is not condoned in any semester are detained and are not eligible to take their end examinations of that semester. **They get detained and their registration for that semester shall stand canceled**, including all academic credentials (internal marks etc.,) of that semester. **They will not be promoted to the next semester**. They may seek re-registration for all those subjects registered in that semester in which the student is detained, by seeking readmission into that semester as and when offered; if there are any professional electives and/ or open electives, the same may also be reregistered if offered. However, if those electives are not offered in later semesters, then alternate electives may be chosen from the **same** set of elective subjects offered under that category.

A student fulfilling the attendance requirement in the present semester shall not be eligible for readmission into the same class.

7. Paper Setting, Evaluation of Answer Scripts, Marks and Assessment:

a) Paper setting and evaluation of the answer scripts shall be done as per the procedures laid down by the Academic Council from time to time.

b) Distribution and Weightage of marks

S. No	Components	Internal	External	Total
1	Theory	40	60	100
2	Practical	40	60	100
3	Graphics for Engineers	40	60	100
4	Mini Project	40	60	100
5	Project Work	40	60	100

c) Continuous Internal Evaluation and Semester End Examinations: The assessment of the student's performance in each course will be based on Continuous Internal Evaluation (CIE) and Semester-End Examination (SEE). The marks for each of the components of assessment are fixed as shown in the following Table

Assessment Procedure:

S. No	Component of Assessment	Marks Allotted	Type of Assessment	Scheme of Examinations
1	Theory	40	Internal Examination & Continuous Evaluation	1) Two mid semester examination shall be conducted for 30 marks each for a duration of 120 minutes. Average of the two mid exams shall be considered **i) Subjective – 20 marks** **ii) Objective – 10 marks** 2) Continuous Evaluation is for each unit using **i) Assignment – 05 marks** **ii) Quiz/Subject Viva-voce/PPT/Poster Presentation/ Case Study on a topic in the concerned subject – 05 marks**
		60	Semester end examination	The semester-end examination is for a duration of 3 hours
2	Practical	40	Internal Examination & Continuous Evaluation	One internal lab examination towards the end of course for a duration of 90 minutes with a viva of 5 minutes. **i) Internal Exam-10 marks** **ii)Viva voce – 10 marks** **iii) Continuous Assessment- 10 marks** **iv) G-Lab on Board(G-LOB) (Case study inter threading of all experiments of lab)/ Laboratory Project/Prototype Presentation/App Development -10 marks**
		60	Semester end examination	The semester-end examination is for a duration of 3 hours. **i) write-up (algorithm/flowchart/procedure) as per the task/experiment/program - 10 marks** **ii) task/experiment/program-15 marks** **iii) evaluation of results -15 marks** **iv) write-up (algorithm/flowchart/procedure) for another task/experiment/program- 10 marks** **v) viva-voce on concerned laboratory course - 10 marks**

3	Graphics for Engineers	40	Internal Examination & Continuous Evaluation	1) Two mid semester examinations shall be conducted for 15 marks each for a duration of 90 minutes. Average of the two mid exams shall be considered 2) Day-to-Day activity -15 marks 3) Continuous Evaluation using ● **Assignment – 05 marks** ● **Quiz/Subject Viva-voce/PPT/Poster Presentation/ Case Study on a topic in the concerned subject – 05 marks**
		60	Semester end examination	The semester-end examination is for a duration of 3 hours

d) Mini Project:

S. No	Component of Assessment	Marks Allotted	Type of Assessment	Scheme of Examinations
1	Mini Project	40	Continuous Evaluation & Internal Evaluation	1) The supervisor continuously assesses the students for 20 marks **i) Continuous Assessment – 15 marks** • Abstract Presentation - 3 marks • Architectural Design Presentation - 3 marks • Modules Presentation - 3 marks • Execution Cycle 1 Presentation - 3 marks • Execution Cycle 2 Presentation - 3 marks **ii) Report – 5 marks** 2) At the end of the semester, Mini Project shall be displayed in the road show at the department level. The Mini Project is evaluated by the Mini Project Review Committee for **10 marks**. 3) Technical Event Participation in project area/MOOCs Course in project area/ Paper Publication/Publishing or Granting of a Patent/Hackathon participation/ Book Publication – **10 marks**
		60	External Evaluation	The mini project report shall be presented before the Project Review Committee in the presence of External Examiner and the same is evaluated for **60 marks**.

Note:

i) Mini Project Review Committee consists of HoD, Mini Project Coordinator and Supervisor.

ii) Plagiarism check is compulsory for mini project report as per the plagiarism policy of GRIET.

e) Internship/Skill Development Course/ Industrial Training: Internship/Skill Development Course/Industrial Training shall be done by the student immediately after II-Year II Semester Examinations and pursue it during summer vacation/semester break & during III Year without effecting regular course work. Internship/Skill Development Course/Industrial Training at reputed organization shall be submitted in a report form and presented before the committee in III-year II semester before end semester examination.

f) Project Work (Phase–I and Phase-II):

<table>
<tr><th>S. No</th><th>Component of Assessment</th><th>Marks Allotted</th><th>Type of Assessment</th><th>Scheme of Examinations</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Project Work (Phase- I and Phase -II)</td><td>40</td><td>Continuous Evaluation & Internal Evaluation</td><td>1) The supervisor continuously assesses the students for 20 marks

i) Continuous Assessment – 15 marks
• Abstract Presentation - 3 marks
• Architectural Design Presentation - 3 marks
• Modules Presentation - 3 marks
• Execution Cycle 1 Presentation - 3 marks
• Execution Cycle 2 Presentation – 3 marks
ii) Report – 5 marks
2) At the end of the semester, Project work shall be displayed in the road show at the department level. Project work is evaluated by the Project Review Committee for 10 marks.
3) Technical Event Participation in project area/ MOOCs Course in project area/ Paper Publication/Publishing or Granting of a Patent/Hackathon participation/Book Publication – 10 marks.</td></tr>
<tr><td>60</td><td>External Evaluation</td><td>The Project report shall be presented before the Project Review Committee in the presence of External Examiner</td></tr>
</table>

				and the same is evaluated for **60 marks**.

Note:

i) Project Review Committee consists of HoD, Project Coordinator and Supervisor.

ii) Plagiarism check is compulsory for project work report (Phase I and Phase II) as per the plagiarism policy of GRIET.

iii) The above rules are applicable for both Phase I and Phase II.

- A student is deemed to have satisfied the academic requirements and earned the credits allotted to Project Stage-I if the student secures not less than 40% of marks (40 marks out of 100 marks) in the evaluation of the same.
- A student is deemed to have failed if the student does not submit a report on work carried out during Project Stage-I or does not make a presentation of the same before the evaluation committee as per schedule or secures less than minimum marks in the evaluation.
- A student who has failed may reappear once for evaluation when it is scheduled again; if the student fails in the evaluation of 'one such reappearance', the student has to reappear for the same in the subsequent semester, as and when it is offered.
- A student is deemed to have satisfied the academic requirements and earned the credits allotted to Project Stage-II if the student secures not less than 35% (14 marks out of 40 marks) in the Continuous Internal Evaluation (CIE), not less than 35% (21 marks out of 60 marks) in the Semester End Examinations (SEE), and a minimum of 40% (40 marks out of 100 marks) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of letter grades, this implies securing 'C' grade or above in that subject/ course.
- The student is deemed to have failed if the student does not submit a report on work carried out during Project Stage-II or does not make a presentation of the same before the evaluation committee as per schedule or secures less than minimum marks in either CIE or SEE or CIE+SEE taken together.
- A student who has failed may reappear once for the evaluation when it is scheduled again; if the student fails again in the evaluation of "once such reappearance", the student has to reappear for the same in the subsequent semester as and when the evaluation is scheduled.

g) The evaluation of courses having ONLY **CIE** is as follows:

- **Elements of CE/EEE/ME/ECE/CSE as a Theory Course**, in I year I semester is evaluated for **50 marks**. The CIE for 50 marks shall be done through first and second mid-term examinations. The average marks of two mid-term examinations are taken as final marks in CIE. Students shall have to earn 40% i.e. 20 marks out of 50 marks in the average of two mid-term examinations. **There shall be no external evaluation**. The student is deemed to have failed, if he (i) is absent as per schedule, or (ii) secures less than 40% marks in this course.

CIE is done for 50 marks as follows:

- There shall be two mid-term examinations during the semester conducted for 40 marks consisting of two parts with a total duration of 2 hours: Part A for 20 marks and Part B for 20 marks.

- Part A is an objective paper or a quiz and shall consist of multiple-choice questions, fill-in-the blanks, match the following, etc. for a total of 20 marks.
- Part B is a descriptive paper and shall contain 6 questions out of which, the student needs to answer 4 questions each carrying 5 marks.
- While the first mid-term examination shall be conducted for the first 50% syllabus, the second mid-term examination shall be conducted for the remaining 50% of the syllabus. The average of the two mid-term examinations shall be taken as final marks.
- Two assignments are evaluated for 5 marks each. The first assignment should be submitted before the conduct of the first mid-term examination, and the second assignment should be submitted before the conduct of the second mid-term examination. The assignments shall be given by the subject teachers. The average of the two assignments shall be taken as the final marks.
- The remaining 5 marks may be evaluated by conducting viva-voce in the subject or by evaluating the performance of the student in PPT/Poster/Case-Study presentation on a topic in the concerned subject before the second mid-term examination.

- **Elements of CE/EEE/ME/ECE/CSE as a Lab Course**, in I year I semester is evaluated for **50 marks**.

CIE is done for 50 marks as follows:

- A write-up on day-to-day experiments in the laboratory (in terms of aim, components/procedure, expected outcome) shall be evaluated for 10 marks
- 10 marks are awarded either for the performance in viva-voce (or) case study presentation (or) application development (or) poster presentation.
- Internal practical examination shall be conducted by the concerned laboratory teacher for 15 marks.
- The remaining 15 marks are awarded for the laboratory project, which consists of the design (or) model presentation (or) prototype presentation at the end of the completion of laboratory course and before semester end practical examination.

- **Real-Time/Field-based Research Project** Course in II-year II Semester is evaluated for **50 marks.** The internal evaluation for 50 marks shall take place during I Mid-Term examination and II Mid-Term examination. The average marks of two Mid-Term examinations is the final for 50 marks. Students shall have to earn 40%, i.e 20 marks out of 50 marks from average of the two examinations. There shall be **NO external evaluation.**

  A student is deemed to have satisfied the academic requirements and earned the credits allotted to "Real-Time/Field-Based Research Project" if the student secures not less than 40% marks (i.e. 20 marks out of 50 marks) in the evaluation of the same.

  A student is deemed to have failed in Real-Time/Field-Based Research Project, if he (i) does not submit a report on the same or (ii) does not make a presentation of the same before the evaluation committee as per schedule, or (iii) secures less than 40% marks in evaluation of the same.
  A student who is failed in either Real-Time/Field-Based Research Project may reappear once for the evaluation when they are scheduled again; if the student fails again in the evaluation of 'one such reappearance', the student has to reappear for the same in the subsequent semester, as and when it is offered.

- **Mandatory Courses** are evaluated for **50 marks**. The CIE for 50 marks shall be done through first and second mid-term examinations. The average marks of two mid-term examinations are taken as final marks in CIE. Students shall have to earn 40% i.e. 20 marks out of 50 marks in the average of two mid-term examinations. There shall be **NO external evaluation**. The student is deemed to have failed, if he (i) is absent as per schedule, or (ii) secures less than 40% marks in this course.

  A mandatory course is not graded and does not carry credits. Only Pass/Fail shall be indicated in Grade Card

  The evaluation pattern for mandatory courses shall be done similar to **Elements of CE/EEE/ME/ECE/CSE as a Theory Course.**

8. **Recounting of Marks in the End Examination Answer Books:** A student can request for recounting of his/her answer book on payment of a prescribed fee.

9. **Re-evaluation of the End Examination Answer Books:** A student can request for re-evaluation of his/her answer book on payment of a prescribed fee.

10. **Supplementary Examinations:** A student who has failed to secure the required credits can register for a supplementary examination, as per the schedule announced by the College for a prescribed fee.

11. **Malpractices in Examinations:** Disciplinary action shall be taken in case of malpractices during Mid/ End-examinations as per the rules framed by the Academic Council.

12. **Re-registration for mid examination:** A student shall be given one time chance to re-register for a maximum of two subjects in a semester:
    - If the internal marks secured by a student in Continuous Internal Evaluation marks for 40 (sum of average of 2 mid-term examinations, average of all assignments and Subject Viva-voce/ PPT/Poster Presentation/Case Study on a topic in the concerned subject) are less than 35% and failed in those subjects.
    - A student must re-register for the failed subject(s) for 40 marks within four weeks of commencement of the classwork when the course is offered next, it could be a semester for first years and a year for others.
    - In the event of the student taking this chance, his/her Continuous Internal Evaluation marks for 40 and Semester End Examination marks for 60 obtained in the previous attempt stand canceled.

13. **Academic Requirements and Promotion Rules:**

a) A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course, if student secures not less than 35% (14 marks out of 40), not less than 35% (21 marks out of 60 marks) in the semester end examination, and a minimum of 40% (40 marks out of 100 marks) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

The student is eligible to write Semester End Examination of the concerned subject/course if the student scores ≥ 35% (14 marks) of 40 Continuous Internal Examination (CIE) marks.
In case, the student appears for Semester End Examination (SEE) of the concerned subject/course but not scored minimum 35% of CIE marks (14 marks out of 40 internal marks), his/her performance in that subject/course in SEE shall stand cancelled inspite of appearing the SEE.

b) A student shall be promoted to the next year only when he/she satisfies the requirements of all the previous semesters.

S.No	Promotion	Conditions to be fulfilled
1	First year first semester to First year second semester	Regular course of study of First year first semester.
2	First year second semester to Second year first semester	**(i)** Regular course of study of First year second semester. **(ii)** Must have secured at least 50% credits up to First year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
3	Second year first semester to Second year second semester	Regular course of study of Second year first semester.
4	Second year second semester to Third year first semester	**(i)** Regular course of study of Second year second semester **(ii)** Must have secured at least 60% credits up to Second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
5	Third year first semester to Third year second semester	Regular course of study of Third year first semester.
6	Third year second semester to Fourth year first semester	**(i)** Regular course of study of Third year second semester. **(ii)** Must have secured at least 60% credits up to Third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.

7	Fourth year first semester to Fourth year second semester	Regular course of study of Fourth year first semester.

14. Grade Points: A 10 - point grading system with corresponding letter grades and percentage of marks, as given below, is followed

Letter Grade	Grade Point	Percentage of marks
O (Outstanding)	10	Marks >= 90
A+ (Excellent)	9	Marks >= 80 and Marks < 90
A (Very Good)	8	Marks >= 70 and Marks < 80
B+ (Good)	7	Marks >= 60 and Marks < 70
B (Average)	6	Marks >= 50 and Marks < 60
C (Pass)	5	Marks >= 40 and Marks < 50
F (Fail)	0	Marks < 40
Ab (Absent)	0	

Letter grade 'F' in any Course implies failure of the student in that course and no credits of the above table are earned.

Computation of SGPA and CGPA:

The UGC recommends the following procedure to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

i) **Sk** the SGPA of **kth** semester (1 to 8) is the ratio of sum of the product of the number of credits and grade points to the total credits of all courses registered by a student, i.e.,

$$SGPA\ (S_k) = \sum_{i=1}^{n} \quad (C_i * G_i) / \sum_{i=1}^{n} \quad C_i$$

Where **Ci** is the number of credits of the **ith** course and **Gi** is the grade point scored by the student in the **ith** course and **n** is the number of courses registered in that semester.

ii) The CGPA is calculated in the same manner taking into account all the courses **m**, registered by student over all the semesters of a programme, i.e., up to and inclusive of **Sk**, where $k \geq 2$.

$$CGPA = \sum_{i=1}^{m} \quad (C_i * G_i) / \sum_{i=1}^{m} \quad C_i$$

iii) The SGPA and CGPA shall be rounded off to 2 decimal points.

15. Award of Class: After a student satisfies all the requirements prescribed for the completion of the Degree and becomes eligible for the award of B.Tech Degree by JNTUH, he/she shall be placed in one of the following four classes based on CGPA secured from the 160 credits.

S. No	Class Awarded	CGPA Secured
1	First Class with Distinction	CGPA >= 8.00 with no F or below grade/ detention anytime during the programme
2	First Class	CGPA >= 8.00 with rest of the clauses of S.No 1 not satisfied
3	First Class	CGPA ≥ 6.50 and CGPA < 8.00
4	Second Class	CGPA ≥ 5.50 and CGPA < 6.50
5	Pass Class	CGPA ≥ 5.00 and CGPA < 5.50

Equivalence of grade to marks

Marks % = (CGPA -0.5)*10

16. Award of 2-Year B.Tech Diploma Certificate

1. A student is awarded 2-Year UG Diploma Certificate in the concerned engineering branch on completion of all the academic requirements and earned all the 80 credits (within 4 years from the date of admission) upto B.Tech – II Year – II Semester if the student want to exit the 4-Year B.Tech program and requests for the 2-Year B.Tech (UG) Diploma Certificate.

2. The student **once opted and awarded for 2-Year UG Diploma Certificate, the student will be permitted to join** in B.Tech III Year – I Semester and continue for completion of remaining years of study for 4-Year B.Tech Degree. ONLY in the next academic year along with next batch students. However, if any student wishes to continue the study after opting for exit, he/she should register for the subjects/courses in III Year I Semester before commencement of classwork for that semester.

3. The students, who exit the 4-Year B.Tech program after II Year of study and wish to re-join the B.Tech program, must submit the 2 -Year B.Tech (UG) Diploma Certificate awarded to him, subject to the eligibility for completion of Course/Degree.

4. A student may be permitted to take one year break after completion of II Year II Semester or B.Tech III Year II Semester (with university permission through the principal of the college well in advance) and can re-enter the course in **next Academic Year in the same college** and complete the course on fulfilling all the academic credentials within a stipulated duration i.e. double the duration of the course (Ex. within 8 Years for 4-Year program).

17. Withholding of Results: If the student has not paid dues to the Institute/ University, or if any case of indiscipline is pending against the student, the result of the student (for that Semester) may be withheld and the student will not be allowed to go into the next semester. The award or issue of the Degree may also be withheld in such cases.

18. Transitory Regulations

A. For students detained due to shortage of attendance:

1. A Student who has been detained in I year of GR22 Regulations due to lack of attendance, shall be permitted to join I year I Semester of GR24 Regulations and he is required to complete the study of B.Tech programme within the stipulated period of eight academic years from the date of first admission in I Year.
2. A student who has been detained in any semester of II, III and IV years of GR22 regulations for want of attendance, shall be permitted to join the corresponding semester of GR24 Regulations and is required to complete the study of B.Tech within the stipulated period of eight academic years from the date of first admission in I Year. The GR24 Academic Regulations under which a student has been readmitted shall be applicable to that student from that semester. See rule (C) for further Transitory Regulations.

B. For students detained due to shortage of credits:

3. A student of GR22 Regulations who has been detained due to lack of credits, shall be promoted to the next semester of GR24 Regulations only after acquiring the required number of credits as per the corresponding regulations of his/her first admission. The total credits required are 160 including both GR22 & GR24 regulations. The student is required to complete the study of B.Tech within the stipulated period of eight academic years from the year of first admission. The GR24 Academic Regulations are applicable to a student from the year of readmission. See rule (C) for further Transitory Regulations.

C. For readmitted students in GR24 Regulations:

4. A student who has failed in any subject under any regulation has to pass those subjects in the same regulations.
5. The maximum credits that a student acquires for the award of degree, shall be the sum of the total number of credits secured in all the regulations of his/her study including GR24 Regulations. **There is NO exemption of credits in any case**.
6. If a student is readmitted to GR24 Regulations and has any subject with 80% of syllabus common with his/her previous regulations, that particular subject in GR24 Regulations will be substituted by another subject to be suggested by the college academic administration.

Note:

If a student readmitted to GR24 Regulations and has not studied any courses/topics in his/her earlier regulations of study which is prerequisite for further subjects in GR24 Regulations, then the college shall conduct remedial classes to cover those courses/topics for the benefit of the students.

19. Transfer of students from the Constituent Colleges of JNTUH or from other Colleges / Universities:

a) Transfer of students from the Constituent Colleges of JNTUH or from other Colleges/ Universities shall be considered only on case-to-case basis.

b) There shall be no branch transfers after the completion of admission process.

c) The students seeking transfer to GRIET from various other Universities/institutions have to pass the failed courses which are equivalent to the courses of GRIET, and also pass the courses of GRIET which the students have not studied at the earlier institution. Further, though the students have passed some of the courses at the earlier institutions, if the same courses are prescribed in different semesters of GRIET, the students have to study those courses in GRIET in spite of the fact that those courses are repeated.

d) The transferred students from other Universities/institutions to GRIET who are on rolls are to be provided one chance to write the CBT (internal marks) in the **equivalent course(s)** as per the clearance (equivalence) letter issued by the University.

20. General Rules

a. The academic regulations should be read as a whole for the purpose of any interpretation.
b. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Academic Council is final.
c. In case of any error in the above rules and regulations, the decision of the Academic Council is final.
d. 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.

Academic Regulations for B.Tech (Lateral Entry) under GR24
(Applicable for Batches Admitted from 2025-26)

1. All regulations as applicable for B.Tech 4-year degree programme (Regular) will hold good for B.Tech (Lateral Entry Scheme) except for the following rules:

a) Pursued programme of study for not less than three academic years and not more than six academic years.

b) A student should register for all 120 credits and secure all credits. The marks obtained in all 120 credits shall be considered for the calculation of the final CGPA.

c) Students who fail to fulfil all the academic requirements for the award of the degree within six academic years from the year of their admission, shall forfeit their seat in B.Tech programme.

2. Academic Requirements and Promotion Rules:

a) A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory or laboratories if he/she secures not less than 35% of marks in the Semester-end Examination and a minimum of 40% of the sum total of the Internal Evaluation and Semester-end Examination taken together.

b) A student shall be promoted to the next year only when he/she satisfies the requirements of all the previous semesters.

S. No.	Promotion	Conditions to be fulfilled
1	Second year first semester to Second year second semester.	Regular course of study of Second year first semester.
2	Second year second semester to Third year first semester.	(i) Regular course of study of Second year second semester. (ii) Must have secured at least 50% credits up to Second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
3	Third year first semester to Third year second semester.	Regular course of study of Third year first semester.
4	Third year second semester to Fourth year first semester.	(i) Regular course of study of Third year second semester. (ii) Must have secured at least 60% credits up to third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
5	Fourth year first semester to Fourth year second semester.	Regular course of study of Fourth year first semester.

3. **Award of Class:** After a student satisfies all the requirements prescribed for the completion of the Degree and becomes eligible for the award of B.Tech Degree by JNTUH, he/she shall be placed in one of the following four classes based on CGPA secured from the 120 credits.

S. No	Class Awarded	CGPA Secured
1	First Class with Distinction	CGPA >= 8.00 with no F or below grade/ detention anytime during the Programme
2	First Class	CGPA >= 8.00 with rest of the clauses of S.no 1 not satisfied
3	First Class	CGPA ≥ 6.50 and CGPA < 8.00
4	Second Class	CGPA ≥ 5.50 and CGPA < 6.50
5	Pass Class	CGPA ≥ 5.00 and CGPA < 5.50

Academic Regulations for B.Tech with Minors Programme under GR24
(Applicable for Batches Admitted from 2024-25)

1. Objectives

The key objectives of offering B.Tech with Minor program are:

- To expand the domain knowledge of the students in one of the other programmes of engineering.
- To increase the employability of undergraduate students keeping in view of better opportunity in interdisciplinary areas of engineering & technology.
- To provide an opportunity to students to pursue their higher studies in the inter-disciplinary areas in addition to their own programme of study.
- To offer the knowledge in the areas which are identified as emerging technologies/thrust areas of Engineering.

2. Academic Regulations for B.Tech Degree with Minor programmes

a) The weekly instruction hours, internal & external evaluation and award of grades are on par with regular 4 -Years B.Tech programme.

b) For B.Tech with Minor, a student needs to earn additional 18 credits (over and above the required 160 credits for B.Tech degree). All these 18 credits need to be completed in III year and IV year only.

c) After registering for the Minor programme, if a student is unable to earn all the required 18 credits in a specified duration (twice the duration of the course), he/she shall not be awarded Minor degree. However, if the student earns all the required 160 credits of B.Tech, he/she will be awarded only B.Tech degree in the concerned programme.

d) There is no transfer of credits from Minor programme courses to regular B.Tech degree course and vice versa.

e) These 18 credits are to be earned from the additional Courses offered by the host department in the college as well as from the MOOCs platform.

f) For the course selected under MOOCs platform following guidelines may be followed:

- **i)** Prior to registration of MOOCs courses, formal approval of the courses, by the University is essential. University before the issue of approval considers the parameters like the institute / agency which is offering the course, syllabus, credits, duration of the programme and mode of evaluation etc.
- **ii)** Minimum credits for MOOCs course must be equal to or more than the credits specified in the Minor course structure provided by the University.
- **iii)** Only Pass-grade/marks or above shall be considered for inclusion of grades in minor grade memo.
- **iv)** Any expenses incurred for the MOOCs courses are to be met by the students only.

g) The option to take a Minor programme is purely the choice of the student.

h) The student shall be given a choice of withdrawing all the courses registered and/or the credits earned for Minor programme at any time; and in that case the student will be awarded only B.Tech degree in the concerned programme on earning the required credits of 160.

i) The student can choose only one Minor programme along with his/her basic engineering degree. A student who chooses an Honors programme is not eligible to choose a Minor programme and vice-versa.

j) A student can graduate with a Minor if he/she fulfils the requirements for his/her regular B.Tech programme as well as fulfils the requirements for Minor programme.

k) The institute shall maintain a record of students registered and pursuing their Minor programmes, minor programme-wise and parent programme -wise. The same report needs to be sent to the University once the enrolment process is complete.

l) The institute / department shall prepare the time-tables for each Minor course offered at their respective institutes without any overlap/clash with other courses of study in the respective semesters.

3. Eligibility conditions for the student to register for Minor programme

a) A student can opt for B.Tech programme with Minor programme if she/he has no active backlogs till II Year I Semester (III semester) at the time of entering into III year I semester.

b) Prior approval of mentor and Head of the Department for the enrolment into Minor programme, before commencement of III year I Semester (V Semester), is mandatory

c) If more than 50% of the students in a programme fulfil the eligibility criteria (as stated above), the number of students given eligibility should be limited to 50%.

4. Registration for the courses in Minor Programme

a) At the beginning of each semester, just before the commencement of classes, students shall register for the courses which they wish to take in that semester.

b) The students should choose a course from the list against each semester (from Minors course structure) other than the courses they have studied/registered for regular B.Tech programmes. No course should be identical to that of the regular B.Tech course. The students should take the advice of faculty mentors while registering for a course at the beginning of semester.

c) The maximum No. of courses for the Minor is limited to two (three in case of inclusion of lab) in a semester along with regular semester courses.

d) The registration fee to be collected from the students by the College is **Rs. 1000/-** per one credit.

e) A fee for late registration may be imposed as per the norms.

5. Minor courses and the offering departments

S. No.	Minor Programme	Eligible programme of students	@Offering Department	Award of Degree
1.	Artificial Intelligence & Machine Learning	All programmes, except B.Tech in CSE (AI&ML) /B.Tech (AI&ML)/ B.Tech (AI)/ B.Tech CSE(AI)	CSE	"B.Tech in programme name with Minor in Artificial Intelligence & Machine Learning"

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
Bachupally, Kukatpally, Hyderabad–500090, India. (040)65864440
COMPUTER SCIENCE AND BUSINESS SYSTEM (CSBS)
GR24 Course Structure

I B. Tech – CSBS - I Semester

S.No	BOS	Group	Course Code	Course Name	L	T	P	Credits	Int.	Ext	Total Marks
1	Maths	BS	GR24A1029	Discrete Mathematics for Computer Science	3	1	0	4	40	60	100
2	Maths	BS	GR24A1030	Introductory Topics in Statistics, Probability and Calculus	3	0	0	3	40	60	100
3	CSBS	ES	GR24A1031	Fundamentals of Computer Science	2	0	0	2	40	60	100
4	EEE	ES	GR24A1032	Principles of Electrical Engineering	2	0	0	2	40	60	100
5	Physics	BS	GR24A1003	Applied Physics	3	1	0	4	40	60	100
6	CSBS	ES	GR24A1033	Fundamentals of Computer Science Lab	0	0	3	1.5	40	60	100
7	EEE	ES	GR24A1034	Principles of Electrical Engineering Lab	0	0	2	1	40	60	100
8	Physics	BS	GR24A1018	Applied Physics Lab	0	0	3	1.5	40	60	100
9	English	HS	GR24A1035	Business Communication and Value Science – I	2	0	0	2	40	60	100
		TOTAL			**15**	**2**	**8**	**21**	**360**	**540**	**900**

I B. Tech CSBS - II Semester

S. No	BOS	Group	Course Code	Course Name	L	T	P	Credits	Int.	Ext	Total Marks
1	Maths	BS	GR24A1036	Linear Algebra	3	1	0	4	40	60	100
2	Maths	BS	GR24A1037	Statistical Methods and Modelling	3	0	0	3	40	60	100
3	CSBS	ES	GR24A1038	Data Structures and Algorithms	2	0	0	2	40	60	100
4	ECE	ES	GR24A1039	Principles of Electronics	2	0	0	2	40	60	100
5	Mgmt	HS	GR24A1040	Design and Critical Thinking	2	0	0	2	40	60	100
6	CSE	ES	GR24A1027	Python Programming	1	0	0	1	50	---	50
7	Maths	BS	GR24A1041	Statistical Methods and Modelling Lab	0	0	2	1	40	60	100
8	CSBS	ES	GR24A1042	Data Structures and Algorithms Lab	0	0	2	1	40	60	100
9	ECE	ES	GR24A1043	Principles of Electronics Lab	0	0	2	1	40	60	100
10	English	HS	GR24A1044	Business Communication and Value Science – II	2	0	0	2	40	60	100
TOTAL					**15**	**1**	**6**	**19**	**410**	**540**	**950**

II B. Tech –CSBS - I Semester

S. No	BOS	Group	Course Code	Course Name	L	T	P	Credits	Int.	Ext	Total Marks
1	CSBS	PC	GR24A2086	Theory of Computation	3	0	0	3	40	60	100
2	CSBS	PC	GR24A2087	Computer Organization and Architecture	3	0	0	3	40	60	100
3	CSBS	PC	GR24A2088	Object Oriented Programming	2	0	0	2	40	60	100
4	CSBS	PC	GR24A2089	Computational Statistics	3	0	0	3	40	60	100
5	CSBS	PC	GR24A2090	Fundamentals of Database Systems	3	0	0	3	40	60	100
6	CSBS	PC	GR24A2091	Computer Organization and Architecture Lab	0	0	4	2	40	60	100
7	CSBS	PC	GR24A2092	Object Oriented Programming Lab	0	0	4	2	40	60	100
8	CSBS	PC	GR24A2093	Computational Statistics Lab	0	0	2	1	40	60	100
9	CSBS	PC	GR24A2094	Databases Lab	0	0	2	1	40	60	100
		TOTAL			**14**	**0**	**12**	**20**	**360**	**540**	**900**
10	Chemistry	MC	GR24A2001	Environmental Science	2	0	0	0	50	--	50

II B. Tech –CSBS - II Semester

S.No	BOS	Gro up	Course Code	Course Name	L	T	P	Credits	Int.	Ext	Total Mark s
1	CSBS	PC	GR24A2095	Operating Systems Concepts	2	0	0	2	40	60	100
2	CSBS	PC	GR24A2096	Principles of Software Engineering	2	0	0	2	40	60	100
3	CSBS	PC	GR24A2097	Algorithm Design and Analysis	3	0	0	3	40	60	100
4	Mgmt	HS	GR24A2098	Introduction to innovation, IP management and Entrepreneurship	3	0	0	3	40	60	100
5	ME	PC	GR24A2099	Operational Research	2	0	0	2	40	60	100
6	Mgmt	HS	GR24A2100	Fundamentals of Economics	2	0	0	2	40	60	100
7	CSBS	PC	GR24A2101	Operating Systems Concepts Lab	0	0	2	1	40	60	100
8	CSBS	PC	GR24A2102	Software Engineering Lab	0	0	2	1	40	60	100
9	CSBS	PC	GR24A2103	Algorithm Design and Analysis Lab	0	0	2	1	40	60	100
10	ME	PC	GR24A2104	Operational Research Lab	0	0	2	1	40	60	100
11	CSBS	MC	GR24A2106	Real-time Research Project/ Societal Related Project	0	0	4	2	50	--	50
		TOTAL			**14**	**0**	**12**	**20**	**450**	**600**	**1050**
12	Mgmt	MC	GR24A2105	Essence of Indian Traditional Knowledge	2	0	0	0	50	--	50

III B. Tech –CSBS - I Semester

S.No	BOS	Group	Course Code	Course Name	L	T	P	Credits	Int.	Ext	Total Marks
1	CSBS	PC		Software Design with UML	2	0	0	2	40	60	100
2	CSBS	PC		Cloud, Microservices and Application	3	0	0	3	40	60	100
3	Mgmt	HS		Fundamentals of Management	2	0	0	2	40	60	100
4	CSBS	PC		Machine Learning with R	2	0	0	2	40	60	100
5	English	HS		Business Communication and Value Science – III	2	0	0	2	40	60	100
6	CSBS	PE		**Professional Elective I**	2	1	0	3	40	60	100
7	CSBS	PC		Software Design with UML Lab	0	0	4	2	40	60	100
8	CSBS	PC		Compiler Construction Lab	0	0	4	2	40	60	100
9	CSBS	PC		Machine Learning with R Lab	0	0	2	1	40	60	100
10	CSBS	PW		Mini Project	0	0	2	1	40	60	100
		TOTAL			**13**	**1**	**12**	**20**	**400**	**600**	**1000**
11	Mgmt	MC		Constitution of India	2	0	0	0	50	--	50

PROFESSIONAL ELECTIVE – I				
S. No.	**BOS**	**Group**	**Course Code**	**COURSE**
1	CSBS	PE		Conversational Systems
2	CSBS	PE		Compiler Construction
3	CSBS	PE		Business Strategy

PROFESSIONAL ELECTIVE – II				
S.No.	**BOS**	**Group**	**Course Code**	**COURSE**
1	CSBS	PE		Modern Day Robotics and its Industrial Applications
2	CSBS	PE		Modern Web Applications
3	CSE (AIML)	PE		Natural language Processing

III B. Tech –CSBS - II Semester

S.No	BOS	Gro up	Course Code	Course Name	L	T	P	Credits	Int.	Ext	Total Mark s
1	CSBS	PC		Computer Communications	3	0	0	3	40	60	100
2	CSBS	PC		Information Security	3	0	0	3	40	60	100
3	CSBS	PC		Fundamentals of Artificial Intelligence	3	0	0	3	40	60	100
4	Mgmt	HS		Financial and Cost Accounting	3	0	0	3	40	60	100
5	English	HS		Business Communication and Value Science – IV	2	0	0	2	40	60	100
6	CSBS	PE		**Professional Elective II**	3	0	0	3	40	60	100
7	CSBS	PC		Computer Networks and Security Lab	0	0	2	1	40	60	100
8	CSBS	PC		Fundamentals of Artificial Intelligence Lab	0	0	2	1	40	60	100
9	CSBS	PC		Data Mining and Analytics Lab	0	0	2	1	40	60	100
		TOTAL			**17**	**0**	**6**	**20**	**360**	**540**	**900**

PROFESSIONAL ELECTIVE – III				
S. No.	**BOS**	**Group**	**Course Code**	**COURSE**
1	CSBS	PE		Cognitive Science and Analytics
2	CSBS	PE		Introduction to IoT
3	CSE(DS)	PE		Information Retrieval Systems

PROFESSIONAL ELECTIVE – IV				
S. No.	**BOS**	**Group**	**Course Code**	**COURSE**
1	CSBS	PE		Quantum Computation and Quantum Information
2	CSBS	PE		Generative AI
3	CSBS	PE		Mobile Computing

IV B. Tech –CSBS - I Semester

S. No	BOS	Gro up	Course Code	Course Name	L	T	P	Credits	Int.	Ext	Total Mark s
1	CSBS	PC		Usability Design of Software Applications	2	1	0	3	40	60	100
2	Mgmt	HS		Financial Management	3	0	0	3	40	60	100
3	Mgmt	HS		Human Resource Management	3	0	0	3	40	60	100
4	CSBS	PE		**Professional Elective III**	2	1	0	3	40	60	100
5	CSBS	PE		**Professional Elective IV**	2	1	0	3	40	60	100
6	CSBS	PC		Usability Design of Software Applications Lab	0	0	4	2	40	60	100
7	CSBS	PC		Mobile Computing Lab	0	0	4	2	40	60	100
8	CSBS	PW		Project Work Phase- I	0	0	12	6	40	60	100
		TOTAL			**12**	**3**	**20**	**25**	**320**	**480**	**800**

PROFESSIONAL ELECTIVE – III				
S. No.	**BOS**	**Group**	**Course Code**	**COURSE**
1	CSBS	PE		Cognitive Science and Analytics
2	CSBS	PE		Introduction to IoT
3	CSE(DS)	PE		Information Retrieval Systems

PROFESSIONAL ELECTIVE – IV				
S. No.	**BOS**	**Group**	**Course Code**	**COURSE**
1	CSBS	PE		Quantum Computation and Quantum Information
2	CSBS	PE		Generative AI
3	CSBS	PE		Mobile Computing

IV B. Tech – CSBS - II Semester

S.No	BOS	Gro up	Course Code	Course Name	L	T	P	Credits	Int.	Ext	Total Mark s
1		OE		**Open Elective -I**	3	0	0	3	40	60	100
2		PE		**Professional Elective V**	3	0	0	3	40	60	100
3		PE		**Professional Elective VI**	3	0	0	3	40	60	100
4	CSBS	PW		Project Work Phase-II	0	0	12	6	40	60	100
				TOTAL	**9**	**0**	**12**	**15**	**160**	**240**	**400**

OPEN ELECTIVE – I				
S.No.	**BOS**	**Group**	**Course Code**	**COURSE**
1	Mgmt	OE		Services Science and Service Operational Management
2	CSBS	OE		IT Project Management
3	Mgmt	OE		Marketing Research and Marketing Management

PROFESSIONAL ELECTIVE – V				
S. No.	**BOS**	**Group**	**Course Code**	**COURSE**
1	Mgmt	PE		Behavioral Economics
2	Mgmt	PE		Computational Finance & Modeling
3	Mgmt	PE		Industrial Psychology

PROFESSIONAL ELECTIVE – VI				
S. No.	**BOS**	**Group**	**Course Code**	**COURSE**
1	Mgmt	PE		Enterprise Systems
2	Mgmt	PE		Advance Finance
3	CSE	PE		Cyber Security

PROFESSIONAL ELECTIVES – 3 THREADS

S. No.	Theory and Algorithms	Applications	Data Science and Machine Intelligence
1	Business Strategy	Compiler Construction	Conversational Systems
2	Modern Day Robotics and its Industrial Applications	Modern Web Applications	Natural Language Processing
3	Cognitive Science and Analytics	Introduction to IoT	Information Retrieval Systems
4	Quantum Computation and Quantum Information	Generative AI	Mobile Computing
5	Behavioral Economics	Computational Finance & Modeling	Industrial Psychology
6	Enterprise Systems	Advance Finance	Cyber Security

OPEN ELECTIVE- THREADS

THREAD 1	THREAD 2	OFFERED BY
Soft Skills and Interpersonal Skills Human Resource Development and Organizational Behavior Cyber Law and Ethics Economic Policies in India	Data Science for Engineers	**CSE**
	Data Analytics using Open-Source Tools	
	Augmented Reality and Virtual Reality	
	Basics of Java Programming	**CSE (AIML)**
	Introduction to DBMS	
	Introduction to Data Mining	
	Introduction to Operating Systems	**CSE (DS)**
	Internet of Things	
	Scripting Languages	
	Services Science and Service Operational Management	**CSBS**
	IT Project Management	
	Marketing Research and Marketing Management	
	Introduction to Data Science	**IT**
	User Centric Human Computer Interaction	
	Design Patterns	
	Non-Conventional Energy Sources	**EEE**
	Concepts of Control Systems	
	Artificial Neural Networks and Fuzzy Logic	
	Principles of Communications	**ECE**
	Sensor Technology	
	Communication Technologies	
	Industrial Automation and Control	**ME**
	Composite Materials	
	Operations Research	
	Engineering Materials for Sustainability	**CE**
	Geographic Information Systems and Science	
	Environmental Impact Assessment	
	Basics of Java Programming	**CSE (AI)**
	Introduction to DBMS	
	Introduction to Data Mining	
	Introduction to Data Science	**CSIT**
	User Centric Human Computer Interaction	
	Design Patterns	

I YEAR
I SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DISCRETE MATHEMATICS FOR COMPUTER SCIENCE

Code: GR24A1029 **L/T/P/C:3/1/0/4**
I Year I Semester

Course Outcomes

1. Relate characteristics of Sets, Groups, Rings and Fields
2. Apply propositional calculus to establish tautology, contradiction, and contingency
3. Apply combinatorial mathematics in counting principles
4. Analyze the design of various combinational & sequential logic circuits using the concepts of Boolean Algebra
5. Apply graph theoretical models to solve some discrete optimization problems

UNIT I

Abstract Algebra

Sets, Finite sets, Power sets, Set Operations, Algebra of sets and duality, Partitions, Relations, Types of relations, Closure properties, Equivalence relations, Partial Ordering, Groups, subgroups, Lagrange's theorem on finite groups, Introduction to Ring, Integral domain and Field.

UNIT II

Logic

Propositional calculus - propositions and connectives, syntax; Semantics – truth assignments and truth tables, validity and satisfiability, tautology; Adequate set of connectives; Equivalence and normal forms; Compactness and resolution; Formal reducibility - natural deduction system and axiom system; Soundness and completeness.

UNIT III

Combinatorics

Basic counting, balls and bins problems, generating functions, recurrence relations. Proof techniques, principle of mathematical induction, pigeonhole principle.

UNIT-IV

Boolean algebra

Introduction of Boolean algebra, truth table, basic logic gate, basic postulates of Boolean algebra, principle of duality, canonical form, Karnaugh map.

UNIT V

Graph Theory

Graphs and digraphs, complement, isomorphism, connectedness and reachability, adjacency matrix, Trees, Properties of trees, spanning trees, Minimal Spanning trees using Kruskal's and Prim's Algorithms.

Graph Theory Applications

Eulerian paths and circuits in graphs and digraphs, Hamiltonian paths and circuits in graphs and tournaments, Planar graphs, Euler's formula, dual of a planar graph, independence number and clique number, chromatic number,statement of Four-color theorem.

Textbooks:

1. Topics in Algebra, I. N. Herstein, 2nd Edition, John Wiley and Sons, 1975.
2. Digital Logic & Computer Design, M. Morris Mano, 2nd Edition, Pearson, 2017.
3. Discrete Mathematics for Computer scientists and Mathematician, 2nd Edition, Joe

L. Mott, Abraham Kandel, Theodore P. Baker (PHI)

4. Discrete Mathematics and its applications, Eighth Edition, Kemmeth H. Rosem (Mc.Graw hill Education)
5. Mathematical Logic for Computer Science, L. Zhongwan, 2nd Edition, WorldScientific, Singapore, 1998.

Reference Books:

1. Discrete and Combinational Mathematics,5thEdition, Rudph P.Grimaldo (PearsonEducation)
2. Discrete Mathematics with graph Thoery, 3rd edition, Edgar G Goodair (PearsonEducation)
3. Graph Theory with Applications to Engineering and Computer Science, N. Deo,Prentice Hall, Englewood Cliffs, 1974.
4. Introduction to Mathematical Logic, (Second Edition), E. Mendelsohn, Van- Nostrand,London.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

INTRODUCTORY TOPICS IN STATISTICS, PROBABILITY AND CALCULUS

Course Code: GR24A1030 **L/T/P/C: 3/0/0/3**
I Year I Semester

Course Outcomes

1. Estimate the chance of occurrence of various uncertain events in different random experiments with strong basics of probability.
2. Evaluate random processes which occur in engineering applications governed by the Binomial, Poisson, Normal and Exponential distributions.
3. Apply descriptive statistics for data analysis.
4. Determine series approximations of univariate functions and extreme values of bivariate functions.
5. Apply multiple integrals to determine areas and volumes.

Unit-I

Introduction to Statistics and Descriptive Statistics

Definition of Statistics, Collection of Data: Internal and external data, Primary and secondary Data, Population and sample, Representative sample.

Classification and tabulation of univariate data; graphical representation, Frequency curves, Descriptive measures-Central tendency and Dispersion.

Unit-II

Basic Probability and Mathematical Expectations

Concept of experiments, sample space, event, Definition of Combinatorial Probability, Conditional Probability, Bayes' Theorem. Discrete and continuous random variables, Expected values and moments: mathematical expectation and its properties, Moments (including variance) and their properties (Statements), interpretation.

Unit-III

Probability Distributions

Discrete distributions: Binomial, Poisson and Geometric distribution.

Continuous distributions: Uniform, Exponential, Normal distributions.

Unit-IV

Differential Calculus

Limit of functions, continuity, derivatives. Taylor's and McLaurin's series expansions, Partial derivatives of first and second order, Maxima and minima of function of two variables without constraints.

Unit-V

Integral Calculus

Multiple Integrals- double integrals with constant and variable limits (Cartesian form), change of order of integration (Cartesian form), triple integrals (Cartesian coordinates), applications of double and triple integrals: Area as double integration in Cartesian coordinates and Volume as a triple integration.

Text Books*:*

1. S. M. Ross, "Introduction of Probability Models", Academic Press,N.Y.
2. Sheldon M. Ross, "Introduction to probability and statistics for Engineers and scientists", third edition, Academic Press.
3. A. Goon, M. Gupta and B. Dasgupta, "Fundamentals of Statistics", vol. I & II, WorldPress.

Reference Books*:*

1. I. R. Miller, J.E. Freund and R. Johnson, "Probability and Statistics for Engineers". Fourth Edition,PHI.
2. A. M. Mood, F.A. Graybill and D.C. Boes, "Introduction to the Theory of Statistics", McGraw Hill Education.
3. Peter V O'Neil, "Advanced Engineering Mathematics", seventh edition, Thomson learning.
4. M.D. Greenberg, "Advanced Engineering Mathematics", second edition, Pearson Education.
5. P.N. Wartikar and J.N. Wartikar, "Applied Mathematics", Vol. I&II, Vidyarthi Prakashan.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
FUNDAMENTALS OF COMPUTER SCIENCE

Course Code: GR24A1031 **L/T/P/C: 2/0/0/2**
I Year I Semester

Course Outcomes:

1.Design Algorithms and flowcharts for a problem by applying the fundamentals of the language.
2.Implement selection statements, iterative statements and arrays for solving a given problem.
3.To decompose a problem into functions and work with standard and user defined libraries.
4.Exercise on programs using pointers, structures and unions.
5.Interpret solution for a given problem using files in C and an idea of a unix file system.

UNIT I

General problem-Solving concepts: Algorithm, and Flowchart for problem solving with Sequential Logic Structure.
Imperative languages: Introduction to imperative language; syntax and constructs of a specific language (ANSI C)
Types Operator and Expressions with discussion of variable naming and Hungarian Notation: Variable Names, Data Type and Sizes (Little Endian Big Endian), Constants, Declarations, Arithmetic Operators, Relational Operators, Logical Operators, Increment Decrement Operators, Bitwise Operators, Assignment Operators and Expressions, Precedence and Order of Evaluation, proper variable naming and Hungarian Notation, Type Conversion.

UNIT II

Decisions and Loops: Control Flow with discussion on structured and unstructured programming: Statements and Blocks, If-Else-If, Switch, Loops – while, do, for, break and continue, goto labels, structured and un- structured programming.
Input and Output: Standard I/O, Formatted Output – printf, Formatted Input – scanf,
Arrays: One Dimensional, Two Dimensional and Multi-dimensional array and Row/column major formats.

UNIT III

Functions and Program Structure with discussion on standard library: Basics of functions, parameter passing and returning type, C main return as integer, External, Auto, Local, Static, Register Variables, Scope Rules, Block structure, Initialisation, Recursion, Standard Library Functions and return types.
Programming Method: Pre-processor, Debugging, Macro,
User Defined Header, User Defined Library Function, make file utility

UNIT IV

Structures: Basic Structures, Structures and Functions, Array of structures, Table look up, typedef, unions, Bit-fields
Pointers: Pointers and address, Pointer to functions, Pointers and Function Arguments, Pointers and Arrays, Address Arithmetic, character Pointers and Functions, Pointer Arrays, Pointer to Pointer, Initialisation of Pointer Arrays, Pointer of structures, Self-referral structures.

UNIT V

Files: Variable length argument list, file access including FILE structure, fopen, stdin, sdtout and stderr, Error Handling including exit, perror and error.h, Line I/O(related miscellaneous

functions).Command line arguments, complicated declarations and how they are evaluated.
Unix system Interface: File Descriptor, Low level I/O – read and write, open, create, close and unlink, Random access – lseek, Discussions on Listing Directory, Storage allocator.

Text Books:

1. The C Programming Language, B. W. Kernighan and D. M. Ritchi, Second Edition, PHI.
2. Programming in C, B. Gottfried, Second Edition, Schaum Outline Series.

References:

1. C: The Complete Reference, Herbert Schildt, Fourth Edition, McGraw Hill.
2. Let Us C, Yashavant Kanetkar, BPB Publications.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

PRINCIPLES OF ELECTRICAL ENGINEERING

Course Code: GR24A1032 **L/T/P/C: 2/0/0/2**
I Year I Semester

Course Outcomes:

1. Understand the basic concepts and terminology of electrical quantities
2. Analyze the DC circuit using various network theorems
3. Analyze the electrical parameters of AC circuits with R-L-C elements
4. Interpret the working principle of Electrical machines.
5. Apply the concept of sensors in measurement of various electrical quantities and understand the electrical safety norms

UNIT I
BASIC CIRCUIT CONCEPTS

Concept of Potential difference, voltage, current, Fundamental linear passive and active elements to their functional current-voltage relation, Terminology and symbols in order to describe electric networks, voltage source and current sources, ideal and practical sources, concept of dependent and independent sources, Kirchhoff-s laws and applications to network solutions using mesh and nodal analysis, Concept of work, power, energy, and conversion of energy.

UNIT II
DC CIRCUITS

Current - Voltage relations of the electric network by mathematical equations to analyze the network (Thevenin's theorem, Norton's Theorem, Maximum Power Transfer theorem) Simplifications of networks using series-parallel, Star/Delta transformation. Superposition theorem.

UNIT III
AC CIRCUITS

AC waveform definitions, form factor, peak factor, study of R-L, R-C,RLC series circuit, R- L-C parallel circuit, phasor representation in polar and rectangular form, concept of impedance, admittance, active, reactive, apparent and complex power, power factor, 3 phase Balanced AC Circuits (ƛ-Δ&ƛ-ƛ).

UNIT IV
ELECTROSTATICS AND ELECTRO-MECHANICS

Electrostatic field, electric field strength, concept of permittivity in dielectrics, capacitor composite, dielectric capacitors, capacitors in series and parallel, energy stored in capacitors, charging and discharging of capacitors, Electricity and Magnetism, magnetic field and

Faraday's law, self and mutual inductance, Ampere's law, Magnetic circuit, Single phase transformer, principle of operation, EMF equation, voltage ratio, current ratio, KVA rating, efficiency and regulation, Electromechanical energy conversion. DC generator construction, principle, EMF generated, types, DC motor principle, back EMF.

UNIT V

MEASUREMENTS AND SENSORS

Introduction to measuring devices/sensors and transducers (Piezoelectric and thermo-couple) related to electrical signals, Elementary methods for the measurement of electrical quantities in DC and AC systems(Current & Single-phase power). Electrical Wiring and Illumination system: Basic layout of the distribution system, Types of Wiring System &Wiring Accessories, Necessity of earthing, Types of earthing, Safety devices & system.

Text Books:

1.Electric Machinery,(Sixth Edition) A.E. Fitzgerald, Kingsely Jr Charles, D. Umans Stephen, Tata McGraw Hill.
2.A Textbook of Electrical Technology,(vol. I),B. L. Theraja, Chand and Company Ltd., New Delhi.
3.Basic Electrical Engineering, V. K. Mehta, S. Chand and Company Ltd., New Delhi.
4.Theory and problems of Basic Electrical Engineering, (SecondEdition), J. Nagrath and Kothari, Prentice Hall of India Pvt. Ltd.

Reference Books:

1.Basic of Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford University Press.
2.T. K. Nagsarkar and M. S. Sukhija, Basic of Electrical Engineering, Oxford University Press, 2011.
3.Introduction to Electrodynamics, D. J. Griffiths, (Fourth Edition), Cambridge University Press.
4.Engineering Circuit Analysis, William H. Hayt& Jack E. Kemmerly, McGraw-Hill Book Company Inc.
5.Fundamentals of Electrical and Electronics Engineering,Smarjith Ghosh, Prentice Hall (India) Pvt. Ltd.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

APPLIED PHYSICS

Course Code: GR24A1003 **L/T/P/C: 3/ 1/ 0/ 4**
I Year I Semester

1. Solve engineering problems involving the quantum nature of radiation and matter waves.
2. Understand the characteristics of semiconductor devices and operation of optoelectronic devices.
3. Identify magnetic and superconducting materials based on their properties for various applications.
4. Analyze the properties of Laser and its propagation in different types of optical fibers.
5. Explore the features of nanomaterials.

UNIT I: Quantum Physics and Solids

Quantum Mechanics: Introduction, Black body radiation, Planck's law, Photoelectric effect-Einstein's Photoelectric equation(quantitative), Wave-Particle duality: de Broglie hypothesis, Davisson and Germer experiment, Heisenberg's uncertainty principle, Born's interpretation of the wave function, Schrodinger's time independent wave equation, Particle in one dimensional infinite potential box.

Solids: Classification of solids into metals, semiconductors, and insulators.

UNIT II: Semiconductors and devices

Intrinsic and extrinsic semiconductors(qualitative) - Hall Effect and its applications, direct and indirect band gap semiconductors, Construction and principle of operation of p-n junction diode, I-V characteristics of p-n junction diode and Zener diode.

Radiative transition: Absorption, Spontaneous and Stimulated emissions, Principle, Construction, Working, Characteristics and Applications: LED and Solar cell.

UNIT III: Magnetic materials and Superconductivity

Magnetic Materials: Introduction, permeability, field intensity, magnetic field induction, magnetisation, magnetic susceptibility, origin of magnetic moment: Bohr magneton, classification of magnetic materials: Ferro, Para, Dia, Antiferro and Ferri, Hysteresis curve based on domain theory of ferromagnetism, Soft and hard magnetic materials, Applications of magnetic materials.

Superconductivity: Superconductivity phenomenon, Meissner effect, Type I and Type II superconductors, applications of superconductors.

UNIT IV: Lasers and Fiber Optics

Lasers: Introduction, Characteristics of lasers, Lasing action, Essential components of laser, Construction and working: Ruby laser, He-Ne laser and Semiconductor laser, Applications of lasers.

Fiber Optics: Introduction, Principle and Structure of an optical fiber, Basic components in optical fiber communication system, Advantages of optical fibers over conventional cables, Types of optical fibers, Acceptance angle-Numerical aperture, Losses associated with optical fibers, Applications of optical fibers.

UNIT V: Nanotechnology

Introduction, Quantum confinement, Surface to volume ratio, Classification of Nanomaterials, Synthesis methods: Top-Down Technique: Ball milling method, Bottom-Up technique: Sol-Gel method, Characterization techniques: SEM, TEM and EDAX.

Text books:

1. Engineering Physics, B.K. Pandey, S. Chaturvedi – Cengage Learing.
2. Applied Physics, T. Bhīma Sankaram, BSP Publishers.
3. Engineering Physics, P.K Palanisamy, Scitech Publishers.
4. A textbook of Engineering Physics, Dr. M. N. Avadhanulu, Dr. P.G. Kshirsagar - S. Chand.

References:

1. Fundamentals of Semiconductor Devices, Second Edition, Anderson and Anderson, McGraw Hill.
2. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw- Hill Inc. (1995)
3. Semiconductor Physics and Devices, 4e, Neamen and Biswas, McGraw Hill.
4. Online Course: “Optoelectronic Materials and Devices” by Monica Katiyar and Deepak Guptha on NPTEL.
5. Halliday and Resnick, Physics – Wiley.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

FUNDAMENTALS OF COMPUTER SCIENCE LAB

Course Code: GR24A1033 **L/T/P/C: 0/0/3/1.5**
I Year I Semester

Course Outcomes:

1.Design algorithms and convert them to programs to solve simple problems.
2.Design, implement, debug a given problem using selection and looping constructs.
3.Implement programs using modular approach using functions and recursion.
4.Solve a given problem using C language arrays, strings and structures and pointers.
5.Implement various operations of files and make use of user defined libraries.

LIST OF EXPERIMENTS:

TASK-1 (Basic Programs):

a) Write a C program to implement operators in c?

b) Write a C program to find the greatest and smallest among three numbers using a conditional operator.

c)Write a C program to implicit and explicit type conversion in c?

TASK-2 (Basic Programs):

a)Write a C program to find the roots of a quadratic equation using if-else.
b)The program should request the user to input two numbers and display one of the following as per the desire of user:
i. Sum of numbers

ii.Difference of numbers

iii.Product of the numbers

iv.Division of the numbers.

c)Write a C program using switch statements to accomplish the above TASK.
d)Write a C program to find the GCD of a given number.

TASK-3 (Small but tricky codes):

a) Write a C program to find Maximum and minimum of two numbers without using any loop or condition.
b) Write a C program to check if two numbers are equal without using arithmetic operators or comparison operators.

TASK-4 (Proper parameter passing):

a)Write a C program to swap two numbers using call by value.
b)Write a C program to swap two numbers using call by reference

TASK-5(Command line Arguments):

a)Write a C program to find the sum of n numbers using command line arguments.

b)Write a C program to count the number of times a character occurs in a text file. The file name and the character are supplied as command line arguments.

TASK-6 (Variable parameter):

a)Write a C program to demonstrate the working of variable parameters to find the average of multiple numbers.

b)Write a C program using functions to accept N number of arguments using variable length arguments. Return maximum of all values.

TASK-7(Pointer to functions):

a)Write a c program using functions and pointers that compares two strings to see whether they are identical. The function returns 1 if they are identical, 0 otherwise.

b)Write a C program that uses functions to perform the following:

i.Addition of Two Matrices

ii.Multiplication of Two Matrices

iii.Transpose of a matrix with memory dynamically allocated for the new matrix as row and column counts may not be the same.

TASK-8 (User defined header):

a)Write a c program to implement the following preprocessor directives.

(i) define (ii) ifdef (iii) undef (iv) ifndef.

b)Write a c program to create a user defined header file to find product and greatest of two numbers.

TASK-9 (Make file utility):

a)Write a C program to merge two files into a third file.

b)Write a C program to reverse the contents of a file and display it.

TASK-10(Multi file program and user defined libraries):

a)Write a c program to implement a multi file program to set and print the value of a variable.

b)Write a C program to implement a multi file program to read, write and update a student record containing the fields name, roll number, marks.

TASK-11(Interesting substring matching / searching programs):

a)Write a C program that uses functions to insert a sub-string into a given main string from a given position.

b)Write a C program that uses functions to delete n characters from a given position in a given string.

TASK-12(Parsing related assignments):

a) Write a C program for implementing type checker.
b) Write a C program to implement predictive parser.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

PRINCIPLES OF ELECTRICAL ENGINEERING LAB

Course Code: GR24A1034 **L/T/P/C :0/0/2/1**
I Year I Semester

Course Outcomes:

1. Understand the basic concepts and terminology of electrical quantities
2. Analyze the DC circuit using various network theorems
3. Understand the response of different types of electrical circuits to different excitations
4. Understand the measurement, calculation and relation between the basic electrical parameters.
5. Compare the basic characteristics of Electrical machines

LIST OF EXPERIMENTS

1. Familiarization of electrical Elements, sources, measuring devices and transducers related to electrical circuits
2. Verification of KVL and KCL
3. Verification of Thevenin's and Norton's theorems
4. Verification of superposition theorem
5. Verification of maximum power transfer theorem
6. Calculations and Verification of Impedance and Current of RL, RC and RLC series circuits.
7. Verification of relation between phase and line quantities in a 3-phase balanced star and delta connected systems.
8. Measurement of Active and Reactive Power in a balanced Three-phase circuit.
9. Torque-Speed Characteristics of a Separately/Self Excited DC Shunt/Compound Motor
10. Load test on single phase transformer.
11. Demonstration of measurement of electrical quantities in DC and AC systems.

Textbooks:

1. Basic Electrical Engineering, D. C. Kulshreshtha, 2nd Edition, TMH, Revised 2019.
2. Basic of Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford University Press, 2011.
3. Electromagnetic Field Theory, K. A. Gangadhar, P. M. Ramanathan, Sixteenth Edition, Khanna Publishers, 2011.

Reference Books:

1. Basic Electrical Engineering, V. K. Mehta, S. Chand and Company Ltd., New Delhi.
2. Circuits and Networks Analysis and Synthesis, A. Sudhakar, Shyammohan S. Palli, Tata McGraw Hill, 2010.
3. Engineering Electromagnetics, William H. Hayt, Jr. John A. Buck, 8th Revised Edition, McGraw Hill Higher Education, 2011.
4. Fundamentals of Electrical and Electronics Engineering, SmarjithGhosh, Prentice Hall (India) Pvt. Ltd., 2010.
5. Basic Electrical Engineers, P. Ramana, M. Surya Kalavathi, G. T. Chandra Sekhar, S. Chand Technical Publications, 2018.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

APPLIED PHYSICS LAB

Course Code: GR24A1018 **L/T/P/C :0/0/3/1.5**
I Year I Semester

Course Outcomes:

1. Compare the behavior of Solar cells and LEDs.
2. Analyze the behavior of magnetic fields and their applications.
3. Infer the work function of a material through photoelectric effect.
4. Discuss the characteristics of Lasers and infer the losses in optical fibers.
5. Estimate the frequency of tuning fork through the phenomena of resonance.

List of Experiments:

1. Energy gap of P-N junction diode: To determine the energy gap of a semiconductor diode.

2. Solar Cell: To study the V-I Characteristics of solar cell.

3. Light emitting diode: To study V-I characteristics of light emitting diode.

4. Stewart – Gee's experiment: Determination of magnetic field along the axis of a current carrying coil.

5. Hall effect: To determine Hall coefficient of a given semiconductor.

6. Photoelectric effect: To determine the work function of a given material and Planck's constant.

7. LASER: To study the V-I characteristics of LASER sources.

8. Optical fiber: To determine the bending losses of Optical fibers.

9. Optical fiber: To determine the Numerical Aperture of Optical fibers.

10. Melde's experiment: To determine the frequency of a tuning fork using Melde's arrangement.

Note: Any 8 experiments are to be performed.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

BUSINESS COMMUNICATION AND VALUE SCIENCE – I

Course Code: GR24A1035 **L/T/P/C: 2/ 0/ 0/ 2**
I Year I Semester

COURSE PREREQUISITES:

1. Basic communication in tenses (past, present, future)
2. Awareness of common words (adjectives used in daily verbal communication)
3. Basic idea of sentence formation and thereby paragraph building and writing
4. Communication according to daily and varied contextual scenarios
5. Basic communication model/channel (sender, receiver and feedback), Active and passive listening skills
6. Basic social etiquettes and knowledge of group work and communication that will enhance their professional growth

Course Outcomes

1. Recognize the need for life skills and values
2. Recognize own strengths and opportunities
3. Apply the life skills to different situations
4. Understand the basic tenets of communication
5. Apply the basic communication practices in different types of communication

UNIT I

Overview of Leadership Oriented Learning:

i) Self-Introduction
ii) Recognize the need of life Skills and Values
iii) Overview of Business Communication
iv) Identify Strengths and Opportunities
v) Stress- Management

UNIT II

A. Essential Grammar – I:

i) Parts of speech
ii) Tenses
iii) Sentence Formation (General & technical)
iv) Common errors
v) Voices

B. Overview of Communication Skills:

i) Importance of effective communication
ii) Types of communication- verbal and non - verbal
iii) Barriers of communication, effective communication
iv) Importance of Questioning
v) Listening Skills: Law of nature- Importance of listening skills, Difference between listening and hearing; Types of listening.

UNIT III

Verbal Communication and Vocabulary Enrichment:

A. Vocabulary Enrichment:

i) Exposure to words from General Service List (GSL) by West,
ii) Academic word list (AWL) technical specific terms related to the field of technology, phrases, idioms,
iii) Significant abbreviations formal business vocabulary

B. Phonetics:

i) Pronunciation, Clarity of Speech
ii) Reduction of MTI in spoken English
iii) Importance of Questioning: Question formation with emphasis on common errors made during conversation.

UNIT IV

Written Communication:

i) Letter Writing –Formal and Informal letter writing, Application letters, Job application letter
ii) Summary writing
iii) Story Writing
iv) Report writing
v) Building Curriculum Vitae.

UNIT V

Realities of Facing Life:

i) Stress management Working with rhythm and balance, Teamwork
ii) Need for Life skills and values, importance, Critical life skills
iii) Multiple Intelligences- Embracing diversity
iv) Values: Leadership, Teamwork, dealing with ambiguity, motivation, creativity, result orientation.

Textbooks:

There are no prescribed texts for semester I – there will be handouts and reference links shared.

Reference Books:

1. Strategic Writing, Charles Marsh
2. The Seven Basic Plots, Christopher Booker
3. Business Communication, Saroj Hiremath
4. English vocabulary in Use, Alan McCarthy and O'Dell

Web References:

- **Train your mind to perform under pressure- Simon sinek**
  https://curiosity.com/videos/simon-sinek-on-training-your-mind-to-perform-under-pressure-capture-your-flag/
- **Brilliant way one CEO rallied his team in the middle of layoffs**
  https://www.inc.com/video/simon-sinek-explains-why-you-should-put-people-before- numbers.html
- **Will Smith's Top Ten rules for success**

https://www.youtube.com/watch?v=bBsT9omTeh0

Online Resources:

- https://www.coursera.org/learn/learning-how-to-learn
- https://www.coursera.org/specializations/effective-business-communication

Reservations & Suggestions:

1. The external experts expressed the need for flexibility regarding the change of title and components of the syllabus.
2. They also suggested to have flexible teaching methodologies.
3. The experts mentioned to have clarity regarding testing patterns and practicality of executing the course.
4. Credit parity in relation to other B. Tech. courses
5. Suggested semester – II syllabus to be given in advance for consultation with faculty and subject experts before finalizing the syllabus.

I YEAR
II SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

LINEAR ALGEBRA

Course Code: GR24A1036 **L/T/P/C: 3/1/0/4**
I Year II Semester

Course Prerequisites: Elementary knowledge of vectors, matrices and pre-calculus

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

1. Determine the inverse, generalized inverse and rank of a matrix.
2. Solve a system of linear algebraic equations for an exact solutions
3. Determine the eigenvalues and eigenvectors of a square matrix and perform matrix factorization
4. Interpret vector spaces and subspaces and apply their properties
5. Perform SVD, PCA and apply them to some problems in engineering

UNIT-I:

FUNDAMENTALS OF VECTOR AND MATRIX ALGEBRA

Operations on vectors and matrices- Structured square matrices (Symmetric, skew symmetric, orthogonal, Hermitian, skew Hermitian and unitary matrices)- Their properties- Exact and Generalized inverse of a matrix
Rank of a matrix- Linear independence of vectors- Orthogonal projection of vectors

UNIT-II:

SOLUTION OF A LINEAR ALGEBRAIC SYSTEM OF EQUATIONS

Solution of a homogeneous and non-homogeneous system of equations using Gaussian elimination-The Gram-Schmidt orthonormalization process-QR factorization

UNIT-III:

MATRIX EIGENVALUE PROBLEM AND MATRIX DECOMPOSITION

Determination of eigenvalues and eigenvectors of a matrix- Properties of eigenvalues and eigenvectors (without proof)- Similarity of matrices- Diagonalization of a matrix- Definiteness of a symmetric matrix- Orthogonal diagonalization of a symmetric matrix –LU Decomposition of a square matrix.

UNIT-IV:

VECTOR SPACES

Definition of a vector space- Subspace of a vector space- Linear Span, Basis and dimension of a vector space Linear transformation- Rank and Nullity of a linear transformation

UNIT-V:
SINGULAR VALUE DECOMPOSITION AND PRINCIPAL COMPONENT ANALYSIS

Low rank matrix approximation- Computation of the full singular value decomposition of a real matrix- Application to image approximation Covariance matrix of multivariate data- Determination of principal components- Elementary treatment of principal component analysis to dimension reduction and face recognition

TEXT BOOKS

1. Advanced Engineering Mathematics, R.K.Jain & S.R.K.Iyengar, Narosa
2. Higher Engineering Mathematics-B.S.Grewal- Khanna publications

REFERENCES

1. Advanced Engineering Mathematics, Peter V. O'Neil, 7th Edition, Cengage,2012.
2. Advanced Engineering Mathematics, Michael. D. Greenberg, 2nd Edition, Pearson,2017.
3. Introduction to Linear Algebra, Gilbert Strang, 5thEdition, Wellesley,2017.
4. Applied Mathematics, Vol. I & II, P. N. Wartikar& J. N. Wartikar, Pune Vidyarthi GrihaPrakashan,2010.
5. Digital Image Processing, R. C. Gonzalez and R. E. Woods, 4thEdition, Kluwer, 1997.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

STATISTICAL METHODS & MODELLING

Course Code: GR24A1037 **L/T/P/C: 3/ 0/ 0/3**
I Year II Semester

Pre-requisites: Elementary statistics and Linear algebra

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

1. Apply sampling distribution techniques
2. Apply statistical estimation methods
3. Apply Inferential Statistics to make predictions or judgments about the population from which the sample data is drawn.
4. Forecast using Regression analysis models
5. Interpret data using Time series analysis

UNIT-I:
Sampling and Estimation
Sampling Techniques: Random sampling. Sampling from finite and infinite populations. Sampling distribution and Standard error (sampling with and without replacements), Sampling distribution of sample mean.

Estimation: Concepts of Point and interval estimation, criteria for good estimates (unbiasedness, consistency and Sufficiency) and applications. Estimation of parameters of Binomial, Poisson, Exponential and Normal distributions using Maximum Likelihood Estimation.

UNIT-II:
Testing of hypothesis (parametric Inference)
Concept and formulation, Type I and Type II errors.
Procedures of Parametric testing of Single and two population means in small and large samplings, Single and two population Proportions in large sampling, Analysis of variance : one-way and two- way classifications.

UNIT-III:
Testing of hypothesis (Non-parametric Inference)
Comparison with parametric inference, Use of order statistics. Sign test, Wilcoxon signed rank test, Mann-Whitney test, Run test, Kolmogorov-Smirnov test, Kendall's test.

UNIT-IV:
Linear Statistical Models
Correlation (Karl-Pearson's correlation coefficient and Spearman's Rank correlation (Statements of their properties and problems)), Simple and Multiple Linear Regression of three variables (Statements of properties of Regression coefficients and problems), Residual Analysis and Concept of Multicollinearity

UNIT-V:

Time Series

Components of Time series, Additive and Multiplicative models of Decomposition of Time series, Estimation of trend by method of Moving averages, fitting of various mathematical curves (Straight line and Second-degree parabola) and Estimation of seasonal component by Ratio to Trend method and Ratio to Moving averages method, Stationary, ARIMA Model: Identification, Estimation and Forecasting.

TEXT BOOKS:

1. Probability and Statistics for Engineers(4thEdition), I.R. Miller, J.E. Freund and R. Johnson, Pearson.
2. Fundamentals of Statistics (Vol. I & Vol. II), A. Goon, M. Gupta and B. Dasgupta, World Press.
3. The Analysis of Time Series: An Introduction, Chris Chatfield, Chapman and Hall/CRC.
4. Introduction to Linear Regression Analysis, D.C. Montgomery & E. Peck, Wiley.
5. Hands-on Programming with R, Garrett Grolemund, O′Reilly.

REFERENCE BOOKS:

1. Introduction to the Theory of Statistics, A.M. Mood, F.A. Graybill& D. C. Boes, McGraw-Hill.
2. Applied Regression Analysis, N. Draper & H. Smith, John Wiley & Sons.
3. R for Everyone: Advanced Analytics and Graphics, Jared P. Lander, Addison-Wesley Professional.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DATA STRUCTURES AND ALGORITHMS

Course Code: GR24A1038 **L/T/P/C: 2/ 0/ 0/ 2**
I B. Tech II Semester

Course Prerequisites: C Language

Course Outcomes:

1.To analyze the performance of algorithms using asymptotic notations
2.Implement all operations on different linear data structures.
3.Interpret various operations on non-linear data structure trees.
4.Analyse various operations on graphs.
5.Apply various searching, sorting and indexing techniques

UNIT I

Basic Terminologies & Introduction to Algorithm and Data Organization: Algorithm specification, Recursion, Performance analysis, Asymptotic Notation - The Big-O,Omega and Theta notation, Programming style, Refinement of coding-Time-Space Trade Off, Testing, Data Abstraction

UNIT II

Linear Data Structure: Array**,** Stack, Queue, Linked list and its types, Various Representations, Operations & Applications of Linear Data Structures.

UNIT III

Non-linear Data Structure: Trees: Binary Tree – Terminology and basic operations (no implementation), Binary Search Tree – Insert, delete, search, traversal and implementation, B Tree, B+ Tree, AVL Tree, Splay Tree (B, B+, AVL trees only definitions no implementation).

UNIT IV

Non-linear Data Structure: Graphs: Basic Terminologies, Directed, Undirected and Representations, Graph search and Traversal algorithms Breadth First Search, Depth First Search and complexity analysis, Applications of Non-Linear Data Structures.

UNIT V

Searching and Sorting on Various Data Structures: Sequential Search, Binary Search, Insertion Sort, Selection Sort, Shell Sort, Heap Sort, Divide and Conquer Sort: Merge Sort, Quick Sort, Comparison Trees (Decision tree), Introduction to Hashing.
File: Organization Sequential, Direct, Indexed Sequential, Hashed, and various types of accessing schemes (no implementation).

TEXTBOOKS:

1. Fundamentals of Data Structures, E. Horowitz and S. Sahni, 1977.
2. Data Structures and Algorithms, Alfred V. Aho, John E. Hopperoft, Jeffrey D. UIlman.

REFERENCES:

1. The Art of Computer Programming: Volume 1: Fundamental Algorithms, Donald

E. Knuth

2. Introduction to Algorithms, Thomas, H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein.
3. Open Data Structures: An Introduction (Open Paths to Enriched Learning), 31st Edition, Pat Morin.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

PRINCIPLES OF ELECTRONICS

Course Code: GR24A1039 **L/T/P/C: 2/ 0/ 0/ 2**
I Year II Semester

Course Prerequisite: Fundamentals of Physics

Course Outcomes:

1. Explain the principles of operation and substantiate the applications of
2. various semiconductor devices
3. Compare the functionalities of various electronic devices
4. Understand the effect of feedback in amplifiers
5. Apply the knowledge of analog IC's Use several digital IC's in various applications

UNIT I

Semiconductors: Crystalline material: Mechanical properties, Energy band theory, Fermi levels; Conductors, Semiconductors & Insulators: electrical properties, band diagrams; Semiconductors: intrinsic & extrinsic, energy band diagram, P and N-type semiconductors, drift & diffusion currents.

UNIT II

Diodes and Diode Circuits: Formation of P-N junction, energy band diagram, formation of depletion zone, built-in-potential, forward and reverse biased P-N junction, V-I characteristics, Linear piecewise model, Junction capacitance, Zener breakdown, Avalanche breakdown, Zener diode and its reverse characteristics. Rectifier circuits: half wave, full wave, PIV, DC voltage and current, ripple factor, efficiency, regulation.

UNIT-III

Bipolar Junction Transistors: Formation of PNP / NPN junctions; transistor mechanism and principle of transistors, CE, CB, CC configuration, transistor characteristics: cut- off, active and saturation mode, transistor action, injection efficiency, base transport factor and current amplification factors; Biasing and Bias stability: calculation of stability factor.
Field Effect Transistors: Concept of Field Effect Transistors (channel width modulation), Gate isolation types, JFET structure and characteristics, MOSFET structure and characteristics, depletion and enhancement type; CS, CG, CD configurations; CMOS: Basic Principles.

UNIT IV

Feedback Amplifier, Oscillators and Operational Amplifiers: Concept (Block diagram), properties, positive and negative feedback, loop gain, open loop gain, feedback factors; topologies of feedback amplifier; effect of feedback on gain, output impedance, input impedance, sensitivities (qualitative), bandwidth stability; effect of positive feedback: instability and oscillation, condition of oscillation, Barkhausen criteria. Introduction to integrated circuits, operational amplifier and its terminal properties; Application of operational amplifier; inverting and non-inverting mode of operation, Adders, Subtractors, Constant-gain multiplier, Voltage follower, Comparator, Integrator, Differentiator

UNIT V

Digital Electronics Fundamentals: Difference between analog and digital signals, Boolean algebra, Basic and Universal Gates, Symbols, Truth tables, logic expressions, Logic simplification using K- map, Logic ICs, half and full adder/subtractor, multiplexers, de-multiplexers, flip-flops, shift registers, counters.

TEXTBOOKS:

1. Millman's Integrated Electronics, Jacob Millman, Christos Halkias, Chetan Parikh, 2^{nd} Edition, TMH, 2010.
2. Op-Amps and Linear ICs, Ramakanth A. Gayakwad, 4^{th} Edition, PHI, 2016.
3. Digital Logic & Computer Design, M. Morris Mano, 4^{th} Edition, PHI, 2016.

REFERENCES:

1. Electronic Devices and Circuit Theory, Robert L. Boylestad, Louis Nashelsky, 11^{th} Edition, Pearson Publishers, 2015.
2. Solid State Electronic Devices, Ben Streetman, Sanjay Banerjee, 7^{th} Edition, PHI, 2016.
3. Electronic Principle, Albert Paul Malvino, 3^{rd} Edition, TMH, 2010.
4. Microelectronics, Jacob Millman, Arvin Grabel, 2^{nd} Edition, TMH, 2000.
5. Electronics Devices and Circuits, S. Salivahanan, N. Suresh Kumar, A.Vallavaraj, 2^{nd} Edition, TMH, 2011.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DESIGN AND CRITICAL THINKING

Course Code: GR24A1040 **L/T/P/C: 2/0/0/2**
I Year II Semester

Course Outcomes:

1. Understand the application of Design Thinking in engineering and business application and how to empathize and identify the steps in the DT process
2. Create personas in the defined phase of DT. Recognize the steps to create problem statements in the define phase of DT
3. Apply the steps in the ideate phase of DT. Recognize how doodling can help to express ideas. Apply storytelling in presenting ideas and prototypes
4. Create a prototype for the Idea chosen
5. Create a value proposition statement. Recognize the best practices of the testing phase in DT. Test a prototype created through a DT process. Recognize how DT can help in functional work

UNIT I

Design Thinking Overview and Motivation: Design Thinking for business – Stories, Examples and Case Studies; Design Thinking for Students; Introduction to Design Thinking – Stanford's 5-step model.

*Activities to understand Design Thinking and its applications

UNIT II

Doing Design: Empathize Phase: Empathy; Importance of Empathy; Empathy Tools; Introduction to Immersion Activity; Persona, Importance of Persona Creation; Data collection and Inferences

*Activities for Empathize Phase

UNIT III

Doing Design: Define Phase: Problem Statements – Introduction, Definition, Validation; Need Analysis: Types of Users, Types of Needs; Addressable Needs and Touchpoints; Structuring Need Statements.

*Activities for Define Phase

UNIT IV

Doing Design: Ideate Phase Ideation tools: Six Thinking Hats; Ideate to generate solutions; Doodling and Storytelling to present ideas.

*Activities for Ideate Phase

UNIT V

Doing Design:

Prototype Phase

Introduction to Prototype: Methods of Prototyping, Value proposition for the solution

Test Phase

Importance of testing; Feedback Collection, Documentation of Feedback, Inference from Feedback, Looping of Design Thinking, Agile and Design Thinking to deliver customer satisfaction.

*****Activities for Prototype Phase, Test Phase

TEXTBOOKS:

1. There are no prescribed texts for Semester 5 – there will be handouts and reference links shared

Web References:

1. What is Design Thinking? Interaction Design Foundation
2. What are some of the good examples of design thinking? - Quora
3. Design thinking 101: Principles, Tools & Examples to transform your creative process

REFERENCES:

1. Nir Eval, Hooked. How to Build Habit-Forming Products, Penguin Publishing Group
2. Rod Judkins, The Art of Creative Thinking, Hodder & Stoughton
3. Dan Senor and Saul Singer, Start-up Nation. The Story of Israel's Economic Miracle,
4. Grand Central Publishing
5. Simon Sinek, Start with Why. How Great Leaders Inspire Everyone to Take Action, Penguin Books Limited

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

PYTHON PROGRAMMING

Course Code: GR24A1027 **L/T/P/C: 1/0/0/1**

I Year II Semester

Course Outcomes:

1. Demonstrate the fundamental concepts and flow control in Python
2. Implement different sequence types and file handling operations.
3. Design python programs using functions and exception handling mechanisms.
4. Develop programs with object-oriented programming features and modules.
5. Design GUI based applications using Tkinter.

UNIT I

Introduction: features of Python-Interactive execution, comments, types, variables, operators, expressions, Statements-assignment, input, print.

Control flow: if, if-else, if-elif-else Statements, Nested Decision Structures, Loops-while loop, for loop, Nested Loops, break, continue, pass statement.

UNIT II

Sequences: Strings, Lists and Tuples-basic operations and functions, iterating over sequences, Sets and Dictionaries- operations and functions, Python program examples.

Files-operations-opening, reading, writing, closing, file positions.

UNIT III

Exceptions: raising and handling exceptions, try/except statements, finally clause, standard exceptions, custom exceptions.

Functions: definition, call, scope and lifetime of variables, keyword arguments, default parameter values, variable length arguments, recursive functions, Lambda function.

UNIT IV

Modules: Modules, Standard Modules, Importing Modules, Namespaces and Packages.

Object Oriented Programming: Classes, constructors, objects, class variables, class methods, static methods, operator overloading. Inheritance-is-a relationship, composition, polymorphism, overriding, multiple inheritance, abstract classes, multithreaded programming, Python program examples.

UNIT V

GUI Programming: Introduction, Tkinter, Widgets (Buttons, Canvas, Frame, Label, Menu, Entry, Text, Scrollbar, Combobox, Listbox), event driven programming-events, callbacks, binding, layout management- geometry managers: pack and grid, creating GUI based applications in Python.

Teaching methodologies:

- PowerPoint Presentations
- Tutorial Sheets
- Assignments

TEXTBOOKS

1) Exploring Python, Timothy A. Budd, McGraw Hill Publications.
2) Introduction to Programming using Python, Y.Daniel Liang, Pearson.
3) Python Programming, Sheetal Taneja and Naveen Kumar, Pearson.

REFERENCE BOOKS

1) Introduction to Computer Science using Python, Charles Dierbach, Wiley India Edition.
2) Internet of Things - A hands on approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015.
3) Fundamentals of Python, K. A. Lambert, B.L. Juneja, Cengage Learning.
   Think Python, how to think like a computer scientist, Allen B. Downey,SPD, O'Reilly.
4) Core Python Programming, Wesley J.Chun, second edition, pearson.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

STATISTICAL METHODS & MODELLING LAB

Course Code: GR24A1041 **L/T/P/C: 0/0/2/1**
I Year II Semester

Course Outcomes:

1. Build various data types for a specified problem.
2. Apply tests of significance
3. Compute descriptive statistics
4. Forecast in cross sectional and Time Series Data.
5. Create Graphics

Task1: Write an R program to create an array, passing in a vector of values and a vector of dimensions. Also provide names for each dimension.

Task 2: Write an R program to find the factors of a given number using functions.

Task 3: Write an R program to create a list of random numbers in normal distribution and count occurrences of each value.

Task4: Write an R program for addition and Multiplication of two matrices.

Task 5: Write an R program to create a Data Frame which contains details of 5 employees and display summary of the data.

Task 6: Write an R program to read the .csv file and perform the following: (i) Summary statistics on the data, (ii) Remove outliers from the data.

Task 7: Plot the data using ggplot

Task 8: Test a hypothesis about the data using Z and t – tests.

Task 9: Write an R program for modeling Cross sectional data with Multiple Regression.

Task 10: Write an R program for modeling Time series with ARIMA.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DATA STRUCTURES AND ALGORITHMS LAB

Course Code: GR24A1042 **L/T/P/C: 0/ 0/ 2/ 1**
I Year II Semester

Course Outcomes:

1. Implement operations on various linear and non-linear data structures.
2. To identify the appropriate data structure for solving a given problem.
3. Acquire practical knowledge on applications of various data structures.
4. Implement various searching and sorting techniques.
5. To effectively troubleshoot, debug and run programs in C.

LIST OF EXPERIMENTS:

TASK 1

a) Write a C program to implement Towers of Hanoi.
b) Write a C program to implement Stack using Arrays.
c) Write a C program to implement Queue using Arrays.

TASK 2

a) Write a C program to evaluate a Postfix Expression.
b) Write a C program to implement Circular Queue using Arrays.

TASK 3

a) Write a C program to implement reading, writing, and addition of polynomials.

TASK 4

a) Write a C program to implement the operations – create, insert, delete, search and traversal of a Double linked list

TASK 5

a) Write a C program to implement the following Binary search tree operations- insert, delete, search.

TASK 6

a) Write a C program to implement BFS and DFS traversal on a Binary Search Tree.

TASK 7

a) Write a C program to implement Breadth First Search on graphs.
b) Write a C program to implement Depth First Search on graphs.

TASK 8

a) Write a C program to implement sequential search
b) Write a C program to implement Binary search

TASK 9

a) Write a C program to implement Insertion Sort.
b) Write a C program to implement Selection Sort.

TASK 10

a) Write a C program to implement Shell Sort.
b) Write a C program to implement Heap Sort.

TASK 11

a) Write a C program to implement Merge Sort.
b) Write a C program to implement Quick Sort.

TASK 12

a) Write a C program to implement Line editors with line count, word count showing on the screen.
b) Write a C program to perform the following:
(i) Construct a Binary Search Tree from a file. (retrieving non-linear data structure from a file)
(ii) Display the contents of a Binary Search Tree on a file. (Saving a non-linear data structure in a file)

TEXTBOOKS:

1. Fundamentals of Data Structures, E. Horowitz and S. Sahni, 1977.
2. Data Structures and Algorithms, Alfred V. Aho, John E. Hopperoft, Jeffrey D. UIlman.

REFERENCES:

1. The Art of Computer Programming: Volume 1: Fundamental Algorithms, Donald E. Knuth
2. Introduction to Algorithms, Thomas, H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein.
3. Open Data Structures: An Introduction (Open Paths to Enriched Learning), 31st Edition, Pat Morin.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

PRINCIPLES OF ELECTRONICS LAB

Course Code:GR24A1043 **L/T/P/C: 0/ 0/ 2/ 1**
I Year II Semester

Course Outcomes:

1. Analyze the characteristics of various semiconductor devices
2. Apply the knowledge of semiconductors
3. Understand the functionality of analog and digital IC's
4. Design various circuits based on the characteristics of the components
5. Verify the theoretical concepts through laboratory and simulation

LIST OF EXPERIMENTS:

Simulation of any 3 or 4 experiments using open-source software

1. Forward and Reverse Bias V-I characteristics of PN junction Diode.
2. V-I characteristics of Zener diode.
3. Full wave rectifier.
4. Characteristics of a BJT under CB configuration.
5. Characteristics of a BJT under CE configuration.
6. JFET characteristics under CS configuration.
7. MOSFET characteristics under CS configuration.
8. Hartly oscillator
9. Inverting and Non-Inverting amplifiers using IC 741 Op-Amp.
10. Adder, subtractor and comparator using IC 741 Op-Amp.
11. Integrator and Differentiator using IC 741 Op-Amp.
12. Truth table verification of Logic gates.
13. Truth table verification of Half-Adder and Full Adder.
14. Truth table verification of Multiplexer and De-multiplexer

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

BUSINESS COMMUNICATION AND VALUE SCIENCE – II

Course Code: GR24A1044 **L/T/P/C: 2/ 0/ 0/ 2**
I Year II Semester

Course Outcomes:

1. Use electronic/social media to share concepts and ideas
2. Understand the basics of presentation
3. Understand tools for quick reading
4. Identify individual personality types and role in a team
5. Students will have learned the basic concepts of Morality and Diversity

UNIT I

Reading - Skimming – Scanning – Active and Passive Reading - Note making skills – making notes from books, or any form of written materials - Intensive reading - Reading the job advertisements and the profile of the company concerned – Speed reading – reading passages with time limit – Critical reading, Comprehension skills - Developing analytical skills, Deductive and inductive reasoning - Extensive and Intensive Reading.

UNIT II

Writing - Elements of good and bad writing (e.g. ABC of writing, cohesion & coherence, etc.) - Common errors - Rules of Punctuation – Use of Words - Lucid Writing - Catherine Morris and Joanie McMahon's writing techniques.

UNIT III

A. **Presentation and Personality Skill** – Elements of Presentation Strategies – Objectives – Medium

– Key Ideas – Structuring the material – Organizing content – Audio visual aids – Handouts – Use of Powerpoint – Clarity of presentation – Non-verbal Communication – Seminar Paper presentation Discussion – Work with an NGO and make a presentation – ORAI App

B. **Group Discussion** – Types - Dos – Don'ts

UNIT IV

A. **Personality -** Types – Traits – Dr. Meredith Belbin and his research on teamwork and how individuals contribute - Dr. Meredith Belbin's 8 Team Roles - Lindgren's Big 5 personality traits - Belbin's 8 team player styles
B. **Interpersonal Skill:** Teamwork, Team effectiveness, Group discussion, Decision making - Team Communication. Team, Conflict Resolution, Team Goal Setting, Team Motivation Understanding Team Development, Team Problem Solving, Building the team dynamics. Multicultural team activity

UNIT V

Inclusion – Definition – concept of inclusion – workplace inclusion – 7 pillars of inclusion – How to promote inclusion - Examples
Morality – Definition – Purpose – Importance -Types – Examples – Morality vs. Ethics
Diversity – Definition – Different forms of diversity in our society – Examples Discussion on TCS values, Respect for Individual and Integrity.

TEXTBOOKS:

1. Essentials of Business Communication- Rajendra Pal & J.S. Koralahalli
2. Communication for Business – Shirley Taylor.
3. Business Communication Today- Bovee, Thill, Schatzman
4. Advanced Business Communication- Penrose, Rasberry, Myers
5. Doing Business on the Internet- Simon Collins.
6. Business Communication- Process and Product- Mary Ellen Guffey

REFERENCES:

1. Guiding Souls: Dialogues on the purpose of life; Dr. A.P.J Abdul Kalam, 2005; Co- author--Arun Tiwari
2. The Family and the Nation; Dr. A.P.J Abdul Kalam, 2015; Co-author: Acharya Mahapragya
3. The Scientific India: A twenty First Century Guide to the World around Us; Dr. A.P.J Abdul Kalam, 2011; Co-author- Y.S.Rajan
4. Forge Your Future: Candid, Forthright, Inspiring; Dr. A.P.J Abdul Kalam, 2014
5. Abundance: The Future is Better Than You Think; Peter H. Diamandis and Steven Kotler, 21 Feb 2012; Free Press
6. Start With Why: How Great Leaders Inspire Everyone to Take Action; Simon Sinek, 6 October 2011; Penguin
7. Advertising & IMC: Principles and Practice; Sandra Moriarty, Nancy D. Mitchell, William

D. Wells, 15 June 2016; Publiher: Pearson Education India

WEB REFERENCES:

1. Ethics Fundamentals and Approaches to Ethics https://www.eolss.net/Sample Chapters/C14/E1-37-01-00.pdf
2. A Framework for Making Ethical Decisions, https://www.brown.edu/academics/science- and-technology-studies/framework - making- ethical-decisions
3. Five Basic Approaches to Ethical Decision- http://faculty.winthrop.edu/meelerd/docs/rolos/5_Ethical_Approaches.pdf

ONLINE RESOURCES:

1. https://youtu.be/CsaTslhSDI
2. https://m.youtube.com/watch?feature=youtu.be&v=IIKvV8_T95M
3. https://m.youtube.com/watch?feature=youtu.be&v=e80BbX05D7Y
4. https://m.youtube.com/watch?v=dT_D68RJ5T8&feature=youtu.be
5. https://m.youtube.com/watch?v=7sLLEdBgYYY&feature=youtu

II YEAR
I SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

THEORY OF COMPUTATION

Course Code: GR24A2086 **L/T/P/C: 3 /0/ 0/ 3**
II Year I Semester

Course Outcomes:

1. Design Regular Expressions and equivalent automata models.
2. Construct Regular Grammars and regular languages
3. Formulate Context-free languages and pushdown automata.
4. Design Turing machines models
5. Analyze Undecidability and Complexity

UNIT I

Introduction: Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages.

Regular languages and finite automata: Regular expressions and languages, deterministic finite automata (DFA) and equivalence with regular expressions, nondeterministic finite automata (NFA) and equivalence with DFA.

UNIT II

Regular grammars: Regular grammars and equivalence with finite automata, properties of regular languages, Kleene's theorem, pumping lemma for regular languages, Myhill-Nerode theorem and its uses, minimization of finite automata.

UNIT III

Context-free languages and pushdown automata: Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic pushdown automata, closure properties of CFLs.

Context-sensitive languages: Context-sensitive grammar (CSG) and languages, linear bounded automata and equivalence with CSG.

UNIT IV

Turing machines: The basic model for Turing machines (TM), Turing recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs, unrestricted grammars and equivalence with Turing machines, TMs as enumerators.

UNIT V

Undecidability: Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice s theorem, undecidable problems about languages.

Basic Introduction to Complexity: Introductory ideas on Time complexity of deterministic and nondeterministic Turing machines, P and NP, NP- completeness, Cook's Theorem, other NP - Complete problems.

TEXTBOOKS:

1. Introduction to Automata Theory, Languages, and Computation John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman.

REFERENCE BOOKS:

1. Elements of the Theory of Computation, Harry R. Lewis and Christos H. Papadimitriou.
2. Automata and Computability, Dexter C. Kozen.
3. Introduction to the Theory of Computation, Michael Sipser.
4. Introduction to Languages and the Theory of Computation, John Martin.
5. Computers and Intractability: A Guide to the Theory of NP Completeness, M. R. Garey and

D. S. Johnson.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

COMPUTER ORGANIZATION AND ARCHITECTURE

Course Code: GR24A2087 **L/T/P/C: 3/ 0/ 0/3**

II Year I Semester

Course Outcomes:

1. Demonstrate knowledge of register organization of a basic computer system
2. Incorporate In-depth understanding of design formats and arithmetic operations.
3. Understand the memory design and performance of I/O interfaces.
4. Analyze and emphasize various parallel processing techniques and pipeline hazards.
5. Develop an ability to analyze the types of memory hierarchy.

UNIT I

Revision of basics in Boolean logic and Combinational/Sequential Circuits.

Functional blocks of a computer: CPU, memory, input-output subsystems, control unit.

Data representation: Signed number representation, fixed and floating-point representations, character representation.

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

UNIT II

Introduction to x86 architecture.

CPU control unit design: Hardwired and microprogrammed design approaches, design of a simple hypothetical CPU.

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

UNIT III

Memory system design: Semiconductor memory technologies, memory organization.

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

UNIT IV

Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards.

Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency.

UNIT V

Memory organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies.

TEXTBOOKS:

1. Computer System Architecture M. M. Mano:, 3rd ed., Prentice Hall of India, New Delhi, 1993.
2. Computer Organization and Design: The Hardware/Software Interface, David A. Patterson and John

L. Hennessy.

3. Computer Organization and Embedded Systems, Carl Hamacher.

REFERENCES:

1. Computer Architecture and Organization, John P. Hayes.
2. Computer Organization and Architecture: Designing for Performance, William Stallings.
3. Computer System Design and Architecture, Vincent P. Heuring and Harry F. Jordan.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

OBJECT ORIENTED PROGRAMMING

Course Code: GR24A2088 **L/T/P/C: 2/ 0/ 0/2**

II Year I Semester

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Prerequisites: A course on "Procedural programming".

Course Outcomes:

1. Understand the concepts of procedural programming language
2. Distinguish procedural and object-oriented approach in developing programs of C and C++Understand)
3. Experiment with various object-oriented concepts like Inheritance, exceptions to solve different problems (Apply)
4. Select suitable inheritance mechanism, overloading/overriding of C++ to implement solution for problem on hand.
5. Code a foolproof application using the concepts of generic programming and apply objected methodology to generate different diagrams of UML design documents.

UNIT I

Procedural programming, An Overview of C: Types Operator and Expressions, Scope and Lifetime, Constants, Pointers, Arrays, and References, Control Flow, Functions and Program Structure, Namespaces, error handling, Input and Output (*C*-way), Library Functions (*string*, *math*, *stdlib*), Command line arguments, Pre-processor directive

UNIT II

Some difference between C and C++: Single line comments, Local variable declaration within function scope, function declaration, function overloading, stronger type checking, Reference variable, parameter passing – value vs reference, passing pointer by value or reference, ~~#define constant vs const~~, Operator new and delete, the type casting operator, Inline Functions in contrast to macro, default arguments

UNIT III

The Fundamentals of Object-Oriented Programming: Necessity for OOP, Data Hiding, Data Abstraction, Encapsulation, Procedural Abstraction, Class and Object.

More extensions to C in C++ to provide OOP Facilities: Scope of Class and Scope Resolution Operator, Member Function of a Class, private, protected and public Access Specifier, this Keyword, Constructors and Destructors, friend class, error handling (exception)

UNIT IV

Essentials of Object-Oriented Programming: Operator overloading, Inheritance – Single and Multiple, Class Hierarchy, Pointers to Objects, Assignment of an Object to another Object, Polymorphism through dynamic binding, Virtual Functions, Overloading, overriding and hiding, Error Handling

UNIT V

Generic Programming: Template concept, class template, function template, template specialization

Input and Output: Streams, Files, Library functions, formatted output

Object Oriented Design and Modelling: UML concept, Use case for requirement capturing, Class diagram, Activity diagram and Sequence Diagram for design, Corresponding C++ code from design

TEXTBOOKS:

1. The C++ Programming Language, Bjarne Stroustrup, Addison Wesley.
2. C++ and Object-Oriented Programming Paradigm, Debasish Jana, PHI Learning Pvt. Ltd.

REFERENCE BOOKS:

1. Programming – Principles and Practice Using C++, Bjarne Stroustrup, Addison Wesley.
2. The Design and Evolution of C++, Bjarne Stroustrup, Addison Wesley.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

COMPUTATIONAL STATISTICS

Course Code: GR24A2089 **L/T/P/C: 3/0/0/3**
II Year I Semester

Course Outcomes:

1. Correlate statistical inference methods for testing hypotheses and plot the graphs.
2. Exemplify multivariate normal distribution methods and relevant properties.
3. Analyze the importance of principal components and their role in plot graphs
4. Develop linear and multiple linear regression models to solve real time problems
5. Implement different kinds of clustering algorithms.

UNIT I

Multivariate Normal Distribution: Multivariate Normal Distribution Functions, Conditional Distribution and its relation to regression model, Estimation of parameters.

Multivariate Regression: Assumptions of Multivariate Regression Models, Parameter estimation, Multivariate Analysis of variance and covariance.

UNIT II

Multiple Linear Regression Model: Standard multiple regression models with emphasis on detection of collinearity, outliers, non-normality and autocorrelation, Validation of model assumptions.

UNIT III

Discriminant Analysis: Statistical background, linear discriminant function analysis, Estimating linear discriminant functions and their properties.

UNIT IV

Principal Component Analysis: Principal components, Algorithm for conducting principal component analysis, deciding on how many principal components to retain, H-plot.
Factor Analysis: Factor analysis model, extracting common factors, determining number of factors, Transformation of factor analysis solutions, Factor scores.

UNIT V

Cluster Analysis: Introduction, Types of clustering, Correlations and distances, clustering by partitioning methods, hierarchical clustering, overlapping clustering, K-Means Clustering-Profiling and Interpreting Clusters.

TEXTBOOKS:

1. An Introduction to Multivariate Statistical Analysis, T.W. Anderson.
2. Applied Multivariate Data Analysis, Vol I & II, J.D. Jobson.
3. Statistical Tests for Multivariate Analysis, H. Kris.

4. Programming Python, Mark Lutz.
5. Python 3 for Absolute Beginners, Tim Hall and J-P Stacey.
6. Beginning Python: From Novice to Professional, Magnus Lie Hetland. Edition, 2005.

REFERENCE BOOKS:

1. Regression Diagnostics, Identifying Influential Data and Sources of Collinearety, D.A. Belsey, E. Kuh and R.E. Welsch
2. Applied Linear Regression Models, J. Neter, W. Wasserman and M.H. Kutner.
3. The Foundations of Factor Analysis, A.S. Mulaik.
4. Introduction to Linear Regression Analysis, D.C. Montgomery and E.A. Peck.
5. Cluster Analysis for Applications, M.R. Anderberg.
6. Multivariate Statistical Analysis, D.F. Morrison.
7. Python for Data Analysis, Wes Mc Kinney.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

FUNDAMENTALS OF DATABASE SYSTEMS

Course Code: GR24A2090 **L/T/P/C: 3/0/0/3**
II Year I Semester

Course Outcomes:

1. Illustrate the usage of data models in designing the database
2. Correlate the query in SQL with Relational Query Languages
3. Interpret the purpose of normalization and indexing in database optimization
4. Summarize the schedulers and concurrency control mechanisms for transactions
5. Examine the security models for database authentication

UNIT I

Introduction: Introduction to Database, Hierarchical, Network and Relational Models, Database System Architecture, Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML).

Data Models: Entity-Relationship Model, Network Model, Relational and Object-oriented Data Models, Integrity Constraints, and Data Manipulation Operations.

UNIT II

Relational Query Languages: Relational Algebra, Tuple and Domain Relational Calculus, SQL3, DDL and DML Constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, and SQL server.

UNIT III

Relational Database Design: Domain and Data Dependency, Armstrong's Axioms, Functional Dependencies, Normal Forms, Dependency Preservation, Lossless Design.
Query Processing and Optimization: Evaluation of Relational Algebra Expressions, Query Equivalence, Join Strategies, Query Optimization Algorithms.
Storage Strategies: Indices, B-Trees, Hashing.

UNIT IV

Transaction Processing: Concurrency Control, ACID Property, Serializability of Scheduling, Locking and Timestamp Based Schedulers, Multi-Version and Optimistic Concurrency Control Schemes, Database Recovery.

UNIT V

Database Security: Authentication, Authorization and Access Control, DAC, MAC and RBAC Models, Intrusion Detection, SQL Injection.
Advanced Topics: Object oriented Databases, Object Relational Databases, Logical Databases, Web Databases, Distributed Databases, Data Warehousing and Data Mining.

TEXTBOOKS:

1. Database System Concepts. Abraham Silberschatz, Henry F. Korth and S. Sudarshan.

REFERENCES:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

COMPUTER ORGANIZATION AND ARCHITECTURE LAB

Course Code: GR24A2091 **L/T/P/C: 0/0/4/2**
II Year I Semester

Course Outcomes

1. Incorporate logic gates with different combinations.
2. Develop sequential circuits for different applications.
3. Perform various operations using MLP.
4. Understand accessing communication ports and memory locations.
5. Analyze the applications of different address modes.

Lab: Circuits on breadboard or simulators. TASK 1

Implementation of Boolean Circuits: Operations of Logic Gates: OR, AND, NOT, NAND and NOR gates.

TASK 2

Implementation of Combinational Circuits: Adder, Subtractor, Multiplication Module, Division Module.

TASK 3

Implementation of Multiplexer, Demultiplexer, Encoder, Decoder.

TASK 4

Implementation of Sequential Circuits: Counters, Linear Feedback Shift Registers (LFSR)

TASK 5

C/C++ programming to understand the formats of char, int, float, double, long etc.

TASK 6

Machine language programming on x86 or higher version kits or simulators:

(i) Add/subtract/multiplication/division/GCD/LCM.

TASK 7

Machine language programming: Accessing some specific memory locations/ports

TASK 8

Counting odd and even integers from a series of memory locations

TASK 9

Printing values of selected registers

TASK 10

Handing interrupts

TASK 11

Write a program for data transfer using different addressing modes

TASK 12

Write a program to convert binary numbers to BCD numbers and vice versa.

TEXTBOOKS:

1. Computer System Architecture M. M. Mano: 3rd ed., Prentice Hall of India, New Delhi, 1993.
2. Computer Organization and Design: The Hardware/Software Interface, David A. Patterson and John L. Hennessy.
3. Computer Organization and Embedded Systems, Carl Hamacher.

Reference Books:

1. Computer Architecture and Organization, John P. Hayes.
2. Computer Organization and Architecture: Designing for Performance, William Stallings.
3. Computer System Design and Architecture, Vincent P. Heuring

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

OBJECT ORIENTED PROGRAMMING LAB

Course Code: GR24A2092 **L/T/P/C:0/0/4/2**
II Year I Semester

Course Outcomes:

1. Recall the concepts of Object-oriented programming to solve real life problems
2. Demonstrate object-oriented programming skills by using overloading, overriding, inheritance concepts in developing solutions of a problem on hand.
3. Apply concepts of class hierarchy, templates and structure data using stacks and queue with help of OOP while developing programs.
4. Perceive and choose appropriate input-output formats and manipulators for developing interactive programs
5. Build systems with the help of UML diagrams and OOPs concepts to solve real world problems.

TASK-1

a) Parameter passing, parameter by value vs by reference, passing array as constant pointer

b) Function overloading: writing string operations like strcat and strncat, strcpy and strncpy as overloaded functions.

c) Dynamically allocating space for a pointer depending on input and doing this repeatedly, depending on different inputs and finally de-allocating the pointer.

TASK-2

a) Define class complex with all possible operations: constructor, destructor, copy constructor, assignment operator with the data members stored as pointer to integers.

b) Define a class vector of integers with all possible operations like constructor, destructor, copy constructor and assignment operators.

c) Define class matrix of integers with all possible operations like constructor, destructor, copy constructor and assignment operators.

d) Define a class matrix of integers using vectors, with all possible operations like constructor, destructor, copy constructor and assignment operators.

TASK-3

3. Define class stack, queue, linked-list, array, set using some data type (int) with data members kept as private and functions kept in both protected and public sections.

TASK-4

a) Define class complex with all possible operators: constructor, destructor, copy constructor, assignment operator and operators >, <, >=, <=, ==, ++ (pre and post), +, +=, ( ), with the data members stored as pointer to integers.

c) Define class vector of integers with all possible operations like constructor, destructor, copy constructor and assignment operators>, <, >=, <=, ==, ++ (pre and post), +, +=, ( )

TASK-5

a) Define class matrix of integers with all possible operations like constructor, destructor, copy constructor and assignment operators>, <, >=, <=, ==, ++ (pre and post), +, +=, ( ).

c) Define a class matrix of integers using vectors, with all possible operations like constructor, destructor, copy constructor and assignment operators>, <, >=, <=, ==, ++ (pre and post),+, +=, ( ).

TASK-6

6. Define stack and queue inherited from array class, with standard functions and operators

TASK-7

7 a) Define a class called 'array' with data type passed as template type with constructor, destructor, copy constructor and assignment operators and index operator.

b) Define template functions for comparison and use it in the algorithms like bubble sort, insertion sort, merge sort.

TASK-8

8. Formatted input-output examples

TASK-9

9. Input manipulators

TASK-10

10. Overriding operators <<, >>

TASK-11

11. Define class model for complex number, student class, book class and show it using UML diagram as well as concrete class.

TASK-12

12. Show behavioral modeling through sequence diagram and activity diagram for workflow in a typical log-in, log-out situation.

TEXTBOOKS:

1. The C++ Programming Language, Bjarne Stroustrup, Addison Wesley.
2. C++ and Object-Oriented Programming Paradigm, Debasish Jana, PHI Learning Pvt. Ltd.

REFERENCE BOOKS:

1. Programming – Principles and Practice Using C++, Bjarne Stroustrup, Addison Wesley.
2. The Design and Evolution of C++, Bjarne Stroustrup, Addison Wesley.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

COMPUTATIONAL STATISTICS LAB

Course Code: GR24A2093 **L/T/P/C: 0/0/2/1**

II Year I Semester

Course Outcomes:

1. Develop programs using Python concepts such as Flow control, Functions, Files.
2. Demonstrate various types of graphs using the Matplotlib package.
3. Implement programs using Matplotlib package for annotating graphs and
4. Implement Multivariate regression, Multiple regression, Cluster analysis using Python
5. Implement PCA and LDA for dimensionality reduction using python

LIST OF EXPERIMENTS:

TASK-1 (Control Flow)

a) Write a program to check whether the given number is even or not.
b) Using a for loop, write a program that prints out the decimal equivalents of 1/2, 1/3, 1/4, . . . ,1/10
c) Write a program using a while loop that asks the user for a number and prints a countdown from that number to zero.

TASK-2 (Functions)

a) Write a python program to swap given numbers using Functions.
b) Write a python program to find Fibonacci Numbers using Recursive function

TASK-3 (Data Structures)

a) Write a program to count the numbers of characters in the string and store them in a dictionary data structure
b) Write a program to use split and join methods in the string and trace a birthday with a dictionary data structure.

TASK-4 (Files)

a) Write a script named copyfile.py. This script should prompt the user for the names of two text files. The contents of the first file should be input and written to the second file.

b) Write a program that inputs a text file. The program should print all of the unique words in the file in alphabetical orde

TASK-5 (Matplotlib package)

a) Import Iris dataset from UCI Machine learning repository and Wine Reviews dataset from Kaggle.
b) Scatter the Sepal Length against Sepal Width
c) Create a Line chart by plotting each column in dataset
d) Draw a Histogram and Bar chart for Wine Reviews scores

TASK-6 (Matplotlib package)

a) Using the "text" command add text to the axes of figures.
b) Using the "annotate" command, label the parts of the axes in figures.
c) Using Locator and Formatter objects , set the axis properties.

TASK-7 (Matplotlib package)

a) Draw a rectangle patch to a plot
b) Draw a circular patch at a given center with a given radius in a plot.

TASK-8

a) Demonstrate the use of setp( ) and getp( ) methods.
b) Write a python program to implement Multiple regression.

TASK-9 (Multivariate Analysis).

a) Read Multivariate Analysis Data from Wine dataset
b) Plot Multivariate Data and calculate the summary statistics.

TASK-10 (**Classification using Principal Component Analysis**).

a) Read the Iris dataset
b) Apply Principal Component Analysis for Dimensionality reduction.
c) Classify the data using Random Forest Classifier
d) Evaluate the performance of the model.

TASK-11 (**Classification using Linear Discriminant Analysis**).

a) Read the iris dataset
b) Perform Linear Discriminant Analysis.
c) Classify the data using Random Forest Classifier.
d) Evaluate the performance of the model.
e) Compare the performance of LDA with PCA (results from TASK-10)

TASK-12(Cluster Analysis using K-Means).

a) Read the Titanic dataset from UCI Machine learning repository.
b) Apply data Preprocessing techniques.
c) Use PCA for dimensionality reduction.
d) Perform Cluster Analysis using K-Means algorithm

Textbooks:

1. An Introduction to Multivariate Statistical Analysis, T.W. Anderson.
2. Applied Multivariate Data Analysis, Vol I & II, J.D. Jobson.
3. Statistical Tests for Multivariate Analysis, H. Kris.
4. Programming Python, Mark Lutz.
5. Python 3 for Absolute Beginners, Tim Hall and J-P Stacey.
6. Beginning Python: From Novice to Professional, Magnus Lie Hetland. Edition, 2005.

Reference Books:

1. Regression Diagnostics, Identifying Influential Data and Sources of Collinearety, D.A. Belsey,

E. Kuh and R.E. Welsch

2. Applied Linear Regression Models, J. Neter, W. Wasserman and M.H. Kutner.
3. The Foundations of Factor Analysis, A.S. Mulaik.
4. Introduction to Linear Regression Analysis, D.C. Montgomery and E.A. Peck.
5. Cluster Analysis for Applications, M.R. Anderberg.
6. Multivariate Statistical Analysis, D.F. Morrison.
7. Python for Data Analysis, Wes Mc Kinney.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DATABASES LAB

Course Code: GR24A2094 **L/T/P/C:0/0/2/1**
II Year I Semester

Course Outcomes:

1. Construct the schema of the database and modify it.
2. Compile a query to obtain the aggregated result from the database.
3. Speculate the concepts of database objects.
4. Compare the use of procedure and function in the database.
5. Use SQLite to connect to databases from C programs.

LIST OF EXPERIMENTS:

TASK-1 (DDL and DML Commands):

a) Practice queries on DDL Commands
b) Practice queries on DML Commands

TASK-2 (SQL Functions):

a) Practice queries using basic SQL operators.
b) Practice queries on between..And, like and not operators.
c) Use various built in SQL Functions and practice queries

TASK-3 (Aggregate Operators):

a) Perform aggregate operations and generate queries using them.
b) Implement the group by and having clauses with aggregate operators.

TASK-4 (Nested Queries):

a) Write queries to illustrate the use of pairwise sub queries.
b) Practice the single row and multiple row subqueries.
c) Use sub queries in Create, Insert, Update and delete commands

TASK-5 (Joins and Set Operators):

a) Practice queries on various kinds of joins.
b) Practice queries on set operators.

TASK-6 (Views):

a) Create a simple view and try modifications through it.
b) Create a complex view and understand the restrictions for modifications through it.
c) Practice the creation of sequences and synonyms.

TASK-7(Indexes, Sequences and Synonyms):

a) Practice the creation of sequences and synonyms.
b) Practice creation of function based indexes.
c) Create an index on the attribute of a table.

TASK-8 (DCL Commands):

a) Practice grant and revoke of user level privileges.
b) Practice object-level privileges and creation of roles.

TASK-9 (PL/SQL Blocks, Named Blocks):

a) Write programs to use the anonymous blocks.
b) Develop PL/SQL named blocks-Procedures, Functions.

TASK-10(Cursor and Trigger):

a) Write a PL/SQL program to illustrate the purpose of cursors.
b) Write a PL/SQL program to exemplify the concept of triggers.

TASK-11(C Implementation for DB):

a) Write a C program to connect to SQLite Database and perform DDL and DML operations in it.
b) Write a C program to perform all kinds of retrieval operations on SQLite database.

TASK-12(Case Study):

a) Download standard data of reasonable size (Unit level data of various rounds of NSS surveys) form the internet and implement various SQL commands.

TEXTBOOKS:

1. Database System Concepts. Abraham Silberschatz, Henry F. Korth and S. Sudarshan.

REFERENCE BOOKS:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENVIRONMENTAL SCIENCE

Course Code: GR24A2001 **L/T/P/C:2/0/0/0**
II Year I Semester

Course Outcomes:

1.Gain a variety of experiences & acquire a basic knowledge about the environment & its allied problems

2.Interpret the key components in safeguarding the environment.

3.Evolve an individual vision of harmonious interaction with the natural world.

4.Appraise the quality of the environment in order to create a healthy atmosphere.

5.Familiarize with the individual responsibilities towards green revolution

UNIT I: INTRODUCTION AND AWARENESS ACTIVITIES

Environmental Science: Introduction, Definition, scope and importance.

AWARENESS ACTIVITIES

- Small group meetings about:
- Water management
- Wastewater treatment
- Projects Vs Environment
- Zero waste management
- Impact of Science & Technology on Environment
- E-waste management
- Biodiversity loss
- Renewable Energy

UNIT II

SLOGAN AND POSTER MAKING EVENT

- Food waste management
- Rain water harvesting
- Climate change
- Green Power
- Water conservation
- Green at work
- Role of IT in environment and human health
- Sustainable development

UNIT III

EXPERT LECTURES ON ENVIRONMENTAL SCIENCE

- Environmental Impact Assessment
- Industrial waste treatment
- Regenerative farming/Organic farming/Vertical gardens/Hydroponics
- Circular Economy
-

UNIT IV
CLEANLINESS DRIVE

- Indoor air pollution
- Vehicular pollution
- Visual pollution
- Waste management at home
- Composting
- Plastic recycling

UNIT V
CASE STUDIES

- HPCL and LG Polymers disasters in Vizag
- Oleum gas leak in Delhi
- Mathura Refinery & Taj Mahal
- Conservation of Hussain Sagar lake
- The Cleanest city of India-Surat
- Green Buildings in India
- KBR park in Hyderabad (Environmental protection Vs Development)
- Fluorosis and remediation
- Evaluation of STP or ETP operation in Hyderabad
- Ecotourism & its impacts
- Positive Impact on Environment due to Lockdown Forced by Corona Pandemic

Textbooks:

1. Environmental Studies for UG Courses, Erach Bharucha, UGC Publications, Delhi, 2004.
2. Textbook of Environmental Studies, Deeksha Dave, S. S. Katewa, Cengage Delmar Learning India Pvt., 2012.

References:

1. Introduction to Environmental Science, Y. Anjaneyulu, BS Publications, 2004.
2. Environmental Studies, Anubha Kaushik & C. P. Kaushik, 4th Edition, New Age International Publishers.

II YEAR
II SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

OPERATING SYSTEMS CONCEPTS

Course Code: GR24A2095 **L/T/P/C: 2/0/0/2**
II Year II Semester

Course Outcomes:

1. Explain functions and structures of operating system and differentiate among different OS types; Basics of process and threads
2. Implement and analyze various process management concepts and maximize CPU throughput.
3. Analyze synchronization problems and solutions; Design a deadlock management policy.
4. Optimize memory management for improved system performance.
5. Demonstrate disk management, implement disk scheduling, I/O and file system management, Able to use UNIX operating system

UNIT I

Introduction: Concept of Operating Systems (OS), Generations of OS, Types of OS, OS Services, Interrupt handling and System Calls, Basic architectural concepts of an OS, Concept of Virtual Machine, Resource Manager view, process view and hierarchical view of an OS.
Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching.
Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads.

UNIT II

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time.
Scheduling algorithms: Pre-emptive and non-pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.
Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

UNIT III

Inter-process Communication: Concurrent processes, precedence graphs, Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Semaphores, Strict Alternation, Peterson's Solution, The Producer / Consumer Problem, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dining Philosopher Problem, Barber's shop problem.
Concurrent Programming: Critical region, conditional critical region, monitors, concurrent languages, communicating sequential process (CSP); Deadlocks - prevention, avoidance, detection and recovery.

UNIT IV

Memory Management: Basic concept, Logical and Physical address maps, Memory allocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation and Compaction.

Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page allocation, Partitioning, Paging, Page fault, Working Set, Segmentation, Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

UNIT V

I/O Hardware: I/O devices, Device controllers, Direct Memory Access, Principles of I/O.

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation(linear list, hash table), efficiency and performance.

Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks.

Case study: UNIX OS file system, shell, filters, shell programming, programming with the standard I/O, UNIX system calls.

TEXTBOOKS:

1. Operating System Concepts Essentials. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne.

REFERENCE BOOKS:

1. Operating Systems: Internals and Design Principles. William Stallings.
2. Operating System: A Design-oriented Approach. Charles Patrick Crowley.
3. Operating Systems: A Modern Perspective. Gary J. Nutt.
4. Design of the Unix Operating Systems. Maurice J. Bach.
5. Understanding the Linux Kernel, Daniel Pierre Bovet, Marco Cesati.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

PRINCIPLES OF SOFTWARE ENGINEERING

Course Code: GR24A2096 **L/T/P/C: 2/0/0/2**
II Year II Semester

Course Outcomes:

1. Apply software engineering principles and techniques.
2. Analyze project management and process improvement activities.
3. Produce efficient, reliable, robust and cost-effective software solutions.
4. Analyze the problem domain space, user requirements and design an application using software engineering concepts.
5. Apply various testing activities for real time applications.

UNIT I

Introduction: Programming in the small vs. programming in the large; software project failures and importance of software quality and timely availability; engineering approach to software development; role of software engineering towards successful execution of large software projects; emergence of software engineering as a discipline.

UNIT II

Software Project Management: Basic concepts of life cycle models – different models and milestones; software project planning – identification of activities and resources; concepts of feasibility study; techniques for estimation of schedule and effort; software cost estimation models and concepts of software engineering economics; techniques of software project control and reporting; introduction to measurement of software size; introduction to the concepts of risk and its mitigation; configuration management.

UNIT III

Software Quality and Reliability: Internal and external qualities; process and product quality; principles to achieve software quality; introduction to different software quality models like McCall, Boehm, FURPS / FURPS+, Dromey, ISO – 9126; introduction to Capability Maturity Models (CMM and CMMI); introduction to software reliability, reliability models and estimation.

UNIT IV

Problem Space Understanding:

How an industry works, how an IT company works, How IT supports business, Problem Space Understanding, Knowledge Driven Development (KDD), Domain knowledge framework of KDD,usage of domain knowledge framework in Insurance, Banking and Automobile, KDD as a project delivery methodology, Linking domain knowledge to software development, An example to illustrate this, A case study to produce a KDD artifact using Agile.

Software Requirements Analysis, Design and Construction: Introduction to Software Requirements Specifications (SRS) and requirement elicitation techniques; techniques for requirement modeling – decision tables, event tables, state transition tables, Petri nets; requirements documentation through use cases; introduction to UML, introduction to software metrics and metrics-based control methods; measures of code and design quality.

UNIT V

Software Testing: Introduction to faults and failures; basic testing concepts; concepts of verification and validation; black box and white box tests; white box test coverage – code coverage, condition coverage, branch coverage; basic concepts of black-box tests – equivalence classes, boundary value tests, usage of state tables; testing use cases; transaction-based testing; testing for non-functional requirements – volume, performance and efficiency; concepts of inspection.

TEXTBOOKS:

1. Software Engineering, Ian Sommerville

REFERENCE BOOKS:

1. Fundamentals of Software Engineering, Carlo Ghezzi, Jazayeri Mehdi, Mandrioli Dino
2. Software Requirements and Specification: A Lexicon of Practice, Principles and Prejudices, Michael Jackson
3. The Unified Development Process, Ivar Jacobson, Grady Booch, James Rumbaugh
4. Design Patterns: Elements of Object-Oriented Reusable Software, Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides
5. Software Metrics: A Rigorous and Practical Approach, Norman E Fenton, Shari Lawrence Pfleeger
6. Software Engineering: Theory and Practice, Shari Lawrence Pfleeger and Joanne M. Atlee
7. Object-Oriented Software Construction, Bertrand Meyer
8. Object Oriented Software Engineering: A Use Case Driven Approach --Ivar Jacobson
9. Touch of Class: Learning to Program Well with Objects and Contracts --Bertrand Meyer
10. UML Distilled: A Brief Guide to the Standard Object Modeling Language --Martin Fowler

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ALGORITHM DESIGN AND ANALYSIS

Course Code: GR24A2097 **L/T/P/C :3/0/0/3**
II Year II Semester

Course Outcomes:

1. Analyze the performance of algorithms and represent using asymptotic notations.
2. Differentiate and demonstrate various algorithm design strategies.
3. Solve various problems using algorithmic design paradigms and can analyze their complexities.
4. Demonstrate and solve the tree traversal problems and analyze its complexity.
5. Distinguish NP complete and NP hard problems.

UNIT I

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

UNIT II

Fundamental Algorithmic Strategies: Brute-Force, Heuristics, Greedy, Dynamic Programming, Branch and Bound and Backtracking methodologies; Illustrations of these techniques for Problem-Solving, Bin Packing, Knapsack, Travelling Salesman Problem.

UNIT III

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

UNIT IV

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

UNIT V

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

TEXTBOOKS:

1. Fundamentals of Computer Algorithms, E. Horowitz and S. Sahni.
2. The Design and Analysis of Computer Algorithms, A. Aho, J. Hopcroft and J. Ullman.

REFERENCE BOOKS:

1. "Introduction to Algorithms", T. H. Cormen, C. E. Leiserson and R. L. Rivest.

2. "Computer Algorithms: Introduction to Design and Analysis", S. Baase.
3. "The Art of Computer Programming", Vol. 1, Vol. 2 and Vol. 3, .D. E. Knuth.
4. "Quantum Computation and Quantum Information" Michael A. Nielsen and Isaac L. Chuang.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

INTRODUCTION TO INNOVATION, IP MANAGEMENT AND ENTREPRENEURSHIP

Course Code: GR24A2098 **L/T/P/C: 3/ 0/ 0/ 3**
II Year II Semester

Course Outcomes:

1. Study and understand what and why innovation is required and its process and sources of innovation.
2. Investigate, understand, and internalize the process of building an innovative organization.
3. Recognize the characteristics of different types of entrepreneurships and learn to manage various types of IPR to protect competitive advantage
4. Independently formulate a business plan based on a business idea in technology, plan and understanding the financial implication in entrepreneurship & financial planning.
5. Exceptional in IPR in Indian business perspective and IPR in international context.

UNIT I

Introduction to Innovation (What and Why) - Innovation as a core business process, Sources of innovation, Knowledge push vs. need pull innovations.
Class Discussion- Is innovation manageable or just a random gambling activity?

UNIT II

Building an Innovative Organization: Creating new products and services, exploiting open innovation and collaboration, Use of innovation for starting a new venture
Class Discussion- Innovation: Co-operating across networks vs. 'go-it-alone' approach

UNIT III

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

UNIT IV

Entrepreneurship- Financial Planning: Financial Projections and Valuation, Stages of financing, Debt, Venture Capital and other forms of Financing

UNIT V

Intellectual Property Rights (IPR): Introduction and the economics behind development of IPR: Business Perspective, IPR in India – Genesis and Development, International Context, Concept of IP Management, Use in marketing.

Types of Intellectual Property: Patent- Procedure, Licensing and Assignment, Infringement and Penalty, Trademark- Use in marketing, example of trademarks- Domain name, Geographical Indications- What is GI, why protect them? Copyright- What is copyright, Industrial Designs- What is design? How to protect?

Class Discussion- Major Court battles regarding violation of patents between corporate companies

Assignment:

Case study materials books will be given to students. Students are required to meet in groups before coming to class and prepare in case for the day. Instructors may ask the student groups to present their analysis and findings to the class.

Further, the topic for class discussion will be mentioned beforehand and students should be ready to discuss these topics (in groups) in class. Students are required to meet in groups before coming to class and prepare on the topic. Few topics are mentioned below as examples. Instructors can add or change any topic as per requirement.

Topic 1- Is innovation manageable or just a random gambling activity?

Topic 2- Innovation: Co-operating across networks vs. 'go-it-alone' approach

Topic 3- Major Court battles regarding violation of patents between corporate companies

Textbooks:

1. Joe Tidd, John Bessant. Managing Innovation: Integrating Technological, Market and Organizational Change
2. Case Study Materials: To be distributed for class discussion.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

OPERATIONAL RESEARCH

Course Code: GR24A2099 **L/T/P/C: 2/ 0/ 0/ 2**
II Year II Semester

Course Outcomes

1. To impart knowledge in concepts, tools of operations research and to understand and apply the theoretical workings method for linear programming and apply various linear programming techniques for optimal allocation of limited resources.
2. To be able to build and solve transportation and assignment problems using appropriate method
3. To be exceptional to design and solve simple models of project scheduling techniques such as PERT & CPM in developing critical thinking and objective analysis of decision problems.
4. To understand the inventory management elements including the relevant related costs and distinguish various inventory models for developing proper inventory control policies.
5. To examine situations in which queuing problems are generated and appreciate simulation methodology.

UNIT I

Introduction to OR: Origin of OR and its definition. Concept of optimizing performance measure, Types of OR problems, Deterministic vs. Stochastic optimization, Phases of OR problem approach – problem formulation, building mathematical model, deriving solutions, validating model, controlling, and implementing solution.

Linear Programming: Linear programming – Examples from industrial cases, formulation & definitions, Matrix form. Implicit assumptions of LPP.
Some basic concepts and results of linear algebra – Vectors, Matrices, Linear Independence / Dependence of vectors, Rank, Basis, System of linear eqns., Hyperplane, Convex set, Convex polyhedron, Extreme points, Basic feasible solutions.
Geometric method: 2-variable case, Special cases – infeasibility, unboundedness, redundancy & degeneracy, Sensitivity analysis.
Simplex Algorithm – slack, surplus & artificial variables, computational details, big-M method, identification and resolution of special cases through simplex iterations.
Duality – formulation, results, fundamental theorem of duality, dual-simplex and primal-dual algorithms.

UNIT II

Transportation and Assignment problems: TP - Examples, Definitions – decision variables, supply & demand constraints, formulation, Balanced & unbalanced situations, Solution methods – NWCR, minimum cost and VAM, test for optimality (MODI method), degeneracy and its resolution.
AP - Examples, Definitions – decision variables, constraints, formulation, Balanced & unbalanced situations, Solution method – Hungarian, test for optimality (MODI method), degeneracy & its resolution.

UNIT III

PERT – CPM: Project definition, Project scheduling techniques – Gantt chart, PERT & CPM, Determination of critical paths, Estimation of Project time and its variance in PERT using statistical principles, Concept of project crashing/time-cost trade-off.

UNIT IV

Inventory Control: Functions of inventory and its disadvantages, ABC analysis, Concept of inventory costs, Basics of inventory policy (order, lead time, types), Fixed order-quantity models – EOQ, POQ & Quantity discount models. EOQ models for discrete units, sensitivity analysis and Robustness, Special cases of EOQ models for safety stock with known / unknown stock out situations, models under prescribed policy, Probabilistic situations.

UNIT V

Queuing Theory:

Definitions – queue (waiting line), waiting costs, characteristics (arrival, queue, service discipline) of queuing system, queue types (channel vs. phase).

Kendall's notation, Little's law, steady state behaviour, Poisson's Process & queue, Models with examples - M/M/1 and its performance measures; M/M/m and its performance measures; brief description about some special models.

Simulation Methodology:

Definition and steps of simulation, random number, random number generator, Discrete Event System Simulation – clock, event list, Application in Scheduling, Queuing systems and Inventory systems.

Textbooks:

1. Operations Research: An Introduction. H.A. Taha.

Reference Books:

1. Linear Programming. K.G. Murthy.
2. Linear Programming. G. Hadley.
3. Principles of OR with Application to Managerial Decisions. H.M. Wagner.
4. Introduction to Operations Research. F.S. Hiller and G.J. Lieberman.
5. Elements of Queuing Theory. Thomas L. Saaty.
6. Operations Research and Management Science, Handbook: Edited By A. Ravi Ravindran.
7. Management Guide to PERT/CPM. Wiest & Levy.
8. Modern Inventory Management. J.W. Prichard and R.H. Eagle.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

FUNDAMENTALS OF ECONOMICS

Course Code: GR24A2100 **L/T/P/C: 2/ 0/ 0/ 2**

I Year II Semester

Course Outcomes:

1. Providing the fundamental understand of economics and explain the theory of the firm and various micro-economics tools such as demand and supply analysis that would help in forward planning and decision making
2. Summarize production theories, factors of production, various costs, and revenue concepts
3. Apply the above conceptual knowledge to the various market structures under perfect and imperfect competition
4. Classify the components of National income with the help of income determination tools
5. Examine the policies and procedures of Government sector and external sectors of imports and exports in monitory operations by considering demand and supply of money and provide a brief view of monetary, fiscal policies, functioning of central bank of India.

UNIT I

Microeconomics 1: Principles of Demand and Supply - Supply Curves of Firms - Elasticity of Supply; Demand Curves of Households - Elasticity of Demand; Equilibrium and Comparative Statics (Shift of a Curve and Movement along the Curve); Welfare Analysis - Consumers' and Producers' Surplus - Price Ceilings and Price Floors.

UNIT II

Microeconomics 2: Consumer Behaviour - Axioms of Choice - Budget Constraints and Indifference Curves; Consumer's Equilibrium - Effects of a Price Change, Income and Substitution Effects -Derivation of a Demand Curve; Applications - Tax and Subsidies - Intertemporal Consumption - Suppliers' Income Effect;

UNIT III

Microeconomics 3: Theory of Production - Production Function and Iso-quants - Cost Minimization; Cost Curves - Total, Average and Marginal Costs - Long Run and Short Run Costs; Equilibrium of a Firm Under Perfect Competition; Monopoly and Monopolistic Competition.

UNIT IV

Macroeconomics 1: National Income and its Components - GNP, NNP, GDP, NDP; Consumption Function; Investment; Simple Keynesian Model of Income Determination and the Keynesian Multiplier; Government Sector - Taxes and Subsidies; External Sector - Exports and Imports;

UNIT V

Macroeconomics 2: Money - Definitions; Demand for Money -Transactionary and Speculative

Demand; Supply of Money - Bank's Credit Creation Multiplier; Integrating Money and Commodity Markets - IS, LM Model; Business Cycles and Stabilization - Monetary and Fiscal Policy - Central Bank and the Government; The Classical Paradigm - Price and Wage Rigidities - Voluntary and Involuntary Unemployment

TEXTBOOKS:

1. Microeconomics, Pindyck, Robert S., and Daniel L. Rubinfeld, 8th Edition, Pearson Education, 2017.
2. Macroeconomics, Dornbusch, Fischer and Startz, 13th Edition, McGraw-Hill, 2018.
3. Economics, Paul Anthony Samuelson, William D. Nordhaus, 19th Edition, McGraw- Hill, 2012.

REFERENCES:

1. Intermediate Microeconomics: A Modern Approach, Hal R. Varian, 9th Edition,
2. Springer, 2014.
3. Principles of Macroeconomics, N. Gregory Mankiw, 7th Edition, Cengage India, 2012.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

OPERATING SYSTEMS CONCEPTS LAB

Course Code: GR24 A2101 **L/T/P/C: 0/0/2/1**
II Year II Semester

Course Outcomes:

1. Demonstrate the knowledge of UNIX using commands and shell programming
2. Evaluate the performance of different types of CPU scheduling algorithms and implement problems using semaphores.
3. Simulate Banker's algorithm for deadlock avoidance
4. Implement page replacement policies and memory allocation techniques in memory management.
5. Implement indexing and hashing strategies.

Laboratory

TASK 1
Experiment Unix commands (files directory, data manipulation, network communication etc)

TASK 2
Write programs using shell programming and use of vi editor

TASK 3
Simulate the following Scheduling algorithms using C program

a)FCFS b) SJF c) Priority d) Round Robin

TASK 4
To write a C program to implement concept of Shared memory

TASK 5
Simulate Thread and Multi Thread using a C program

TASK 6
To write a C program to implement concept of Inter Process Communication

TASK 7
Implement an Algorithm for Dead Lock Detection in C.

TASK 8
Simulate Bankers Algorithm for Deadlock Avoidance in C.

TASK 9
Simulate the Readers – Writer's problem using semaphores.

TASK 10

To write C program to implement concepts of Memory Management:

a)Simulate First Fit b) Best Fit algorithm

TASK 11

To write C program to Simulate page replacement Algorithms for memory management:
a) FIFO b) LRU

TASK 12

To write a C program to implement the concept of Indexing and Hashing

Textbooks:

1. Operating System Concepts Essentials. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne.

Reference Books:

1. Operating Systems: Internals and Design Principles. William Stallings.
2. Operating System: A Design-oriented Approach. Charles Patrick Crowley.
3. Operating Systems: A Modern Perspective. Gary J. Nutt.
4. Design of the Unix Operating Systems. Maurice J. Bach.
5. Understanding the Linux Kernel, Daniel Pierre Bovet, Marco Cesati.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

SOFTWARE ENGINEERING LAB

Course Code: GR24A2102 **L/T/P/C: 0/0/2/1**
II Year II Semester

Course Outcomes

1. Analyze and identify requirements for real time problems.
2. Design and implement various software design models.
3. Usage of modern engineering tools for specification, design, and implementation.
4. Provide appropriate solutions for real time problems using software engineering methodology.
5. Design test cases for various real time problems.

Software's Used: StarUML /Umbrello & JUNIT
Develop the following applications using software engineering methodologies.

1. Unified Library System 2. Online Railway Reservation System

TASK1
Prepare the problem statement for the above applications.

TASK2
Develop Software Requirement Specification (SRS) for the above applications.

TASK3
Design the data flow diagram for the above applications.

TASK4
Design the class diagrams for the above applications.

TASK 5
Design the Use-case diagrams for the above applications.

TASK 6
Design the interaction diagrams for the above applications.

TASK 7
Perform forward engineering for the above application and generate a report of the same.

TASK 8
Perform reverse engineering for the above application and generate a report of the same.

TASK 9
Write a C++ program to demonstrate the working of the fallowing constructs:

i) while ii) if …else iii) Switch iv) for Loops in C++ language

TASK 10
Create a test plan document for any application (e.g. Unified Library System)

TASK 11

Implement a Junit Test program and design test cases to find the maximum of an array of numbers.

TASK 12

Implement a Junit Test program and design test cases to count the number of elements in array of numbers.

TEXTBOOKS:

1. The Unified Modeling Language User Guide, Grady Booch, James Rumbaugh, Ivar Jacobson,
2. Pearson Education.
3. UML 2 Toolkit, Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado, WILEYDreamtech India Pvt. Ltd.
4. Software Engineering, Ian Sommerville

REFERENCE BOOKS:

1. Fundamentals of Software Engineering, Carlo Ghezzi, Jazayeri Mehdi, Mandrioli Dino
2. Software Requirements and Specification: A Lexicon of Practice, Principles and Prejudices, Michael Jackson
3. The Unified Development Process, Ivar Jacobson, Grady Booch, James Rumbaugh
4. Design Patterns: Elements of Object-Oriented Reusable Software, Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides
5. Software Metrics: A Rigorous and Practical Approach, Norman E Fenton, Shari Lawrence Pfleeger
6. Software Engineering: Theory and Practice, Shari Lawrence Pfleeger and Joanne M. Atlee
7. Object-Oriented Software Construction, Bertrand Meyer
8. Object Oriented Software Engineering: A Use Case Driven Approach --Ivar Jacobson
9. Touch of Class: Learning to Program Well with Objects and Contracts -- Bertrand Meyer

10.UML Distilled: A Brief Guide to the Standard Object Modeling Language --Martin Fowler

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ALGORITHM DESIGN AND ANALYSIS LAB

Course Code: GR24A2103 **L/T/P/C: 0/ 0/ 2/1**

II Year II Semester

Course Outcomes:

1. Ability to write programs in C to solve problems using algorithm design techniques.
2. Compare and measure the performance of different algorithms.
3. Write programs in C to solve problems using divide and conquer strategy.
4. Implement programs in C to solve problems using backtracking strategy.
5. To write programs in C to solve minimum spanning tree for undirected graphs using Krushkal's and prim's algorithms.

List of Programs:

TASK 1

Implement and analyze time complexity in best & worst case for Binary Search and Quick Sort

TASK 2

Implement and analyze time complexity in best & worst case for Merge Sort and Strassen Matrix Multiplication

TASK 3

Implement and analyze time complexity of Greedy Application Problems.

TASK 4

Implement and analyze time complexity of Dynamic Programming Application Problems.

TASK 5

Implement and analyze time complexity of Greedy Application Problems, Prims & Kruskal's Algorithms

TASK 6

Implement and analyze time complexity of Backtracking Application Problems.

TASK 7

Implement and analyze time complexity of Branch & Bound Application Problems.

TASK 8
Implement and analyze time complexity of BFS and DFS and their applications.

TASK 9
Implement and analyze time complexity of Dijkstra and Floyd Warshall Algorithms.

TASK 10
Implement and analyze time complexity of Topological sorting, Network Flow Problems.

TASK 11
Implement sample problem on P, NP, NP complete and NP hard

TASK 12
Implement and analyze time complexity of Randomized Quick Sort.

TEXTBOOKS:

1. Fundamental of Computer Algorithms, E. Horowitz and S. Sahni
2. The Design and Analysis of Computer Algorithms, A. Aho, J. Hopcroft and J. Ullman

REFERENCE BOOKS:

1. Introduction to Algorithms, T. H. Cormen, C. E. Leiserson and R. L. Rivest
2. Computer Algorithms: Introduction to Design and Analysis, S. Baase
3. The Art of Computer Programming, Vol. 1, Vol. 2 and Vol. 3, D. E. Knuth

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

OPERATIONAL RESEARCH LAB

Course Code: GR24A2104 **L/T/P/C: 0 / 0/ 2 / 1**
II Year II Semester

Course Outcomes:

1. Finding the solutions to linear programming problems by Graphical and Simplex Method.
2. Implement optimal solutions of transportation and assignment problems.
3. Analyze the project network diagram.
4. Demonstrate the use of Inventory Models.
5. Implement Queuing & Simulation models

TASK 1
Formulation of linear programming problems.

TASK 2
Solution of linear programming problem using graphical method with:

i. Multiple constraints
ii. Unbounded solution
iii. Infeasible solution
iv. Alternative or multiple solution

TASK 3
Enumeration of all basic solutions for linear programming problem.

TASK 4
Solution of linear programming problem with simplex method.

TASK 5
Problem solving using Big M method.

TASK 6
Problem solving using two phase methods.

TASK 7
Solution on primal problem as well as dual problem.

TASK 8
Solution based on dual simplex method.

TASK 9
Verification of weak duality, strong duality and complementary slackness property.

TASK 10
Solution to transportation problems.

TASK 11
Solution of assignment problem.

TASK 12
ABC analysis.

TASK 13
Inventory model.

TASK 14
Performance measures for M/M/1 queuing model.

TASK 15
Monte Carlo method.

TASK 16
Simulation: Random number generation.

TASK 17
Solution of integer programming problem using Branch and Bound method.

TASK 18
Solution of integer programming problem using Gomory's cutting plane method.

Textbooks:
1. Operations Research: An Introduction. H.A. Taha.

Reference Books:

1. Linear Programming. K.G. Murthy.
2. Linear Programming. G. Hadley.
3. Principles of OR with Application to Managerial Decisions. H.M. Wagner.
4. Introduction to Operations Research. F.S. Hiller and G.J. Lieberman.
5. Elements of Queuing Theory. Thomas L. Saaty.
6. Operations Research and Management Science, Handbook: Edited By A. Ravi Ravindran.
7. Management Guide to PERT/CPM. Wiest & Levy.
8. Modern Inventory Management. J.W. Prichard and R.H. Eagle.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

REAL-TIME RESEARCH PROJECT/ SOCIETAL RELATED PROJECT

Course Code: GR24A2106 **L/T/P/C: 0/0/4/2**
II Year II Semester

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

1. Predict the Field domain in the specialized area under Engineering discipline.
2. Evaluate and obtain the category of the solution with help of Real time studies
3. Analyze and discuss the field problems using software tools /Modes/simulations and experimental investigations.
4. Implementing the solution of a problem statement.
5. Prioritize the reports and deliver the final work with presentation.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE (NON-CREDIT)

Course Code: GR24A2105 **L/T/P/C: 2/0/0/0**
II Year II Semester

Course Outcomes:

1. Impart knowledge in concepts and understand basic principles, thought process, reasoning and recognize the wisdom of Sanskrit literature and its importance in modern society with rapid technological advancements.
2. Understand the legal framework and traditional knowledge and connect various enactments related to the protection of traditional knowledge.
3. Understand that sustainability is at the core of Indian Traditional Knowledge Systems through the evaluation of modern science in the mathematical era.
4. Be familiar with the scientific worldview and basic principle's Indian philosophy and early literature.
5. Familiarize Ayurveda importance in modern life and process for health & Well-being with Ayurveda.

UNIT I

Introduction to the basic structure of the Indian knowledge system: The historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), Traditional Knowledge (TK) Vs western knowledge traditional knowledge vis-à-vis formal knowledge. Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.

UNIT II

Various enactments related to the protection of traditional knowledge: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmers Rights Act, 2001 (PPVFR Act).

UNIT III

Introduction to the modern science and Indian knowledge system: Mathematics in India, Early Historical Period, The Classical Period, The Classical Period, post-Āryabhaṭa, Features of Indian Mathematics.

UNIT IV

Modern Science and Indian philosophy: Early Chemical Techniques, Atomism in Vaiśeṣika, Chemistry in Early Literature, Indian Philosophy Sāṁkhya, Yoga, Vaiśeṣika, Nyāya, Mīmāṁsā, Vedānta, Sāṁkhya.

UNIT V

Yoga and Holistic Health care for human wellbeing: Ayurveda for Life, Health and Well- being Definition of Ayurveda, the principles of Ayurvedic healing, treating diseases to restore health, Astanga Ayurveda.

REFERENCES:

1. Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, Bharatiya Vidya Bhavan, Mumbai. 5th Edition, 2014.
2. Swami Jitatmanand, Holistic Science and Vedant, Bharatiya Vidya Bhavan.
3. "Knowledge Traditions and Practices of India" Kapil Kapoor, Michel Danino
4. RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakasham, Delhi, 2016

E-Resources:

1. https://www.youtube.com/watch?v=LZP1StpYEPM
2. http://nptel.ac.in/courses/121106003/