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 2022-23)

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 GR22

(Applicable for Batches Admitted from 2022-23)

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	Information Technology	12	B.Tech Information Technology
7	Computer Science and Business System	32	B.Tech Computer Science & Business System
8	Computer Science and Engineering (AIML)	66	B.Tech Computer Science and Engineering (AIML)
9	Computer Science and Engineering (Data Science)	67	B.Tech Computer Science and Engineering (Data Science)
10	Computer Science and Engineering (Artificial Intelligence)		B.Tech Computer Science and Engineering (Artificial Intelligence
11	Computer Science and Information Technology	33	B.Tech Computer Science and Information Technology

GR22 Regulations shall govern the above programmes offered by the Departments with effect from the students admitted to the programmes in 2022-23 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) **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. **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 cancelled**, 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 re-admission 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.

6. **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 component 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 examination 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. Mini Project is evaluated by 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 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):

S. No	Component of Assessment	Marks Allotted	Type of Assessment	Scheme of Examinations
1	Project Work (Phase- I and Phase -II)	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, Project work shall be displayed in the road show at the department level. Project work is evaluated by 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 Project report shall be presented before Project Review Committee in the presence of External Examiner 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.

g) The evaluation of courses having ONLY internal marks in I-Year I Semester and II Semester is as follows:

- I Year courses: The internal evaluation is for 50 marks and it 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. Student 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. The student is deemed to have failed, if he/she (i) is absent as per schedule, or (ii) secures less than 40% marks in this course.
- II Year II Semester *Real-Time/Field-based Research Project/Societal Related Project* course: The internal evaluation is for 50 marks and it 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. Student 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. The student is deemed to have failed, if he/she (i) does not submit a report on the Project, or (ii) does not make a presentation of the same before the internal committee as per schedule, or (ii) secures less than 40% marks in this course.

7. **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.

8. **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.

9. **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.

10. **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.

11. **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 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 cancelled.

12. **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 toFirst year second semester	Regular course of study of First year first semester.
2	First year second semester toSecond 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 secondsemester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
3	Second year first semester toSecond year second semester	Regular course of study of Second year firstsemester.
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 semesterto Fourth year first semester	**(i)** Regular course of study of Third year second semester. **(ii)** Must have secured at least 60% credits upto 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 toFourth year second semester	Regular course of study of Fourth year firstsemester.

c) Provision of opting 2 OE courses through online mode.
d) Choice of placement-oriented value-added courses in every semester from II year till IV year
e) Students can take a year break after second or third year to work on R&D
f) Under Mandatory Courses
  i) Co-Curricular activities -- 0.5 credit for publishing paper, publishing patent, attend seminar, technical competition and taking part in hackathon
  ii) Extra-Curricular activities -- 0.5 credit for sports represent University or part or college winning team a medal or cup in outside recognized inter collegiate or above tournaments or NSS activities or donated blood two times or 2 green campus events

13. 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) $\mathbf{S_k}$ the SGPA of $\mathbf{k^{th}}$ 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.,

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

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 ≥ 2**.

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

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

14. 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

15. 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).

16. **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.

17. **Transitory Regulations**

A. For students detained due to shortage of attendance:

1. A Student who has been detained in I year of GR20 Regulations due to lack of attendance, shall be permitted to join I year I Semester of GR22 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 GR20 regulations for want of attendance, shall be permitted to join the corresponding semester of GR22 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 GR22 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 GR20 Regulations who has been detained due to lack of credits, shall be promoted to the next semester of GR22 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 GR20 & GR22 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 GR22 Academic Regulations are applicable to a student from the year of readmission. See rule (C) for further Transitory Regulations.

C. For readmitted students in GR22 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 GR22 Regulations. **There is NO exemption of credits in any case**.

6. If a student is readmitted to GR22 Regulations and has any subject with 80% of syllabus common with his/her previous regulations, that particular subject in GR22 Regulations will be substituted by another subject to be suggested by the college academic administration.

Note:

If a student readmitted to GR22 Regulations and has not studied any courses/topics in his/her earlier regulations of study which is prerequisite for further subjects in GR22 Regulations, then the college shall conduct remedial classes to cover those courses/topics for the benefit of the students.

18. **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.

19. 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 andthe 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 GR22
(Applicable for Batches Admitted from 2023-24)

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 semesterfrom 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 Thirdyear 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 GR22
(Applicable for Batches Admitted from 2022-23)

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 programme. 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) GR22 Course Structure
I B. Tech – CSE (CSBS) - I Semester

S.No	BOS	Group	Course Code	Course Name	Credits				Hours				Int.	Ext	Total Marks
					L	T	P	Total	L	T	P	Total			
1	Maths	BS	GR22A1024	Discrete Mathematics for Engineers	3	1	0	4	3	1	0	4	40	60	100
2	Maths	BS	GR22A1025	Introductory Topics in Statistics, Probability and Calculus	3	0	0	3	3	0	0	3	40	60	100
3	CSE	ES	GR22A1026	Fundamentals of Computer Science	3	0	0	3	3	0	0	3	40	60	100
4	EEE	ES	GR22A1027	Principles of Electrical Engineering	2	0	0	2	2	0	0	2	40	60	100
5	Physics	BS	GR22A1028	Physics for Computing Science	2	0	0	2	2	0	0	2	40	60	100
6	CSE	ES	GR22A1029	Fundamentals of Computer Science Lab	0	0	2	2	0	0	4	4	40	60	100
7	EEE	ES	GR22A1030	Principles of Electrical Engineering Lab	0	0	1	1	0	0	2	2	40	60	100
8	Physics	BS	GR22A1031	Physics for Computing Science Lab	0	0	1	1	0	0	2	2	40	60	100
9	English	HS	GR22A1032	Business Communication and Value Science – I	2	0	0	2	2	0	0	2	40	60	100
		TOTAL			**15**	**1**	**4**	**20**	**15**	**1**	**8**	**24**	**360**	**540**	**900**

I B. Tech – CSE (CSBS) - II Semester

S. No	BOS	Group	Course Code	Course Name	Credits				Hours				Int.	Ext	Total Marks
					L	T	P	To Tal	L	T	P	To tal			
1	Maths	BS	GR22A1033	Linear Algebra	3	1	0	4	3	1	0	4	40	60	100
2	Maths	BS	GR22A1034	Statistical Methods	3	0	0	3	3	0	0	3	40	60	100
3	CSE	ES	GR22A1035	Data Structures and Algorithms	2	1	0	3	2	1	0	3	40	60	100
4	ECE	ES	GR22A1036	Principles of Electronics	2	0	0	2	2	0	0	2	40	60	100
5	Mgmt	HS	GR22A1037	Fundamentals of Economics	2	0	0	2	2	0	0	2	40	60	100
6	Maths	BS	GR22A1038	Statistical Methods Lab	0	0	1	1	0	0	2	2	40	60	100
7	CSE	ES	GR22A1039	Data Structures and Algorithms Lab	0	0	2	2	0	0	4	4	40	60	100
8	ECE	ES	GR22A1040	Principles of Electronics Lab	0	0	1	1	0	0	2	2	40	60	100
9	English	HS	GR22A1041	Business Communication and Value Science – II	2	0	0	2	2	0	0	2	40	60	100
				TOTAL	**14**	**2**	**04**	**20**	**14**	**2**	**8**	**24**	**360**	**540**	**900**

II B. Tech – CSE (CSBS) - I Semester

S. No	BOS	Group	Course Code	Course Name	Credits				Hours				Int.	Ext	Total Marks
					L	T	P	Total	L	T	P	Total			
1	CSBS	PC	GR22A2088	Theory of Computation	3	0	0	3	3	0	0	3	40	60	100
2	CSBS	PC	GR22A2089	Computer Organization and Architecture	3	0	0	3	3	0	0	3	40	60	100
3	CSBS	PC	GR22A2090	Object Oriented Programming	2	0	0	2	2	0	0	2	40	60	100
4	CSBS	PC	GR22A2091	Computational Statistics	3	0	0	3	3	0	0	3	40	60	100
5	CSBS	PC	GR22A2092	Fundamentals of Database Systems	3	0	0	3	3	0	0	3	40	60	100
6	CSBS	PC	GR22A2093	Computer Organization and Architecture Lab	0	0	2	2	0	0	4	4	40	60	100
7	CSBS	PC	GR22A2094	Object Oriented Programming Lab	0	0	2	2	0	0	4	4	40	60	100
8	CSBS	PC	GR22A2095	Computational Statistics Lab	0	0	1	1	0	0	2	2	40	60	100
9	CSBS	PC	GR22A2096	Databases Lab	0	0	1	1	0	0	2	2	40	60	100
		TOTAL			**14**	**0**	**6**	**20**	**14**	**0**	**12**	**26**	**360**	**540**	**900**
10	Mgmt	MC	GR22A2003	Constitution of India	0	0	0	0	2	0	0	2	40	60	100

II B. Tech – CSE (CSBS) - II Semester

S.No	BOS	Group	Course Code	Course Name	Credits				Hours				Int.	Ext	Total Marks
					L	T	P	Total	L	T	P	Total			
1	CSBS	PC	GR22A2097	Operating Systems Concepts	3	0	0	3	3	0	0	3	40	60	100
2	CSBS	PC	GR22A2098	Principles of Software Engineering	3	0	0	3	3	0	0	3	40	60	100
3	CSBS	PC	GR22A2099	Algorithm Design and Analysis	3	0	0	3	3	0	0	3	40	60	100
4	Mgmt	HS	GR22A2100	Introduction to innovation, IP management and Entrepreneurship	3	0	0	3	3	0	0	3	40	60	100
5	ME	PC	GR22A2101	Operational Research	2	0	0	2	2	0	0	2	40	60	100
6	CSBS	PC	GR22A2102	Operating Systems Concepts Lab	0	0	1	1	0	0	2	2	40	60	100
7	CSBS	PC	GR22A2103	Software Engineering Lab	0	0	1	1	0	0	2	2	40	60	100
8	CSBS	PC	GR22A2104	Algorithm Design and Analysis Lab	0	0	1	1	0	0	2	2	40	60	100
9	ME	PC	GR22A2105	Operational Research Lab	0	0	1	1	0	0	2	2	40	60	100
10	Mgmt	HS	GR22A2106	Design and Critical Thinking	3	0	0	3	3	0	0	3	40	60	100
		TOTAL			**17**	**0**	**4**	**21**	**17**	**0**	**8**	**25**	**400**	**600**	**1000**
11	Mgmt	MC	GR22A2107	Essence of Indian Traditional Knowledge	0	0	0	0	2	0	0	2	40	60	100
12	CSE	MC	GR22A2109	Real-time Research Project/ Societal Related Project	0	0	2	2	0	0	4	4	50	--	50

III B. Tech – CSE (CSBS) - I Semester

S. No	BOS	Group	Course Code	Course Name	Credits				Hours				Int.	Ext	Total Marks
					L	T	P	To Tal	L	T	P	Tot al			
1	CSBS	PC		Software Design with UML	2	0	0	2	2	0	0	2	40	60	100
2	CSBS	PC		Compiler Construction	3	0	0	3	3	0	0	3	40	60	100
3	Mgmt	HS		Fundamentals of Management	2	0	0	2	2	0	0	2	40	60	100
4	Mgmt	HS		Business Strategy	2	0	0	2	2	0	0	2	40	60	100
5	English	HS		Business Communication and Value Science – III	2	0	0	2	2	0	0	2	40	60	100
6	CSBS	PE		**Elective I**	2	1	0	3	2	1	0	3	40	60	100
7	CSBS	PC		Software Design with UML Lab	0	0	2	2	0	0	4	4	40	60	100
8	CSBS	PC		Compiler Construction Lab	0	0	2	2	0	0	4	4	40	60	100
9	CSBS	PC		Machine Learning with R Programming Lab	0	0	1	1	0	0	2	2	40	60	100
10	CSBS	PW		Mini Project	0	0	1	1	0	0	2	2	40	60	100
		TOTAL			**13**	**1**	**6**	**20**	**13**	**1**	**12**	**26**	**400**	**600**	**1000**
11	Mgmt	MC	GR22A2001	Environmental Science	0	0	0	0	2	0	0	2	40	60	100

ELECTIVE – I				
S. No.	**BOS**	**Group**	**Course Code**	**COURSE**
1	CSBS	PE		Conversational Systems
2	CSBS	PE		Cloud, Microservices and Application
3	CSBS	PE		Machine Learning with R Programming

III B. Tech – CSE (CSBS) - II Semester

S. No	BOS	Group	Course Code	Course Name	Credits				Hours				Int.	Ext	Total Marks
					L	T	P	To Tal	L	T	P	Tot al			
1	CSBS	PC		Computer Communications	3	0	0	3	3	0	0	3	40	60	100
2	CSBS	PC		Information Security	3	0	0	3	3	0	0	3	40	60	100
3	CSBS	PC		Fundamentals of Artificial Intelligence	3	0	0	3	3	0	0	3	40	60	100
4	Mgmt	HS		Financial and Cost Accounting	3	0	0	3	3	0	0	3	40	60	100
5	English	HS		Business Communication and Value Science – IV	3	0	0	3	4	0	0	4	40	60	100
6	CSBS	PE		**Elective II**	3	0	0	3	3	0	0	3	40	60	100
7	CSBS	PC		Computer Networks and Security Lab	0	0	1	1	0	0	2	2	40	60	100
8	CSBS	PC		Fundamentals of Artificial Intelligence Lab	0	0	1	1	0	0	2	2	40	60	100
9	CSBS	PC		Data Mining and Analytics Lab	0	0	1	1	0	0	2	2	40	60	100
		TOTAL			**18**	**0**	**3**	**21**	**19**	**0**	**6**	**25**	**360**	**540**	**900**
Industrial Project (6-8 weeks)															

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	CSBS	PE		Data Mining and Analytics

IV B. Tech – CSE (CSBS) - I Semester

S. No	BOS	Group	Course Code	Course Name	Credits				Hours				Int.	Ext	Total Marks
					L	T	P	Total	L	T	P	Total			
1	CSBS	PC		Usability Design of Software Applications	2	1	0	3	2	1	0	3	40	60	100
2	Mgmt	HS		Financial Management	3	0	0	3	3	0	0	3	40	60	100
3	Mgmt	HS		Human Resource Management	3	0	0	3	3	0	0	3	40	60	100
4	CSBS	PE		**Elective III**	2	1	0	3	2	1	0	3	40	60	100
5	CSBS	PE		**Elective IV**	2	1	0	3	2	1	0	3	40	60	100
6	CSBS	PC		Usability Design of Software Applications Lab	0	0	1	1	0	0	2	2	40	60	100
7	CSBS	PC		Mobile Computing Lab	0	0	1	1	0	0	2	2	40	60	100
8	CSBS	PW		Project Work Phase- I	0	0	6	6	0	0	12	12	40	60	100
		TOTAL			**12**	**3**	**8**	**23**	**12**	**3**	**16**	**31**	**320**	**480**	**800**

ELECTIVE – III				
S. No.	**BOS**	**Group**	**Course Code**	**COURSE**
1	CSBS	PE		Cognitive Science and Analytics
2	CSBS	PE		Introduction to IoT
3	CSBS	PE		Cryptology

ELECTIVE – IV				
S. No.	**BOS**	**Group**	**Course Code**	**COURSE**
1	CSBS	PE		Quantum Computation and Quantum Information
2	CSBS	PE		Advanced Social, Text and Media Analytics
3	CSBS	PE		Mobile Computing

IV B. Tech – CSE (CSBS) - II Semester

S. No	BOS	Group	Course Code	Course Name	Credits				Hours				Int.	Ext	Total Marks
					L	T	P	To Tal	L	T	P	Total			
1	Mgmt CSBS Mgmt	OE		**Open Elective -I**	3	0	0	3	3	0	0	3	40	60	100
2	Mgmt	PE		**Elective V**	3	0	0	3	3	0	0	3	40	60	100
3	Mgmt Mgmt CSBS	PE		**Elective VI**	3	0	0	3	3	0	0	3	40	60	100
4	CSBS	PW		Project Work Phase-II	0	0	6	6	0	0	12	12	40	60	100
				TOTAL	**9**	**0**	**6**	**15**	**9**	**0**	**12**	**21**	**160**	**240**	**400**

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

ELECTIVE – VI				
S. No.	**BOS**	**Group**	**Course Code**	**COURSE**
1	Mgmt	PE		Enterprise Systems
2	Mgmt	PE		Advance Finance
3	CSBS	PE		Image Processing and Pattern Recognition

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 ELECTIVES – 3 THREADS

S. No.	Theory and Algorithms	Applications	Data Science and Machine Intelligence
1	Conversational Systems	Cloud, Microservices and Application	Machine Learning with R Programming
2	Modern Day Robotics and its Industrial Applications	Modern Web Applications	Data Mining and Analytics
3	Cognitive Science and Analytics	Introduction to IoT	Cryptology
4	Quantum Computation and Quantum Information	Mobile Computing	Advanced Social, Text and Media Analytics
5	Behavioral Economics	Computational Finance & Modeling	Psychology
6	Enterprise Systems	Advance Finance	Image Processing and Pattern Recognition

OPEN ELECTIVE- THREADS

THREAD 1	THREAD 2	OFFERED BY
1. Soft Skills and Interpersonal Communication 2. Human Resource Development and Organizational Behavior 3. Cyber Law and Ethics 4. Economic Policiesin India	1.Data Science using R Programming 2. Data Analytics using Open Source Tools 3. Augmented Reality and Virtual Reality	**CSE**
	1. Internet of Things 2. Augmented Reality and Virtual Reality 3. Human Computer Interaction	**CSE (AIML)**
	1. Internet of Things 2. Augmented Reality and Virtual Reality 3. Human Computer Interaction	**CSE (DS)**
	1. Services Science and Service Operational Management 2. IT Project Management 3. Marketing Research and Marketing Management	**CSBS**
	1. Artificial Intelligence 2. Introduction to Data Science 3. Human Computer Interaction	**IT**
	1. Non-Conventional Energy Sources 2. Machine Learning 3. Artificial Intelligence Techniques	**EEE**
	1. Principles of Communication 2. Sensor Technology 3. Cellular and Mobile Communications	**ECE**
	1. Robotics 2. Composite Materials 3. Operations Research	**ME**
	1. Engineering Materials for Sustainability 2. Geographic Information Systems and Science 3. Environmental Impact Assessment and Life Cycle Analyses	**CE**

I YEAR
I SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DISCRETE MATHEMATICS FOR ENGINEERS

Code: GR22A1024 **L/T/P/C:3/1/0/4**
I Year I Semester

Course Objectives

1. Study the concepts of sets and relations to understand Group and Ring theory
2. Learn the theory of logic for testing validity of statements
3. Make use of Boolean expressions, operations and truth tables
4. Introducetheconcepts of graphs and trees in discrete optimization problems
5. Explain Graph theory to detect patterns in data sets

Course Outcomes

1. Relate characteristics of Sets, Groups, Rings and Fields
2. Apply propositional calculus to establish tautology, contradiction and contingency
3. Apply combinatorial mathemat ics in counting principles
4. Analyze the design of various combinational & sequential logic circuits using theconcepts 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 Prims 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 planer graph, independence number and clique number, chromatic number,statement of Four-color theorem.

Text Books

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: GR22A1025 **L/T/P/C : 3/0/0/3**
I Year I Semester

Pre-requisites: Combinatorics and Basic-calculus

Course Objectives

1. Interpret the significance of statistics as an analytical tool.
2. Interpret the measures of central tendency and dispersion.
3. Apply various probability distributions in various contexts.
4. Apply mean value theorems for function approximation.
5. Interpret the significance of multivariable calculus.

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. Basic objectives, Applications in various branches of science with examples; 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, Moment generating function.

UNIT-III

Probability Distributions

Discrete distributions: Binomial, Poisson and Geometric distribution.
Continuous distributions: Uniform, Exponential, Normal distributions.
Exact Sampling distributions: Chi-square, t and F distributions.

UNIT-IV

Differential Calculus

Limit of functions, continuity, derivatives. Taylor's and Maclaurin's series expansions, Partial derivatives, Maxima and minima of function of two variables.

UNIT-V

Integral Calculus

Length of a plane curve, Volume of solid of revolution, Area of surface of a solid of revolution (Cartesian form). Multiple Integrals- double integrals with constant and variable limits (Cartesian and polar 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.

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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: GR22A1026 **L/T/P/C: 3/0/0/3**
I Year I Semester

Course Pre-Requisites: Basic knowledge of mathematics.
Course Objectives:

1. To relate basics of programming language constructs and problem solving techniques.
2. To classify and implement control structures and derived data types.
3. To analyse and develop effective modular programming.
4. To construct mathematical problems and real time applications using C Language.
5. To learn the different interfaces in the operating system.

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 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 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: GR22A1027 **L/T/P/C: 2/0/0/2**
I Year I Semester

Course Objectives:

1. To understand the basic concepts of electrical circuits
2. To solve problems in DC & AC circuits
3. To provide foundation in theory and applications of Transformers and DC machines
4. To identify the types of sensors and measure quantities in AC and DC systems
5. To study various electrical installation components and safety measures

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 (人-Δ&人-人).

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

PHYSICS FOR COMPUTING SCIENCE

Course Code: GR22A1028 **L/T/P/C: 2/ 0/ 0/ 2**
I Year I Semester

Course Objectives:

1. Demonstrate competence and understanding of the concepts of Harmonic oscillations and waves.
2. Identify interaction of light with matter through interference, diffraction and polarization phenomena.
3. Examine basic concepts of electromagnetism and thermodynamics.
4. Recall the dualistic nature of radiation, basic concepts of crystallography and semiconductors.
5. Discuss the use of lasers as light sources in optical fiber applications.

Course Outcomes:

1. Solve for the solutions and describe the behavior of a damped harmonic oscillator.
2. Apply the principles of interference, diffraction and polarization of light in engineering applications.
3. Recall the importance of electromagnetism and laws of thermodynamics and their applications.
4. Outline the developments of quantum mechanics and identify the types of crystal and their properties.
5. Analyze the properties of Laser and its propagation in different types of optical fibers.

UNIT I

Oscillation: Periodic motion, Simple harmonic motion, Characteristics of simple harmonic motion, Vibration of simple spring mass system, Resonance definition, Damped harmonic oscillator: heavy, critical and light damping, Energy decay in a damped harmonic oscillator, Quality factor.

UNIT II

Interference: Principle of superposition, Young's experiment, Theory of interference fringes, Types of interference, Fresnel's prism, Newton's rings, Diffraction: Two kinds of diffraction, Differences between interference and diffraction, Fraunhofer diffraction at single slit, Temporal and spatial coherence.

Polarization of light: Polarization, Concept of production of polarized beam of light from two SHM acting at right angle, Plane, Elliptical and Circularly polarized light, Brewster's law, Double refraction.

UNIT III

Basic Idea of Electromagnetism: Continuity equation for current densities, Maxwell's equation in vacuum and non-conducting medium.

Thermodynamics: Zeroth law of thermodynamics, First law of thermodynamics, Brief discussion on application of 1st law, Second law of thermodynamics and concept of Engine, Entropy, Change in entropy in reversible and irreversible processes.

UNIT IV

Quantum Mechanics: Introduction, Planck's quantum theory, Matter waves, de-Broglie wavelength, Heisenberg's Uncertainty principle, Time independent Schrödinger's wave equation, Physical significance of wave function, Particle in a one-dimensional potential box.

Crystallography: Introduction, Types of crystal systems, Bravais lattices, Miller indices, Interplanar spacing, Atomic packing factor for SC, BCC and FCC.

Semiconductor Physics: Basic concept of Band theory: Bloch theorem, Kronig-Penny model and its conclusions, Differences between Conductors, Semiconductors and Insulators.

UNIT V

Laser and Fiber optics: Properties of laser beam: mono-chromaticity, coherence, directionality and brightness, Einstein's theory of matter radiation interaction and A and B coefficients, Amplification of light by population inversion, Different types of lasers: Ruby and CO_2, Applications of lasers, Fiber optics and applications, Types of optical fibers.

Teaching methodologies:

- White board and marker
- Power Point Presentations
- Video lectures

Text Books:

1. Concepts of Modern Physics, (Fifth Edition) A Beiser, McGraw Hill International.
2. Fundamentals of Physics, David Halliday, Robert Resnick and Jearl Walker, Wileyplus.

Reference Books:

1. Optics, (Fifth Edition) Ajoy Ghatak, Tata McGraw Hill.
2. Sears & Zemansky University Physics, Addison-Wesley.
3. Fundamentals of Optics, (Third Edition) Jenkins and White, McGraw-Hill.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

FUNDAMENTALS OF COMPUTER SCIENCE LAB

Course Code: GR22A1029 **L/T/P/C: 0/0/4/2**
I Year I Semester

Course Objectives:

1. To gain a working knowledge of C programming to write modular, efficient and readable C programs by Identifying the structural elements and layout of C source code.
2. To declare and manipulate single and multi-dimensional arrays of the C data types and derived data types like structures, unions.
3. To use functions from the portable C library and to describe the techniques for creating program modules using functions and recursive functions.
4. To manipulate character strings in C programs.
5. Utilize pointers to efficiently solve problems.

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 greatest and smallest among three numbers using 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.

Write a C program using switch statement to accomplish the above TASK.

c) 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 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 working of variable parameters to find 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 same.

TASK-8 (User defined header):

a) Write a c program to implement following pre-processor 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 in to 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: GR22A1030 **L/T/P/C :0/0/2/1**
I Year I Semester

Course Objectives:

1. To design electrical systems
2. To analyze a given network by applying various network theorems
3. To know the response of electrical circuits for different excitations.
4. To study various electrical measuring instruments and transducers
5. To summarize the performance characteristics of electrical machines

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 parameter.
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.

Text Books:

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.
2. Engineering Electromagnetics, William H. Hayt, Jr. John A. Buck, 8th Revised Edition, McGraw Hill Higher Education, 2011.
3. Fundamentals of Electrical and Electronics Engineering, SmarjithGhosh, Prentice Hall (India) Pvt. Ltd., 2010.
4. Basic Electrical Engineers, P. Ramana, M. Surya Kalavathi, G. T. Chandra Sekhar, S. Chand Technical Publications, 2018.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

PHYSICS FOR COMPUTING SCIENCE LAB

Course Code: GR22A1031 **L/T/P/C :0/0/2/1**
I Year I Semester

Course Objectives:

1. Identify the behavioral aspects of magnetic fields.
2. Demonstrate the quantum nature of radiation through photoelectric effect.
3. Recall the basic properties of light through hands on experience
4. Apply the theoretical concepts of Lasers and optical fibers in practical applications.
5. Infer the rigidity modulus and energy gap of a semiconductor.

Course Outcomes:

1. Analyze the behavior of magnetic fields with the help of graphs.
2. Calculate the Plank's constant through photoelectric effect.
3. Interpret the properties of light like interference and diffraction through experimentation.
4. Asses the characteristics of Lasers and infer the losses in optical fibers.
5. Compare the rigidity modulus of wires of different materials and infer the type of semiconductor material.

LIST OF EXPERIMENTS:

1. Magnetic field along the axis of current carrying coil – Stewart and Gee's apparatus.
2. Determination of Hall coefficient of semi-conductor.
3. Determination of Planck's constant.
4. Determination of wavelength of light by Laser diffraction method.
5. Determination of wavelength of light by Newton's Ring method.
6. Determination of laser parameters.
7. Determination of optical fiber parameters.
8. Determination of rigidity modulus of wire using Torsional pendulum.
9. Determination of energy gap of a semiconductor.
10. Determination of time constant of R-C circuit.

Note: Any 8 experiments are to be performed.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

BUSINESS COMMUNICATION AND VALUE SCIENCE – I

Course Code: GR22A1032 **L/T/P/C : 2/ 0/ 0/ 2**
I Year I Semester

COURSE PRE-REQUISITES:

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 Objectives

1. To understand what life skills are and their importance in leading a happy and well-adjusted life
2. To motivate students to look within and create a better version of self
3. To introduce them to keyconcepts of values, life skills and business communication
4. To enable them to practice basic communication
5. To improve written skills of the students

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, Team work
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.

Text Books:

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 andcomponents of the syllabus.
2. They also suggested to have flexible teaching methodologies.
3. The experts mentioned to have clarity regarding testing patterns and practicality ofexecuting 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 facultyand subject experts before finalizing the syllabus.

I YEAR
II SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

LINEAR ALGEBRA

Course Code: GR22A1033 **L/T/P/C: 3/1/0/4**
I Year II Semester

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

COURSE OBJECTIVES

1. Understand the purpose behind computation of rank, Gaussian elimination, inverse and generalized inverse of a matrix
2. Interpret vector spaces and subspaces and explore their properties
3. Utilize the concept of latent values of a matrix and explore various matrix factorization procedures
4. Discuss exact and approximate solutions of systems of linear algebraic equations
5. Learn the procedures of SVD and PCA and apply to some problems arising in engineering

COURSE OUTCOMES

1. Determine the inverse, generalized inverse and rank of a matrix.
2. Interpret vector spaces and subspaces and apply their properties.
3. Determine the eigenvalues and eigenvectors of a square matrix and perform matrix factorization
4. Solve a system of linear algebraic equations for an exact or approximate solutions
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

Determinant of a matrix- Rank of a matrix- Linear independence of vectors- Orthogonal projection of vectors

UNIT-II
VECTOR SPACES

Definition of a vector space- Subspace of a vector space- Linear Span, Basis and dimension of a vector space

Definition of the 4 fundamental sub-spaces (Column space Ax, Row space $A^T y$, null space $Ax=0$, null space $A^T y = 0$)- Linear transformation- Formal definitions of rank and nullity of a linear transformation

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- The Gram-Schmidt orthonormalization process-QR factorization.

UNIT-IV

SOLUTION OF A LINEAR ALGEBRAIC SYSTEM OF EQUATIONS

Solution of a homogeneous and non-homogeneous system of equations using Gaussian elimination Least squares approximation of an over determined system of equations using QR factorization and the generalized inverse

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

Course Code: GR22A1034 **L/T/P/C: 3/ 0/ 0/ 3**
I Year II Semester

Pre-requisites: Elementary statistics and Linear algebra

Course Objectives

1. Make use of sampling distribution techniques to establish results from small samples of a comparatively larger population
2. Understand statistical estimation theory
3. Understand parametric and non-parametric procedures to infer from large and small samples about the underlying population
4. Distinguish between explanatory and response variables and analyze data using correlation and regression
5. Employ tools for the analysis of time series data

Course Outcomes

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 (un-biasedness, 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: GR22A1035 **L/T/P/C : 2/ 1/ 0/ 3**
I B. Tech II Semester

Course Pre-Requisites: C Language
Course Objectives:

1. To impart the basic concepts of algorithm analysis.
2. To demonstrate operations of linear and non-linear data structures.
3. To develop an application using suitable data structure.
4. To compare and contrast various data structure performances.
5. To implement various searching and sorting techniques.

Course Outcomes:

1. To analyse 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 Tree.
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: Organisation Sequential, Direct, Indexed Sequential, Hashed and various types of accessing schemes (no implementation).

TEXT BOOKS:

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: GR22A1036 **L/T/P/C : 2/ 0/ 0/ 2**
I Year II Semester

Course Pre-Requisite: Fundamentals of Physics

Course Objectives:

1. To understand the principle of operation and characteristics of various semiconductor devices
2. To study the applications of various semiconductor devices
3. To compare the functionalities of various electronic devices
4. To understand the concepts of feedback in amplifiers
5. To know about analog and digital IC's

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

Feed Back 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 amplified 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.

TEXT BOOKS:

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

REFERENCES

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

FUNDAMENTALS OF ECONOMICS

Course Code: GR22A1037 **L/T/P/C : 2/ 0/ 0/ 2**
I Year II Semester

Course Objectives:

1. To provide a unifying theme of managerial decision making around the theory of firm by introducing tools such as demand and supply analysis
2. To analyse consumer behaviour w.r.t, select, buy, use and dispose goods, services and ideas based on the effects of price change, income change and substitutions
3. To get acquainted with various production theories, various costs and their role in cost minimization and various market structures such as perfect and imperfect competition
4. To gain knowledge on important elements of Nation's economic environment (National Income, National Product, Exports, Imports, Taxes, Subsidies, etc.)
5. To evaluate economic models describing the demand and supply of money and measure policies.

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

TEXT BOOKS:

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

STATISTICAL METHODS LAB

Course Code: GR22A1038 **L/T/P/C: 0/0/2/1**
I Year II Semester

Course Objectives:

1. Identify the structural elements and layout of R source code.
2. Apply tests of significance.
3. Forecast in cross sectional and Time Series Data.
4. Compute descriptive statistics.
5. Depict data through visualization.

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 contain 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: GR22A1039 **L/T/P/C : 0/ 0/ 4/ 2**
I Year II Semester

Course Objectives:

1. To read and make elementary modifications to programs that solves real-world problems.
2. To design and implement various linear and non-linear data structures.
3. To appropriately use a particular data structure and algorithm to solve a problem.
4. To implement searching and sorting techniques.
5. To use library functions, debug and run programs.

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 trouble shoot, 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)

TEXT BOOKS:

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: GR22A1040 **L/T/P/C : 0/ 0/ 2/ 1**
I Year II Semester

Course Objectives:

1. To know the characteristics of various semiconductor devices
2. To verify the functionality and applications of analog IC's
3. To verify the functionality of digital IC's
4. To Design various circuits based on the characteristics of the components
5. To verify the theoretical concepts through laboratory and simulation

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: GR22A1041 **L/T/P/C : 2/ 0/ 0/ 2**
I Year II Semester

Course Objectives:

1. To develop effective writing, reading, presentation and group discussion skills
2. To help students identify personality traits and evolve as a better teamplayer
3. To introduce them to key concepts of Morality, Beliefs and Behaviors and Diversity & Inclusion
4. To make students understand the concepts of Morality and Diversity practically
5. To acquaint students of various personal skills like interpersonal and intrapersonal skills

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 Power point – 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 team work 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: Team work, 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

TEXT BOOKS:

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: GR22A2088 **L/T/P/C: 3 /0/ 0/ 3**
II Year I Semester

Course Objectives:

1. Explain Regular Expressions and Finite Automata Conversions.
2. Understand Regular Grammars and properties
3. Explain Context Free Grammar Normal Forms and Push Down Automata.
4. Learn Turing machines models and types
5. Explain Computational theory and models.

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. Analyse 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 grammars (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.

TEXT BOOKS:

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 ARCHITECHTURE

Course Code: GR22A2089 **L/T/P/C : 3/ 0/ 0/3**
II Year I Semester

Course Objectives:

1. Analyze the functional blocks of a basic computer and understand the data representation, registers and Instruction sets.
2. Understand various CPU design formats and algorithms for arithmetic operations
3. Studythe different ways of memory design and standard I/O interfaces.
4. Understand the design aspects of parallel processing and pipeline hazards
5. Studythe hierarchical memory system including cache memory.

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 micro-programmed 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.

TEXT BOOKS:

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: GR22A2090 **L/T/P/C : 2/ 0/ 0/2**
II Year I Semester

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Prerequisites: A course on "Procedural programming".

Course Objectives:

1. Study the procedural programming language concepts through C.
2. Identify the specific Object Oriented approach in C++(Analyze)
3. Apply concepts of Data Abstraction Encapsulation , Access specifiers to realize Class concepts
4. Analyze how data can be shared through hierarchy and overloading of operators, overriding of methods/functions.
5. Create generic programs using templates, file handling and also develop design entities using UML.

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 object oriented methodology to generate different diagrams of UML design document.

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 typecasting 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

TEXT BOOKS:

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: GR22A2091 **L/T/P/C : 3/0/0/3**
II Year I Semester

Course Objectives:

1. Identify the problem of statistical inference, testing of hypothesis and interpret results.
2. Analyze the concepts of linear and multiple linear regression models.
3. Compare different types of plots such as residual plots, normal probability plots.
4. Illustrate multivariate normal distribution and principal components along with their applications.
5. Apply various kinds of regression and clustering models in real time problems.

Course Outcomes:

1. Correlate statistical inference methods for testing of hypothesis 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.

TEXT BOOKS:

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: GR22A2092 **L/T/P/C : 3/0/0/3**
II Year I Semester

Course Objectives:

1. Summarize the concepts of data modelling and architecture of DBMS
2. Construct the query statements with the available relational query languages
3. Paraphrase the importance of normalization and indexing techniques
4. Identify the mechanisms to perform concurrency control on transactions
5. Describe the authorization and authentication models for database security

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.

TEXT BOOKS:

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 ARCHITECHTURE LAB

Course Code: GR22A2093 **L/T/P/C: 0/0/4/2**
II Year I Semester

Course Objectives:
1. To gain a working knowledge on logic gates and combinational circuits
2. To perform operations on sequential circuits.
3. To gain knowledge on arithmetic operations using Machine language programming.
4. To understand how to access memory locations and ports using MLP.
5. To study the operations of various address modes.

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 port 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, De-multiplexer, 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 number to BCD number and vice versa.

TEXT BOOKS:

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: GR22A2094 **L/T/P/C:0/0/4/2**
II Year I Semester

Course Objectives:

1. Reproduce basics of pointer handling, parameter passing mechanisms and also the concepts of object oriented programming as function overloading, in program.
2. Demonstrate the concepts related to class implementation
3. Construct programs for stack queue linked list considering access specifications
4. Test the concepts of operator overloading and templates using suitable programs
5. Design UML diagrams of Class, Sequence and Activity diagrams for any class concept considered.

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 help of UML diagrams and OOPs concepts to solve real world problems.

TASK-1

1 a) Parameter passing: 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

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 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 class matrix of integers using vector, 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

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

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

c) Define class matrix of integers using vector, 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 compare 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 behavioural modelling through sequence diagram and activity diagram for workflow in a typical log-in, log-out situation.

TEXT BOOKS:

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: GR22A2095 **L/T/P/C: 0/0/2/1**
II Year I Semester

Course Objectives:

1. To gain a working knowledge of Python programming to write modular, efficient and readable programs
2. Understand the concepts of plotting graphs using Matplotlib package.
3. Know how to annotate the graphs and use patches in Matplotlib package
4. Understand the concepts of Multivariate regression , Multiple regression and Cluster Analysis
5. Know the application of PCA and LDA for dimensionality reduction.

Course Outcomes:

1. Develop programs using Python concepts such as Flow control, Functions, Files.
2. Demonstrate various types of graphs using 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 order.

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 "text" command add text to the axes of figures.
b) Using "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 centre 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.

Text Books:

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: GR22A2096 **L/T/P/C:0/0/2/1**
II Year I Semester

Course Objectives:

1. Develop the logical design of the database using data modeling concepts such as Relational model.
2. Infer the commands for retrieving the data.
3. Create a relational database using SQLite
4. Manipulate the data in the tables using SQL.
5. Render the Procedural concepts with SQL

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 database.
5. Use SQLite to connect to database from C programs.

LIST OF EXPERIMENTS:

TASK-1 (DDL and DML Commands):

a) Practice queries on DDL Commands
b) Practise 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 pair wise sub queries.
b) Practice the single row and multiple row sub queries.
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 sequence and synonym.

TASK-7(Indexes, Sequences and Synonyms):

a) Practice the creation of sequence and synonym.
b) Practice creation of function based indexes.
c) Create an index on 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 internet and implement various SQL commands.

TEXT BOOKS:

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

CONSTITUTION OF INDIA

Course Code: GR22A2003 **L/T/P/C: 2/0/0/0**
II Year I Semester

Course Objectives:

1. Create awareness about the Constitution of India, Fundamental Rights and Duties, Directive Principles.
2. Learn the role of Prime Minister, President and the Council of Ministers and the State Legislature.
3. Learn the divisions of executive, legislative and judiciary and so on.
4. Know how a municipal office, panchayat office etc. works.
5. Understand the importance and role of Election Commission Functions.

Course Outcomes:

1. Know the importance of Constitution and Government.
2. Become Good Citizens and know their fundamental rights, duties and principles.
3. Learn about the role of PM, President, Council of Ministers and Local Administration.
4. Understand the importance of Election Commission.
5. Know about Secularism, Federalism, Democracy, Liberty, Freedom of Expression, Special Status of States etc.

UNIT I

Introduction: 'Constitution' meaning of the term, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

UNIT II

Union Government and its Administration: Structure of the Indian Union: Federalism, Centre - State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha.

UNIT III

State Government and its Administration: Governor: Role and Position, CM and Council of ministers, State Secretariat: Organization, Structure and Functions.

UNIT IV

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Pachayati raj: Introduction, PRI: Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

UNIT V

Election Commission: Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.

TEXT/REFERENCE BOOKS:

1.'Indian Polity' by Laxmikanth 5th Edition, McGraw Hill Edition.

2.Indian Constitution by Subhash C. Kashyap, Vision Books Publisher

3.'Introduction to Indian Constitution' by D.D. Basu, 21st Edition, LexisNexis Publisher

4.'Indian Administration by avasthi and avasthi-by lakshminarain agarwal publication

II YEAR
II SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

OPERATING SYSTEMS CONCEPTS

Course Code: GR22A2097 **L/T/P/C: 3/0/0/3**
II Year II Semester

Course Objectives:

1. Understand main concepts of OS, Processes, and threads
2. To analyze the different CPU scheduling policies and Deadlock management strategies
3. Understand inter process communication and process synchronization
4. Understand memory management and virtual memory techniques
5. Appreciate the concepts of storage and file management

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 maximization of 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; Multi processor 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, Dinning 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.

TEXT BOOKS:

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

PRINCIPALS OF SOFTWARE ENGINEERING

Course Code: GR22A2098 **L/T/P/C : 3/0/0/3**
II Year II Semester

Course Objectives:

1. To gain knowledge of basic software engineering methods and practices, and their appropriate application.
2. To describe software engineering layered technology and Process frame work.
3. To identify software measurement and software risks.
4. To describe the approaches to verification and validation using static and dynamic testing.
5. To examine the good qualities of a software.

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 artefact 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.

TEXT BOOKS:

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: GR22A2099 **L/T/P/C :3/0/0/3**
II Year II Semester

Course Objectives:

1. To analyze the asymptotic performance of algorithms.
2. To differentiate various algorithm design strategies.
3. To solve problems using algorithmic design paradigms and analyze the complexities.
4. To demonstrate the tree traversal algorithms and find its complexities.
5. To understand the concepts NP-complete, NP-hard problems and Cook's theorem.

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 Algorithm. 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.

TEXT BOOKS:

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.
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: GR22A2100 **L/T/P/C: 2/ 0/ 0/ 2**
II Year II Semester

Course Objectives:

1. The major emphasis of the course will be on creating, enhancing the learning system through their innovation and creative thinking skills for effective business process.
2. Acquaint themselves with the special challenges of starting new ventures
3. Impart the entrepreneur skills in recognizing the new opportunities and styles required in maintaining competitive advantages
4. Provide the insights of financial aspects in planning and executing the market opportunities into a business plan
5. Emphasis on the role of IPR as an effective tool to protect their innovations and intangible assets from exploitation.

Course Outcomes:

1. Study and understand the 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 entrepreneurship 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 book will be given to students. Students are required to meet in groups before coming to class and prepare on the case for the day. Instructor 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. Instructor 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: GR22A2101 **L/T/P/C: 2/ 0/ 0/ 2**
II Year II Semester

Course Objectives

1. To understand familiarizes students to use quantitative methods and techniques for business planning and effective decisions making in the current business era.
2. To develop and find optimal solutions to transportation and assignment problems.
3. To understand the importance of network analysis and solve problems involved in planning, scheduling and controlling projects using PERT and CPM
4. To familiarize and realize the importance of network analysis and project management & scheduling techniques.
5. Being able to implement various inventory models, queuing, and simulation models in the real-world scenario.

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 develop 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.

Text Books:

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, Hand Book: 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

OPERATING SYSTEMS CONCEPTS LAB

Course Code: GR22A2102 **L/T/P/C : 0/0/2/1**
II Year II Semester

Course Objectives:

1. Learn basic commands and Shell programming in UNIX
2. Learn different types of CPU scheduling algorithms and demonstrate the usage of semaphores for solving synchronization problems.
3. Understand deadlock avoidance and management.
4. Understand memory management techniques and various page replacement policies.
5. Learn indexing and hashing

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 problem 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 – Writers 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

Text Books:

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: GR22A2103 **L/T/P/C: 0/0/2/1**
II Year II Semester

Course Objectives

1. To impart state-of-the-art knowledge on Software Engineering and UML.
2. Practice software engineering principles for real time problems.
3. Design various types of diagrams for real time problems.
4. Learn test case generation.
5. Demonstrate software engineering methodologies for various real time problems.

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 the 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 above applications.

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

TASK3
Design the data flow diagram for the above applications.

TASK4
Design the class diagrams for 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.

TEXT BOOKS:

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: GR22A2104 **L/T/P/C:** 0/ **0**/ **2/1**
II Year II Semester

Course Objectives:

1. Learn how to analyze a problem and design the solution for the problem.
2. Design and implement efficient algorithms for a specified application.
3. Strengthen the ability to identify and apply the suitable algorithm for the given realworld problem.
4. Design and implement various algorithms in C.
5. Employ various design strategies for problem solving.

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.

TEXT BOOKS:

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: GR22A2105 **L/T/P/C: 0 / 0/ 2 / 1**
II Year II Semester

Course Objectives

1. Formulate and solve the linear programming problem.
2. Recognize and formulate transportation &assignment problems.
3. Develop network diagrams with activities and events.
4. Apply the basic inventory model to inventory control situations.
5. Solve queuing problems using M/M/1 and M/M/m models and understand the basic techniques used in a simulation analysis.

Course Outcomes

1. Finding the solutions to liner 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 method.

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 of transportation problem.

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.

Text Books:
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, Hand Book: 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

DESIGN AND CRITICAL THINKING

Course Code : GR22A2106 **L/T/P/C: 3/0/0/3**
II Year II Semester

Course Objectives:

1. Recognize the importance of Design Thinking in engineering and business applications.
2. To understand the steps to create personas in the define phase of DT.
3. To familiarize the steps in the ideate phase of DT
4. Being able to understand the importance of the prototype phase in DT.
5. Recognize the importance of service value proposition.

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 define 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

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE (NON-CREDIT)

Course Code: GR22A2107 **L/T/P/C: 2/0/0/0**
II Year II Semester

Course Objective:

1. The course aims at imparting basic principles of thought process, reasoning, inferencing, and sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature.
2. Holistic lifestyle of Yogic-science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions.
3. The course focuses on introduction to Indian Knowledge System, Indian perspective of modern scientific worldview.
4. Provide basic principles of Yoga and holistic health care system.
5. Being able to instrument various approaches for the enhancement living ideals based on the Indian traditional knowledge.

Course Outcomes:

1. Impart knowledge in concepts and understand basic principles, thought process, reasoning and recognize 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 scientific worldview and basic principles 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 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 Farmer's 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/