Academic Regulations
Programme Structure
and
Detailed Syllabus

Master of Technology (M.Tech.)
in
Computer Science and Engineering

(Two Year Regular Programme)

(Applicable for Batches admitted from 2024)

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

(Autonomous)

Bachupally, Kukatpally, Hyderabad- 500 090

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY HYDERABAD

Academic Regulations for M.Tech. (Regular) under GR24

(Applicable for Batches Admitted from 2024-25)

Post Graduate Degree Programme in Engineering and Technology (PG)

Gokaraju Rangaraju Institute of Engineering & Technology (GRIET) offers a 2-year (4 Semesters) Master of Technology (M.Tech.) degree programme. The following programmes are offered in GRIET.

S.No	Department	Programme Code	Programme
1	Civil Engineering	20	M.Tech. Structural Engineering
2	Computer Science and Engineering	58	M.Tech. Computer Science and Engineering

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

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

2. **Admission:** Admission into the M.Tech. Programme in any discipline shall be made subject to the eligibility and qualifications prescribed by the University from time to time. Admissions shall be made either on the basis of the merit rank obtained by the student in GATE, PGCET conducted by the APSCHE for M.Tech. Programmes or on the basis of any other order of merit approved by the University, subject to reservations as prescribed by the Government 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) The total credits for the Programme are 68.
   d) 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).
   e) A student has a choice of registering for credits from the courses offered in the programme.
   f) All the registered credits will be considered for the calculation of final CGPA.
   g) Each Semester shall have 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)'. Choice Based Credit System (CBCS) and Credit Based Semester

System (CBSS) are taken as 'references' for the present set of Regulations. The terms 'SUBJECT' and 'COURSE' imply the same meaning here and refer to 'Theory Subject', or 'Lab Course', or 'Design/Drawing Subject', or 'Mini Project with Seminar', or 'Dissertation', as the case may be.

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

S. No.	Broad Course Classification	Course Group/ Category	Course Description
1	PC	Professional Core	Includes Core Courses related to the parent discipline/department/ branch of Engineering
2	PE	Professional Elective	Includes Elective Courses related to the parent discipline/ department/ branch of Engineering
3	OE	Open Elective	Elective Courses from other technical and/or emerging subjects
4	Audit	Audit Courses	Mandatory non creditable courses
5	PW	Project Work/Dissertation	Mini Project work, Dissertation Phase-I, II.

4. **Award of M.Tech. Degree:** A student will be declared eligible for the award of the M.Tech. Degree if he/she fulfills the following academic requirements:

   a) A student shall be declared eligible for the award of M.Tech. degree, if he/she pursues the course of study and completes it successfully in not less than two academic years and not more than four academic years.

   b) A Student, who fails to fulfill all the academic requirements for the award of the degree within four academic years from the date of admission, shall forfeit his/her seat in M.Tech. programme.

   c) The Degree of M.Tech. shall be conferred by Jawaharlal Nehru Technological University Hyderabad (JNTUH), Hyderabad, on the students who are admitted to the programme and fulfilled all the 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 each course concerned in the semester.

   b) Condonation of shortage of attendance 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 Academic Council.

d) Students whose attendance is less than 65% in any course are detained and are not eligible to take their end examination of that course. They may seek re-registration for that course when offered next with the academic regulations of the batch into which he/she gets re-registered.

e) A student shall put in a minimum required attendance in at least three theory subjects (excluding audit (non-credit course) in first Year I semester for promotion to first Year II Semester.

f) A student shall put in a minimum required attendance in at least three theory subjects (excluding audit (non-credit course) in first Year II semester for promotion to second Year I Semester.

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 of the College from time to time.

b) The following is the division of marks between internal and external evaluations.

S. No	Components	Internal Evaluation	External Evaluation	Total
1	Theory	40	60	100
2	Practical	40	60	100
3	Mini Project	100	--	100
4	Dissertation	50	50	100
5	Audit Courses	50	--	50

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 by conducting Assignments and Quiz exams at the end of each unit **i) Assignment – 5 marks** **ii) Quiz/Subject Viva-voce/PPT/Poster Presentation/ Case Study on a topic in the concerned subject – 5 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**

d) Project Review Committee: For approval and evaluating mini project, Dissertation-I and Dissertation-II, a Project Review Committee (PRC) will be constituted by the Head of the Department. The composition of PRC is as follows

i) Head of the Department

ii) One senior faculty relevant to the specialization

iii) Coordinator of the specialization.

e) Mini Project: The Mini Project is to be taken up with relevance to Industry and is evaluated for 100 marks. Student shall carryout the mini project in consultation with the mini project supervisor. The Project Review Committee (PRC) along with supervisor will review the progress of the mini project during the internal evaluation for 50 marks. Mini Project Viva Voce will be evaluated by the PRC for another 50 marks before the semester end examinations. The student must secure a minimum of 50% of marks in i) internal evaluation and ii) mini project viva voce, to be declared successful. If he fails to obtain the minimum marks, he/she must reappear for the same as and when scheduled.

Internal Evaluation: Tentative presentation dates and marks distribution of the mini project.

S.No	Date	Review	Marks
Internal Marks (50)			
1	First week of the semester	Abstract submission*	10
2	Fourth week of the semester	First Review	10
2	Mid of the semester	Second Review	10
3	Last week of the semester	Last Review	20

Following are the guidelines for the abstract submission

The faculty are requested to check the document submitted in the first review and should contain following:

1. Title of the project and Literature review.
2. Schematic/Block diagram which gives the broad idea of the entire project.
3. Timeline or milestone of the project. It should clearly indicate deliverables/outcomes of the project.
4. Components required with approximate cost.
5. References.
6. Plagiarism check is compulsory for mini project report as per the plagiarism policy of GRIET.

External Evaluation: (50 Marks) The mini project report is presented before PRC along with the supervisor.

Guidelines to award 50 marks:

S. No	Date	Review/ PRC report	Marks
External Evaluation Marks (50)			
1	Last week of the semester	Final Presentation and report Submission	10
2	Project report: Project report should be written as per IEEE guidelines.	Verified by PRC	10
3	Project Deliverables • Hardware prototype • Simulation in any authorized software • Submission of research articles in any Scopus Indexed conference /Journal	Verified by PRC	20
4	Results and Discussion	Verified by PRC	10

f) Dissertation (Phase I & Phase II): Every candidate shall be required to submit a dissertation on a topic approved by the Project Review Committee (PRC).

- The candidate must present in **Dissertation Work Review - I**, in consultation with his/her Dissertation Supervisor, the title, objective and plan of action of his/her Dissertation work to the PRC for approval ***within four weeks*** from the commencement of **Second year First Semester**. Only after obtaining the approval of the PRC can the student initiate the Dissertation work.
- If a candidate wishes to change his/her supervisor or topic of the Dissertation, he/she can do so with the approval of the PRC. However, the PRC shall examine whether or not the change of topic/supervisor leads to a major change of his/her initial plans of Dissertation proposal. If yes, his/her date of registration for the project work starts from the date of change of Supervisor or topic as the case may be.
- The candidate shall submit his/her Dissertation progress report in two stages at least with a gap of **three** months between them.
- The work on the Dissertation shall be initiated at the beginning of the II year and the duration of the Dissertation is two semesters. A candidate is permitted to submit Dissertation Thesis only after successful completion of all theory and practical courses with the approval of PRC ***not earlier than 40 weeks*** from the date of approval of the Dissertation work. For the approval of PRC, the candidate shall submit the draft copy of thesis to the Head of the Department and make an oral presentation before the PRC.

- **The Dissertation Work Review - II** in II Year I Semester carries 100 internal marks. Evaluation should be done by the PRC for 50 marks and the Supervisor will evaluate the work for the other 50 marks. The Supervisor and DRC will examine the Problem Definition, Objectives, Scope of Work, Literature Survey in the same domain and progress of the Dissertation Work. A candidate must secure a minimum of 50% of marks to be declared successful in Dissertation Work Review - II. If he/she fails to obtain the minimum required marks, he has to reappear for Dissertation Work Review - II as and when conducted.
- **The Dissertation Work Review - III** in II Year II Sem. carries 100 internal marks. Evaluation should be done by the PRC for 50 marks and the Supervisor will evaluate it for the other 50 marks. The PRC will examine the overall progress of the Dissertation Work and decide whether the Dissertation is eligible for final submission. A candidate must secure a minimum of 50% of marks to be declared successful in Dissertation Work Review - III. If he/she fails to obtain the required minimum marks, he/she must reappear for Dissertation Work Review - III as and when conducted. For Dissertation Evaluation (Viva Voce) in II Year II Semester there are external marks of 100 and it is evaluated by the external examiner. The candidate must secure a minimum of 50% marks in Dissertation Evaluation (Viva-Voce) examination.
- Dissertation Work Reviews - II and III shall be conducted in Phase I (Regular) and Phase II (Supplementary). Phase II will be conducted only for unsuccessful students in Phase I. The unsuccessful students in Dissertation Work Review - II (Phase II) shall reappear for it at the time of Dissertation Work Review - III (Phase I). These students shall reappear for Dissertation Work Review- III in the next academic year at the time of Dissertation Work Review - II only after completion of Dissertation Work Review - II, and then Dissertation Work Review - III follows. The unsuccessful students in Dissertation Work Review - III (Phase II) shall reappear for Dissertation Work Review – III in the next academic year only at the time of Dissertation Work Review - II (Phase I).
- A student shall present the progress of the dissertation through Dissertation Reviews II and III with at least a gap of three months between the reviews.
- After approval from the DRC, a soft copy of the thesis should be submitted for ANTI-PLAGIARISM Check from the approved agency with a similarity index not more than 24% and the plagiarism report and be included in the final thesis. If the similarity index has more than the required percentage, the student is advised to modify accordingly and resubmit the soft copy of the thesis after one month. The maximum number of re-submissions of thesis after plagiarism check is limited to ***TWO***. The candidate must register for the Dissertation work and work for two semesters. After three attempts, the admission is liable to be cancelled.
- Three copies of the Dissertation Thesis certified by the supervisor shall be submitted to the Institute, after submission of a research paper related to the Dissertation work in a SCOPUS/Web of Science/UGC approved journal. A copy of the submitted research paper shall be attached to thesis.
- The thesis shall be adjudicated by an external examiner selected by the University. For this, the Principal of the Institute shall submit a panel of **three** examiners from among the list of experts in the relevant specialization as submitted by the supervisor concerned and Head of the Department.
- If the report of the external examiner is unsatisfactory, the candidate shall revise and resubmit the Thesis. If the report of the examiner is unsatisfactory again, the thesis shall be summarily rejected. Subsequent actions for such dissertations may

be considered, only on the specific recommendations of the external examiner and /or Dissertation Review Committee. No further correspondence in this matter will be entertained if there is no specific recommendation for resubmission.

- If the report of the examiner is satisfactory, the Head of the Department shall coordinate and decide for the conduct of Dissertation Viva-Voce examination. The Dissertation Viva-Voce examination shall be conducted by a board consisting of the Supervisor, Head of the Department and the external examiner who adjudicated the Thesis. The candidate must secure a minimum of 50% of marks in Dissertation Evaluation (Viva-Voce) examination.
- If he/she fails to fulfill the requirements of minimum 50% of marks, he/she will reappear for the Dissertation Viva-Voce examination ***only after three months***. In the reappeared examination also, if he/she fails to fulfill the requirements, he/she will not be eligible for the award of the degree, unless he/she is asked to revise and resubmit his/her Dissertation Work by the board within a specified time period (within ***four*** years from the date of commencement of his/her first year first semester).

g) The evaluation of Audit Courses having ONLY CIE is as follows:

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

CIE is done for 50 marks as follows:

- There shall be two mid-term examinations during the semester conducted for 40 marks consisting of two parts with a total duration of 2 hours: Part A for 20 marks and Part B for 20 marks.
- Part A is an objective paper or a quiz and shall consist of multiple-choice questions, fill-in-the blanks, match the following, etc. for a total of 20 marks.
- Part B is a descriptive paper and shall contain 6 questions out of which, the student needs to answer 4 questions each carrying 5 marks.
- While the first mid-term examination shall be conducted for the first 50% syllabus, the second mid-term examination shall be conducted for the remaining 50% of the syllabus. The average of the two mid-term examinations shall be taken as final marks.
- Two assignments are evaluated for 5 marks each. The first assignment should be submitted before the conduct of the first mid-term examination, and the second assignment should be submitted before the conduct of the second mid-term examination. The assignments shall be given by the subject teachers. The average of the two assignments shall be taken as the final marks.
- The remaining 5 marks may be evaluated by conducting viva-voce in the subject or by evaluating the performance of the student in PPT/Poster/Case-Study presentation on a topic in the concerned subject before second mid-term examination**.**

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

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

10. **Supplementary Examinations:** A student who has failed in an end semester examination can appear for a supplementary examination, as per the schedule announced by the College/Institute.

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

12. **Academic Requirements:**

a) A student shall be deemed to have secured the minimum academic requirement in a subject if he / she secures a minimum of 40% of marks (i.e.,16 marks out of 40 marks) in CIE, 40% of marks (i.e.,24 marks out of 60 marks) in SEE and a minimum aggregate of 50%(i.e.,50 marks out of 100 marks) of the total marks in the Semester-end examination (SEE) and Internal Evaluation (CIE) taken together.

The student is eligible to write Semester End Examination of the concerned subject, if the student scores ≥ 40% (16 marks) of 40 Continuous Internal Examination (CIE) marks.

In case, the student appears for Semester End Examination (SEE) of the concerned subject but not scored minimum 40% of CIE marks (16 marks out of 40 internal marks), his performance in that subject in SEE shall stand cancelled inspite of appearing the SEE.

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

c) In order to qualify for the award of M.Tech. Degree, the student shall complete the academic requirements of passing in all the Courses as per the course structure including Seminars and Project if any.

d) In case a student does not secure the minimum academic requirement in any course, he/she has to reappear for the Semester-end Examination in the course, or re-register for the same course when next offered or re-register for any other specified course, as may be required. However, one more additional chance may be provided for each student, for improving the internal marks provided the internal marks secured by a student are less than 50% and he/she failed finally in the course concerned. In the event of taking another chance for re-registration, the internal marks obtained in the previous attempt are nullified. In case of re-registration, the student has to pay the re-registration fee for each course, as specified by the Dean Admissions of College.

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

Letter Grade	Grade Points	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 (Above Average)	6	Marks >= 50 and Marks < 60
F (Fail)	0	Marks < 50
Ab (Absent)	0	

Earning of Credit:

A student shall be considered to have completed a course successfully and earned the credits if he/she secures an acceptable letter grade in the range O-B. Letter grade 'F' in any Course implies failure of the student in that course and no credits 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 k^{th} semester (1 to 4) 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.,

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

Where $\mathbf{C_i}$ is the number of credits of the i^{th} course and $\mathbf{G_i}$ is the grade point scored by the student in the i^{th} 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 a student over all the semesters of a programme, i.e., upto and inclusive of $\mathbf{S_k}$, where $k \geq 2$.

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

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

13. **Award of Class:** After a student satisfies all the requirements prescribed for the completion of the Degree and becomes eligible for the award of M.Tech. Degree by JNTUH, he/she shall be placed in one of the following four classes:

S. No	Class Awarded	CGPA Secured
1	First Class with Distinction	CGPA ≥ 7.75
2	First Class	CGPA ≥ 6.75 and CGPA < 7.75
3	Second Class	CGPA ≥ 6.00 and CGPA < 6.75

Equivalence of grade to marks

Marks % = (CGPA -0.75)*100

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

15. **Re-Admission/Re-Registration (Re-Admission for Discontinued Student)**

- A student, who has discontinued the M. Tech. degree programme due to any reason whatsoever, may be considered for 'readmission' into the same degree programme (with the same specialization) with the academic regulations of the batch into which he gets readmitted, with prior permission from the authorities concerned.
- If a student is detained in a subject (s) due to shortage of attendance in any semester, he/she may be
  permitted to re-register for the same subject(s) in the same category (core or elective group) or equivalent subject, if the same subject is not available, as suggested by the Board of Studies of that department, as and when offered in the subsequent semester(s), with the academic regulations of the batch into which he/she seeks re-registration, with prior permission from the authorities concerned
- A candidate shall be given only one-time chance to re-register and attend the classes for a maximum of two subjects in a semester, if the internal marks secured by a candidate are less than 40% and failed in those subjects but fulfilled the attendance requirement. A candidate must re-register for failed subjects within four weeks of commencement of the class work, in the next academic year and secure the required minimum attendance. In the event of the student taking this chance, his Continuous Internal Evaluation (internal) marks and Semester End Examination marks obtained in the previous attempt stand cancelled.

16. **Transfer of students from the Constituent Colleges of JNTUH or from other Colleges/Universities:** Transfer of students from the Constituent Colleges of JNTUH or from other Colleges/Universities shall be considered only on case-to-case basis by the Academic Council of the Institute.

17. **Transitory Regulations:** Students who have discontinued or have been detained for want of attendance, or who have failed after having undergone the PG degree Programme, may be considered eligible for readmission to the same or equivalent subjects as and when they are offered.

18. **General Rules**

a) The academic regulations should be read as a whole for the purpose of any interpretation.

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

c) In case of any error in the above rules and regulations, the decision of the Academic Council is final.

d) The college may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the college.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

(Autonomous)

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COMPUTER SCIENCE AND ENGINEERING

M.Tech (C.S.E) GR24 Course Structure

I YEAR - I SEMESTER

S.No	Group	Course Code	Subject	L	T	P	Credits	Int. Marks	Ext. Marks	Total Marks
1	**PC**	GR24D5032	Mathematical Foundations for Computer Science Applications	3	0	0	3	40	60	100
2	**PC**	GR24D5026	Advanced Data Structures	3	0	0	3	40	60	100
3	**PE I**	GR24D5025	Data Analytics and Visualization	3	0	0	3	40	60	100
		GR24D5028	Full Stack Development							
		GR24D5029	Information Security							
4	**PE II**	GR24D5030	Computer System Design	3	0	0	3	40	60	100
		GR24D5031	Quantum Computing							
		GR24D5037	Artificial Intelligence and Neural Networks							
5	**PC**	GR24D5034	Advanced Data Structures Lab	0	0	4	2	40	60	100
6	**PE**	GR24D5033	Data Analytics and Visualization Lab	0	0	4	2	40	60	100
		GR24D5043	Full Stack Development Lab							
		GR24D5045	Information Security Lab							
7	**PC**	GR24D5011	Research Methodology and IPR	2	0	0	2	40	60	100
Total				**14**	**0**	**8**	**18**	**280**	**420**	**700**
8	**AC**		Audit course -I	2	0	0	0	50	--	50

I YEAR - II SEMESTER

Sl. No	Group	Course Code	Subject	L	T	P	Credits	Int. Marks	Ext. Marks	Total Marks
1	**PC**	GR24D5036	Advanced Algorithms	3	0	0	3	40	60	100
2	**PC**	GR24D5027	Deep Learning	3	0	0	3	40	60	100
3	**PE III**	GR24D5035	Augmented Reality and Virtual Reality	3	0	0	3	40	60	100
		GR24D5038	Cyber Security							
		GR24D5039	Natural Language Processing							
4	**PE IV**	GR24D5040	Cloud Computing and Applications	3	0	0	3	40	60	100
		GR24D5041	Blockchain Technology							
		GR24D5042	Robotic Process Automation							
5	**PC**	GR24D5044	Advanced Algorithms lab	0	0	4	2	40	60	100
6	**PC**	GR24D5061	Deep Learning Lab	0	0	4	2	40	60	100
7	**PC**	GR24D5048	Mini Project	0	0	2	2	40	60	100
Total				**12**	**0**	**10**	**18**	**280**	**420**	**700**
8	**AC**		Audit course –II	2	0	0	0	50	--	50

II YEAR - I SEMESTER

Sl. No	Group	Course Code	Subject	L	T	P	Credits	Int. Marks	Ext. Marks	Total Marks
1	**PE V**	GR24D5062	Information Storage and Retrieval	3	0	0	3	40	60	100
		GR24D5046	Digital Forensics							
		GR24D5047	High Performance Computing							
2	**OE**	GR24D5052	Advanced Computer Networks	3	0	0	3	40	60	100
		GR24D5051	Cost Management of Engineering Projects							
3	**PW**	GR24D5049	Dissertation Phase – I	0	0	20	10	40	60	100
Total				**6**	**0**	**20**	**16**	**120**	**180**	**300**

II YEAR - II SEMESTER

Sl. No	Group	Course Code	Subject	Hours			Credits	Int. Marks	Ext. Marks	Total Marks
				L	T	P				
1	**PW**	GR24D5050	Dissertation Phase – II	0	0	32	16	40	60	100
Total				**0**	**0**	**32**	**16**	**40**	**60**	**100**

Audit Courses I & II

1	GR24D5053	English for Research Paper Writing
2	GR24D5054	Disaster Management
3	GR24D5055	Sanskrit for Technical Knowledge
4	GR24D5056	Value Education
5	GR24D5057	Indian Constitution
6	GR24D5058	Pedagogy Studies
7	GR24D5059	Stress Management by Yoga
8	GR24D5060	Personality Development through Life Enlightenment Skills

I YEAR

I SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
MATHEMATICAL FOUNDATIONS FOR COMPUTER SCIENCE APPLICATIONS

Course Code: GR24D5032 **L/T/P/C:3/0/0/3**

I YEAR I SEMESTER

Course Outcomes:

1. Demonstrate the basic notions of distribution functions, discrete and continuous probability.
2. Formulate the methods of statistical inference and the role that sampling distributions play in those methods.
3. Perform correct and meaningful statistical analysis of simple to moderate complexity.
4. Solve mathematical as well as graphical problems in systematic and logical manner and also familiarity in calculating number of possible outcomes of elementary combinatorial processes such as permutations and combinations.
5. Apply discrete structures in computer science for various engineering applications.

UNIT I

Probability mass, density, and cumulative distribution functions, parametric families of distributions, Expected value, variance, conditional expectation, Applications of the univariate and multivariate Central Limit Theorem, Probabilistic inequalities, Markov chains

UNIT II

Random samples, sampling distributions of estimators**,** Methods of Moments and Maximum Likelihood

UNIT III

Statistical inference, Introduction to multivariate statistical models: regression and classification problems, principal components analysis**,** The problem of overfitting model assessment.

UNIT IV

Graph Theory: Isomorphism, Planar graphs, graph Coloring, Euler cycles and Hamilton circuits Permutations and Combinations with and without repetition. Specialized techniques to solve combinatorial enumeration problems

UNIT V

Computer science and engineering applications: Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning. Recent Trends in various distribution functions in mathematical field of computer science for varying fields like bioinformatics, soft computing, and computer vision.

TEXT BOOKS:

1. John Vince, Foundation Mathematics for Computer Science, Springer.
2. K. Trivedi. Probability and Statistics with Reliability, Queuing, and Computer Science Applications. Wiley.

REFERENCE BOOKS:

1. M. Mitzenmacher and E. Upfal.Probability and Computing: Randomized Algorithms and Probabilistic Analysis.
2. Alan Tucker, Applied Combinatorics, Wiley

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ADVANCED DATA STRUCTURES

Course Code: GR24D5026 **L/T/P/C:3/0/0/3**

I YEAR I SEMESTER

Course Outcomes:

1. Demonstrate the implementation of the symbol table using hashing techniques.
2. Develop and analyze algorithms for red-black trees, B-trees and Splay trees.
3. Design algorithms for text processing applications.
4. Illustrate data structures and develop algorithms for computational geometry problems.
5. Compare and contrast various computational geometry methods for efficiently solving new evolving problems.

UNIT I

Dictionaries: Definition, Dictionary Abstract Data Type, Implementation of Dictionaries. Hashing: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing

UNIT II

Skip Lists: Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists.

UNIT III

Trees: Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay Trees.

UNIT IV

Text Processing: Sting Operations, Brute- Force Pattern Matching, The Knuth-Morris-Pratt Algorithm, Boyer Moore, Standard Tries, Compressed Tries, Suffix Tries, The Huffman Coding Algorithm, The Longest Common Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem.

UNIT V

Computational Geometry: One Dimensional Range Searching, Two Dimensional Range Searching, Constructing a Priority Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quad trees, k-D Trees. Recent Trends in Hashing, Trees, and various computational geometry methods for efficiently solving the new evolving problem.

TEXT BOOKS:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 2nd Edition, Pearson, 2004

2. M T Goodrich, Roberto Tamassia, Algorithm Design, John Wiley, 2002.

REFERENCE BOOKS:

1. Data Structures with C, Seymour Lipschutz, TMH.
2. Classic Data Structures, 2/e, Debasis, Samanta, PHI, 2009.
3. Michael T. Goodrich & Roberto Tamassia, Algorithm Design, Wiley Singapore Edition, 2002.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
DATA ANALYTICS AND VISUALIZATION
(PROFESSIONAL ELECTIVE-I)

Course Code: GR24D5025 **L/T/P/C: 3/0/0/3**

I YEAR I SEMESTER

Course Outcomes:

1. Illustrate R programming for data analytics.
2. Interpret Summary Statistics by connecting R to NoSQL databases.
3. Demonstrate Regression analysis and correlation.
4. Compare various Verticals - Engineering, Financial and others.
5. Summarize the recent trends in visualization techniques and their applications for real world problems.

UNIT I

Introduction to Analytics and R programming

Introduction to R, RStudio (GUI): R Windows Environment, introduction to various data types, Numeric, Character, date, data frame, array, matrix etc., Reading Datasets, Working with different file types .txt, .csv etc. Outliers, Combining Datasets, R Functions and loops.

UNIT II

SQL using R and Statistics

Introduction to NoSQL, Connecting R to NoSQL databases. Excel and R integration with R connector.

Summary Statistics - Summarizing data with R, Probability, Expected, Random, Bivariate Random variables, Probability distribution. Central Limit Theorem etc.

UNIT III

Regression Analysis and Correlation

Assumptions of OLS Regression, Regression Modelling. Correlation, ANOVA, Forecasting, Heteroscedasticity, Autocorrelation, Introduction to Multiple Regression etc.

UNIT IV

Introduction to Visualization

Visualization process, visual representation of data, Gestalt principles, information overloads. Creating visual representations, visualization reference model, visual mapping, visual analytics, Design of visualization applications.

UNIT V

Introduction to Tableau

Tableau Architecture, Tableau Server Architecture VizQL, introduction to Tableau Prep, Tableau Prep Builder User Interface, Data Preparation techniques using Tableau Prep Builder tool, Features of Tableau Desktop Connect to data from File and Database, Types of Connections, Joins and Unions, Data Blending, Tableau Desktop User Interface.

TEXT BOOKS:

1. Student's Handbook for Associate Analytics.
2. A First Course in Statistical Programming with R, Braun W. J., Murdoch D. J.. — Cambridge University Press, 2007
3. Joshua N. Milligan, Learning Tableau 2019 Tools for Business Intelligence, data prep and visual analytics Third Edition.

REFERENCE BOOKS:

1. Data Manipulation with R, Jaynal Abedin and Kishore Kumar Das, Second Edition, Packt publishing, BIRMINGHAM – MUMBAI.
2. Beginning R The Statistical Programming language- Mark Gardener, John Wiley & Sons, Inc., 2012
3. Introduction to Probability and Statistics Using R, ISBN: 978-0-557-24979-4, is a textbook written for an undergraduate course in probability and statistics.
4. Andy Kirk, Data Visualization – A hand book for data driven design, Sage publications 2016.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

FULL STACK DEVELOPMENT

(PROFESSIONAL ELECTIVE-I)

Course Code: GR24D5028 **L/T/P/C:3/0/0/3**

I YEAR I SEMESTER

Course Outcomes:

1. Illustrate Full stack components for developing web application.
2. Apply packages of NodeJS to work with Data, Files, Http Requests and Responses.
3. Use MongoDB data base for storing and processing huge data and connects with NodeJS application.
4. Design faster and effective single page applications using Express and Angular.
5. Create interactive user interfaces with react components.

UNIT- I

Introduction to Full Stack Development:

Understanding the Basic Web Development Framework- User, Browser, Webserver, Backend Services, Full Stack Components - Node.js, MongoDB, Express, React, Angular. Java Script Fundamentals, NodeJS- Understanding Node.js, Installing Node.js, Working with Node Packages, creating a Node.js Application, Understanding the Node.js Event Model, Adding Work to the Event Queue, Implementing Callbacks.

UNIT- II

Node.js:

Working with JSON, Using the Buffer Module to Buffer Data, Using the Stream Module to Stream Data, Accessing the File System from Node.js- Opening, Closing, Writing, Reading Files and other File System Tasks. Implementing HTTP Services in Node.js- Processing URLs, Processing Query Strings and Form Parameters, Understanding Request, Response, and Server Objects, Implementing HTTP Clients and Servers in Node.js, Implementing HTTPS Servers and Clients. Using Additional Node.js Modules-Using the os Module, Using the util Module, Using the dns Module, Using the crypto Module.

UNIT -III

MongoDB:

Need of NoSQL, Understanding MongoDB, MongoDB Data Types, Planning Your Data Model, Building the MongoDB Environment, Administering User Accounts, Configuring Access Control, Administering Databases, Managing Collections, Adding the MongoDB Driver to Node.js, Connecting to MongoDB from Node.js, Understanding the Objects Used in the MongoDB Node.js Driver, Accessing and Manipulating Databases, Accessing and Manipulating Collections.

UNIT - IV

The Express and Angular:

Getting Started with Express, Configuring Routes, Using Requests Objects, Using Response Objects. Angular: importance of Angular, Understanding Angular, creating a Basic Angular

Application, Angular Components, Expressions, Data Binding, Built-in Directives, Custom Directives, Implementing Angular Services in Web Applications.

UNIT – V

React:

Need of React, Simple React Structure, The Virtual DOM, React Components, Introducing React Components, Creating Components in React, Data and Data Flow in React, Rendering and Life Cycle Methods in React, Working with forms in React, integrating third party libraries, Routing in React.

Text Books:

1. Brad Dayley, Brendan Dayley, Caleb Dayley., Node.js, MongoDB and Angular Web Development, 2nd Edition, Addison-Wesley, 2019.
2. Mark Tielens Thomas, React in Action, 1st Edition, Manning Publications.

Reference Books:

1. Vasan Subramanian, Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node, 2nd Edition, Apress, 2019.
2. Chris Northwood, The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer', 1st edition, Apress, 2018.
3. Kirupa Chinnathambi, Learning React: A Hands-On Guide to Building Web Applications Using React and Redux, 2nd edition, Addison-Wesley Professional, 2018.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
INFORMATION SECURITY
(PROFESSIONAL ELECTIVE-I)

Course Code: GR24D5029 **L/T/P/C: 3/0/0/3**

I YEAR I SEMESTER

Course Outcomes:

1. Analyze information security governance, and related issues.
2. Illustrate various cryptography algorithms.
3. Apply authentication mechanisms and Hash functions to provide secure data exchange.
4. Access network security design using available secure solutions (such as PGP, S/MIME and IPSec).
5. Infer advanced security issues and technologies.

UNIT I

Attacks on Computers and Computer Security: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security Cryptography: Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, stenography, key range and key size, possible types of attacks.

UNIT II

Symmetric key Ciphers: Block Cipher principles & Algorithms(DES, AES,Blowfish), Differential and Linear Cryptanalysis, Block cipher modes of operation, Stream ciphers, RC4,Location and placement of encryption function, Key distribution, Asymmetric key Ciphers: Principles of public key cryptosystems Algorithms(RSA, Diffie-Hellman,ECC), Key Distribution

UNIT III

Message Authentication Algorithms and Hash Functions: Authentication requirements, Functions, Message authentication codes, Hash Functions, Secure hash algorithm, Whirlpool, HMAC, CMAC, Digital signatures, knapsack algorithm Authentication Applications: Kerberos, X.509 Authentication Service, Public — Key Infrastructure, Biometric Authentication

UNIT IV

E-Mail Security: Pretty Good Privacy, S/MIME IP Security: IP Security overview, IP Security architecture, Authentication Header, Encapsulating security payload, Combining security associations, key management.

UNIT V

Web Security: Web security considerations, Secure Socket Layer and Transport Layer Security, Secure electronic transaction Intruders, Virus and Firewalls: Intruders, Intrusion detection,

password management, Virus and related threats, Countermeasures, Firewall design principles, Types of firewalls Case Studies on Cryptography and security: Secure Inter-branch Payment Transactions, Cross site Scripting Vulnerability, Virtual Elections

TEXT BOOKS:

1. Cryptography and Network Security: William Stallings, Pearson Education, 4t" Edition.
2. Cryptography and Network Security: AtulKahate, McGraw Hill, 2nd Edition
3. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1' Edition.

REFERENCE BOOKS:

1. Cryptography and Network Security: ForouzanMukhopadhyay, McGraw Hill, 2 Edition.
2. Information Security, Principles and Practice: Mark Stamp, Wiley India.
3. Principles of Computer Security: WM.Arthur Conklin, Greg White, TMH.
4. Introduction to Network Security: Neal Krawetz, CENGAGE Learning.
5. Network Security and Cryptography: Bernard Menezes, CENGAGE Learning.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

COMPUTER SYSTEM DESIGN

(PROFESSIONAL ELECTIVE-II)

Course Code: GR24D5030 **L/T/P/C: 3/0/0/3**

I YEAR I SEMESTER

Course Outcomes:

1. Demonstrate IA-32 Pentium processor architecture and Computer I/O operations.
2. Compare hardwired control and micro programmed control in the processing unit.
3. Illustrate the management of different type of memories in the computer system.
4. Determine the reasons for deadlocks and understand the different types of IPC mechanisms.
5. Compare and analyze different file systems being used in different operating systems.

UNIT I

Computer structure: Hardware, software, system software, Von-Neumann architecture – case study. IA -32 Pentium: registers and addressing, instructions, assembly language, program flow control, logic and shift/rotate instructions, multiply, divide MMX, SIMD instructions, I/O operations, subroutines. Input/output organization, interrupts, DMA, Buses, Interface circuits, I/O interfaces, device drivers in windows, interrupt handlers.

UNIT II

Processing Unit: Execution of a complete instruction, multiple bus organization, hardwired control, micro programmed control. Pipelining: data hazards, instruction hazards, influence on instruction sets, data path & control consideration, and RISC architecture introduction.

UNIT III

Memory: Types and hierarchy, Model level organization, Cache memory, Performance considerations, Mapping, Virtual memory, Swapping, Paging, Segmentation, Replacement policies

UNIT IV

Processes and Threads: Processes, Threads, Inter process communication, Classical IPC problems, Deadlocks.

UNIT V

File system: Files, directories, Implementation, UNIX file system Security: Threats, intruders, accident data loss, basics of cryptography, user authentication.

TEXT BOOKS:

1. Computer Organization – Car Hamacher, ZvonksVranesic, SafeaZaky, Vth Edition, McGraw Hill.
2. Modern Operating Systems, Andrew S Tanenbaum 2nd edition Pearson/PHI

REFERENCE BOOKS:

1. Computer Organization and Architecture – William Stallings Sixth Edition, Pearson/PHI
2. Morris Mano -Computer System Architecture –3rd Edition-Pearson Education.
3. Operating System Principles- Abraham Silberchatz, Peter B. Galvin, Greg Gagne 7th Edition, John Wiley

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

QUANTUM COMPUTING

(PROFESSIONAL ELECTIVE-II)

Course Code: GR24D5031 **L/T/P/C: 3/0/0/3**

I YEAR I SEMESTER

Course Outcomes:

1. Interpret the basics of Linear Algebra.
2. Apply basic physics for Quantum Computing.
3. Illustrate the core principles of Quantum Architecture.
4. Design Quantum algorithms and their implementation.
5. Demonstrate the Impact of Quantum Computing on Cryptography.

UNIT I

Introduction to Essential Linear Algebra: Some Basic Algebra, Matrix Math, Vectors and Vector Spaces, Set Theory. Complex Numbers: Definition of Complex Numbers, Algebra of Complex Numbers, Complex Numbers Graphically, Vector Representations of Complex Numbers, Pauli Matrice, Transcendental Numbers.

UNIT - II

Basic Physics for Quantum Computing: The Journey to Quantum, Quantum Physics Essentials, Basic Atomic Structure, Hilbert Spaces, Uncertainty, Quantum States, Entanglement Basic Quantum Theory: Further with Quantum Mechanics, Quantum Decoherence, Quantum Electrodynamics, Quantum Chromodynamics, Feynman Diagram Quantum Entanglement and QKD, Quantum Entanglement, Interpretation, QKE.

UNIT - III

Quantum Architecture: Further with Qubits, Quantum Gates, More with Gates, Quantum Circuits, The D-Wave Quantum Architecture. Quantum Hardware: Qubits, How Many Qubits Are Needed? Addressing Decoherence, Topological Quantum Computing, Quantum Essentials.

UNIT - IV

Quantum Algorithms: What Is an Algorithm? Deutsch's Algorithm, Deutsch-Jozsa Algorithm, Bernstein-Vazirani Algorithm, Simon's Algorithm, Shor's Algorithm, Grover's Algorithm.

UNIT - V

Current Asymmetric Algorithms: RSA, Diffie-Hellman, Elliptic Curve The Impact of Quantum Computing on Cryptography: Asymmetric Cryptography, Specific Algorithms, Specific Applications

TEXT BOOKS:

1. Nielsen M. A., Quantum Computation and Quantum Information, Cambridge University Press
2. Dr. Chuck Easttom, Quantum Computing Fundamentals, Pearson

REFERENCE BOOKS:

1. Quantum Computing for Computer Scientists by Noson S. Yanofsky and Mirco A. Mannucci

2. Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol. Basic Concepts, Vol
3. Basic Tools and Special Topics, World Scientific. Pittenger A. O., An Introduction to Quantum Computing Algorithms

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ARTIFICIAL INTELLIGENCE AND NEURAL NETWORKS
(PROFESSIONAL ELECTIVE-II)

Course Code: GR24D5037 **L/T/P/C: 3/0/0/3**

I YEAR I SEMESTER

Course Outcomes:

1. Analyze and differentiate various searching approaches in game playing sand other applications.
2. Illustrate the different methods of AI learning.
3. Model the basic architecture of ANN and explore different learning processes of Artificial Neural Network.
4. Appreciate Single and multi-layer perceptron concepts.
5. Apply the typical NN architectures to various applications.

UNIT I

AI Introduction: AI problems, foundation of AI and history of AI intelligent agents, Agents and Environments. Uninformed search strategies: Breadth first search, depth first Search. Informed search strategies: Greedy best first search, A* search. Game Playing: minimax algorithm, optimal decisions in multiplayer games, Alpha-Beta pruning.

UNIT II

Learning: Learning from Observations: Forms of Learning, inductive learning, Learning decision trees, Ensemble learning. Statistical Learning Methods: Statistical learning, learning with complete data, learning with hidden variables, instance-based learning. Reinforcement learning: Active and passive reinforcement learning

UNIT III

NN introduction: Biological Neuron, Artificial Neural Model, Types of activation functions, Architecture of Feedforward and Feedback NN. Learning Process: Error Correction Learning, Memory Based Learning, Hebbian Learning, Competitive Learning, Boltzmann Learning, Supervised and Unsupervised Learning.

UNIT IV

Single and Multi-Layer Perceptron: Single layer Perceptron: Learning Algorithm, Perceptron Convergence Theorem. Least Mean Square Learning Algorithm. Multilayer Perceptron: Back Propagation Algorithm, feature detection, Cross validation, Limitations of Back Propagation Algorithm, Convolutional networks.

UNIT V

ARCHITECTURES of ANN: Pattern Association, Pattern Classification, Pattern Mapping, Pattern Storage, Pattern clustering, Direct Applications, Application Areas.
CONVERSATIONAL AI

TEXT BOOKS:

1. Artificial Intelligence – A Modern Approach. Second Edition, Stuart Russel, Peter Norvig, PHI/ Pearson Education.
2. Neural Networks - A Comprehensive Foundation - Simon Haykin PHI, 2nd edition
3. Artificial Neural Networks B. YagnaNarayana, PHI

REFERENCE BOOKS:

1. Artificial Intelligence, 2nd Edition, E. Rich and K. Knight (TMH).
2. Artificial Intelligence and Expert Systems – Patterson PHI.
3. Artificial Intelligence, 3rd Edition, Patrick Henry Winston., Pearson Edition.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ADVANCED DATA STRUCTURES LAB

Course Code: GR24D5034 **L/T/P/C: 0/0/4/2**

I YEAR I SEMESTER

Course Outcomes:

1. Choose appropriate data structure as applied to specified problem definition.
2. Illustrate operations like searching, insertion, deletion, traversing mechanism etc. on various data structures.
3. Compare linear and non-linear data structures like stacks, queues , linked lists etc.
4. Implement various searching and sorting algorithms.
5. Apply the various data structures in real time applications.

TASK 1: Develop a Java program that prompts the user for an integer and then prints out all prime numbers up to that integer

TASK 2: Develop a Java program to implements List ADT using arrays

TASK 3: Develop a Java program to implements List ADT using linked lists

TASK 4: Develop a java program that reads an infix expression, converts the expression to postfix form and then evaluates the postfix expression.

TASK 5: Develop a Java program to implement the deque (double ended queue) ADT using Arrays

TASK 6: Develop a Java program to implement the deque (double ended queue) ADT Doubly linked list.

TASK 7: Develop a Java program to perform the following operations:

- Insert an element into a binary search tree.
- Delete an element from a binary search tree.
- Search for a key element in a binary search tree

TASK 8: Develop a Java program to perform the following operations

- Insertion into an AVL-tree
- Deletion from an AVL-tree

TASK 9: Develop a Java program to implement all the functions of a dictionary (ADT) using Hashing

TASK 10: Develop a Java program to implement Graph coloring

TASK 11: Develop a Java program to implement the pattern matching algorithms

- Brute Force approach
- Knuth Morris Pratt

TASK 12: Develop a Java program to implement Huffman coding algorithm

TEXT BOOKS:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 2nd Edition, Pearson, 2004.
2. M T Goodrich, Roberto Tamassia, Algorithm Design, John Wiley, 2002.

REFERENCE BOOKS:

1. Data Structures with C, Seymour Lipschutz, TMH.
2. Classic Data Structures, 2/e, Debasis, Samanta, PHI, 2009.
3. Michael T. Goodrich & Roberto Tamassia, Algorithm Design, Wiley Singapore Edition, 2002.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DATA ANALYTICS AND VISUALIZATION LAB
(PROFESSIONAL ELECTIVE-I LAB)

Course Code: GR24D5033 **L/T/P/C: 0/0/4/2**

I YEAR I SEMESTER

Course Outcomes:

1. Demonstrate proficiency with statistical analysis of data.
2. Apply data modeling techniques to large data sets.
3. Design applications for data analytics using R programming.
4. Apply data visualization tools proficiently to present data insights.
5. Create and interpret effective data visualizations.

TASK 1. Load data sets into the R statistical package and perform summary statistics on the data.

TASK 2. Plot the data using R using lattice and ggplot.

TASK 3. Load the data from an excel sheet and remove outliers from the data.

TASK 4. Test a hypothesis about the data using R studio.

TASK 5. Use the R -Studio environment to code OLS models and review the methodology to validate the model and predict the dependent variable for a set of given independent variables. Use R graphics functions to visualize the results generated with the model.

TASK 6. Use R -Studio environment to code Logistic Regression models and review the methodology to validate the model and predict the dependent variable for a set of given independent variables. Use R graphics functions to visualize the results generated with the model.

Note: Use Tableau for the following Tasks:

TASK 7. Data Representation: chart types: categorical, hierarchical, relational, temporal & spatial.

TASK 8. 2D: Bar charts, Clustered bar charts, dot plots, connected dot plots.

TASK 9. 2D: pictograms, proportional shape charts, bubble charts, radar charts, polar charts.

TASK 10. 2 D: Range chart, Box-and- whisker plots, univariate scatter plots, histograms word cloud.

TASK 11. 2 D: Pie chart, waffle chart, stacked bar chart, back-to-back bar chart, tree map.

TASK 12. 3-D: Surfaces, contours, hidden surfaces, pm3d coloring, 3Dmapping.

TEXT BOOKS:

1. Grolemund, G., 2014. Hands-on programming with R: Write your own functions and simulations. " O'Reilly Media, Inc.".
2. Andy Kirk, Data Visualization – A hand book for data driven design, Sage publications 2016.
3. Joshua N. Milligan, Learning Tableau 2019 Tools for Business Intelligence, data prep and visual analytics Third Edition.

REFERENCE BOOKS:

1. Philipp K. Janert, Gnuplot in Action, Understanding Data with Graphs, Manning Publications, 2010.
2. Sinan ozdemmir , “Principles of Data Science”, Packet Publishers-2016
3. Andy Kirk, Data Visualization A Handbook for Data Driven Design, Sage Publications,2016

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

FULL STACK DEVELOPMENT LAB
(PROFESSIONAL ELECTIVE-I LAB)

Course Code: GR24D5043 **L/T/P/C: 0/0/4/2**

I YEAR I SEMESTER

Course Outcomes:

1. Implement Forms, inputs and Services using AngularJS.
2. Develop a simple web application using Nodejs; Angular JS and Express.
3. Implement data models using MongoDB.
4. Develop a fully functioning website and deploy on a web server.
5. Create web pages that function using external data.

TASK 1. Develop a Form and validate using AngularJS.

TASK 2. Create a simple web application using Express, Node JS and Angular JS.

TASK 3. Create a custom server using http module and explore the other modules of Node JS like OS, path, event.

TASK 4. Create a Simple Login form using React JS.

TASK 5. Write a program to create a simple calculator Application using React JS.

TASK 6. Write a program to create a voting application using React JS.

TASK 7. Develop an express web application that can interact with REST API to perform CRUD operations on student data. (Use Postman).

TASK 8. For the above application create authorized end points using JWT (JSON Web Token).

TASK 9. Create a service in react that fetches the weather information from openweathermap.org and the display the current and historical weather information using graphical representation using chart.js.

TASK 10. Implement CRUD operations on MongoDB

TASK 11. Create a react application for the student management system having registration, login, contact, about pages and implement routing to navigate through these pages.

TASK 12. Develop a leave management system for an organization where users can apply different types of leaves such as casual leave and medical leave. They also can view the available number of days using react application.

TEXT BOOKS:

1. Brad Dayley, Brendan Dayley, Caleb Dayley., Node.js, MongoDB and Angular Web Development, 2nd Edition, Addison-Wesley, 2019.
2. Mark Tielens Thomas, React in Action, 1st Edition, Manning Publications.
3. Kirupa Chinnathambi, Learning React: A Hands-On Guide to Building Web Applications Using React and Redux, 2nd edition, Addison-Wesley Professional, 2018.

REFERENCE BOOKS:

1. Jon Duckett, Beginning HTML, XHTML, CSS, and JavaScript, Wrox Publications, 2010
2. Bryan Basham, Kathy Sierra and Bert Bates, Head First Servlets and JSP, O'Reilly Media, 2nd Edition, 2008.
3. Vasan Subramanian, Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node, 2nd Edition, A Press.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

INFORMATION SECURITY LAB
(PROFESSIONAL ELECTIVE-I LAB)

Course Code: GR24D5045 **L/T/P/C: 0/0/4/2**

I YEAR I SEMESTER

Course Outcomes:

1. Identify and classify various Attacks and explain the same.
2. Compare and contrast symmetric and asymmetric encryption systems and their vulnerability to various attacks.
3. Illustrate the role of third-party agents in the provision of authentication services.
4. Apply authentication, email security, web security services and mechanisms.
5. Distinguish and explain different protocol like SSL, TLS Vis-à-vis their applications.

TASK 1. Write a C program that contains a string(char pointer) with a value \Hello World'. The programs should XOR each character in this string with 0 and display the result.

TASK 2. Write a C program that contains a string (char pointer) with a value \Welcome'. The program should AND or and XOR each character in this string with 127 and display the result.

TASK 3. Write a Java program to perform encryption and decryption using the following algorithms:

a. Ceaser Cipher
b. Substitution Cipher
c. Hill Cipher

TASK 4. Write a Java program to implement the DES algorithm.

TASK 5. Write a C/JAVA program to implement the Blowfish algorithm.

TASK 6. Write a C/JAVA program to implement the Rijndael algorithm.

TASK 7.

1) Write the RC4 logic in Java Using Java Cryptography, encrypt the text "Hello world" using Blowfish. Create your own key using Java key tool.

2)Write a Java program to implement RSA Algorithm

TASK 8.

1. Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript.

2. Calculate the message digest of a text using the SHA-1 algorithm in JAVA.

TASK 9. Calculate the message digest of a text using the MD5 algorithm in JAVA.

TASK 10. Write a java program to implement Diffie Hellman Key Exchange

TASK 11. Write a java program to implement triple DES

TASK 12. Write a java program for Knapsack using Dynamic Programming based solution.

TEXT BOOKS:

1. Cryptography and Network Security (principles and approaches) by William Stallings Pearson Education, 4th Edition.
2. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education.

REFERENCE BOOKS:

3. Principles of Information Security, Whitman, Thomson.
4. Bhunia, S. and Tehranipoor, M.M., 2018. Hardware security: a hands-on learning approach. Morgan Kaufmann.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

RESEARCH METHODOLOGY AND IPR

Course Code: GR24D5011 **L/T/P/C: 2/0/0/2**

I YEAR I SEMESTER

Course Outcomes:

1. Demonstrate research problem formulation.
2. Analyze research related information and follow research ethics
3. Illustrate that today's world is controlled by Computer, Information Technology, but tomorrow's world will be ruled by ideas, concepts, and creativity.
4. Demonstrate that when IPR would take such an important place in the growth of individuals & nations, it is needless to emphasis the need for information about Intellectual Property Rights to be promoted among students in general & engineering.
5. Illustrate the nature of Intellectual Property and IPR in International scenarios.

Unit I

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.

Unit II

Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations, Effective literature studies approaches, analysis Plagiarism, Research ethics.

Unit III

Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

Unit IV

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

Unit V

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System. New, IPR of Biological Systems, Computer Software etc.

Traditional knowledge Case Studies, IPR and IITs.

TEXT BOOKS:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. RanjitKumar, 2 ndEdition , "Research Methodology: A Step by Step Guide for beginners"

REFERENCE BOOKS:

1. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
2. Mayall , "Industrial Design", McGraw Hill,1992.
3. Niebel , "Product Design", McGraw Hill,1974.
4. Asimov , "Introduction to Design", Prentice Hall,1962.
5. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in the New Technological Age",2016. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand,2008

I YEAR

II SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ADVANCED ALGORITHMS

Course Code: GR24D5036 **L/T/P/C: 3/0/0/3**

I YEAR II SEMESTER

Course Outcomes:

1. Analyze performance of different algorithms.
2. Determine the appropriate data structure for solving a particular set of problems.
3. Apply algorithmic paradigms for advanced algorithmic problems.
4. Apply various mathematical techniques for solving the problems.
5. Categorize the different problems in various classes according to their complexity.

UNIT I

Sorting: Shell Sort, Bucket Sort, Radix sort, topological sorting

Graph: Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge-weighted case (Dijkasra's), depth-first search and computation of strongly connected components, emphasis on correctness proof of the algorithm and time/space analysis, Amortized analysis.

UNIT II

Matroids: Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to MST.
Graph Matching: Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting paths.

UNIT III

Flow-Networks: Maxflow-mincut theorem, Ford-Fulkerson Method to compute maximum flow, Edmond-Karp maximum-flow algorithm.

Matrix Computations: Strassen's algorithm and introduction to divide and conquer paradigm, Multithreaded matrix multiplication – divide and conquer method, Multi threaded Strassen’s method.

UNIT IV

Shortest Path in Graphs: Floyd-Warshall algorithm and introduction to dynamic programming paradigm. Examples of dynamic programming- Travelling SalesPerson Problem, Matrix Chain Multiplication, 0/1 Knapsack Problem.

String Matching: Navie String Matching Algorithm, Robin-Karp Algorithm, Boyer-Moore Algorithm

UNIT V

Linear Programming: Formulating problems as Linear Programming, Simplex algorithm, Duality

NP-completeness: NP-hardness and NP completeness Problems Proof. Approximation algorithms, Randomized Algorithms

TEXT BOOK:

1. Design and Analysis of Algorithms, S.Sridhar, OXFORD University Press

REFERENCE BOOKS:

1. Introduction to Algorithms, second edition, T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein, PHI Pvt. Ltd./ Pearson Education.
2. Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni and Rajasekharam, Universities Press.
3. Design and Analysis of algorithms, Aho, Ullman and Hopcroft, Pearson education.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DEEP LEARNING

Course Code: GR24D5027 **L/T/P/C:3/0/0/3**

I YEAR II SEMESTER

Course Outcomes:

1. Implement deep learning algorithms, understand neural networks and traverse the layers of data
2. Learn topics such as convolutional neural networks, recurrent neural networks, training deep networks and high-level interfaces
3. Analyze applications of Deep Learning to Computer Vision.
4. Illustrate Applications of Deep Learning to NLP.
5. Design optimized deep learning applications for small problems using algorithms learnt in the course.

UNIT I

Introduction: Feed forward Neural networks, Gradient descent and the back propagation algorithm, Unit saturation, the vanishing gradient problem, and ways to mitigate it. RelU Heuristics for avoiding bad local minima, Heuristics for faster training, Nestors accelerated gradient descent, Regularization, Dropout

UNIT - II

Convolutional Neural Networks:
Architectures, convolution/pooling layers, Recurrent Neural Networks: LSTM, GRU, Encoder Decoder architectures. Deep Unsupervised Learning: Auto encoders, Variational Auto-encoders, Adversarial Generative Networks, Auto-encoder and DBM Attention and memory models, Dynamic Memory Models

UNIT - III

Applications of Deep Learning to Computer Vision:
Image segmentation, object detection, automatic image captioning, Image generation with Generative adversarial networks, video to text with LSTM models, Attention Models for computer vision tasks

UNIT - IV

Applications of Deep Learning to NLP:
Introduction to NLP and Vector Space Model of Semantics, Word Vector Representations: Continuous Skip-Gram Model, Continuous Bag-of-Wordsmodel (CBOW), Glove, Evaluations and Applications in word similarity

UNIT - V

Analogy reasoning:
Named Entity Recognition, Opinion Mining using Recurrent Neural Networks: Parsing and Sentiment Analysis using Recursive Neural Networks: Sentence Classification using Convolutional Neural Networks, Dialogue Generation with LSTMs

TEXT BOOKS:

1. Deep Learning by Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press.
2. The Elements of Statistical Learning by T. Hastie, R. Tibshirani, and J. Friedman, Springer.
3. Probabilistic Graphical Models. Koller, and N. Friedman, MIT Press.

REFERENCE BOOKS:

1. Bishop, C, M., Pattern Recognition and Machine Learning, Springer, 2006.
2. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
3. Golub, G.,H., and Van Loan,C.,F., Matrix Computations, JHU Press,2013.
4. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
AUGMENTED REALITY AND VIRTUAL REALITY
(PROFESSIONAL ELECTIVE-III)

Course Code: GR24D5035 **L/T/P/C: 3/0/0/3**

I YEAR II SEMESTER

Course outcomes

1. Understand basics of augmented reality.
2. Illustrate AR devices for various applications.
3. Summarize about augmented reality.
4. Experiment with VR devices.
5. Apply AR & VR technology in various domains.

UNIT I

What Is Augmented Reality?, Where Did Augmented Reality Come From?, Augmented Reality, The Relationship Between Augmented Reality and Other Technologies, Augmented Reality Concepts, How Does Augmented Reality Work?, Ingredients of an Augmented Reality Experience.

UNIT II

Augmented Reality Hardware, Major Hardware Components for Augmented Reality Systems, Augmented Reality Software, Major Software Components for Augmented Reality Systems, Software used to Create Content for the Augmented Reality Application.

UNIT III

Virtual Reality: The Three I's of Virtual Reality, A Short History of Early Virtual Reality, Early Commercial VR Technology, VR Becomes an Industry, The Five Classic Components of a VR System.
Input Devices: Trackers, Navigation, and Gesture Interfaces: Three-Dimensional Position Trackers, Navigation and Manipulation Interfaces

Unit IV

Output Devices: Graphics, Three-Dimensional Sound, and Haptic Displays: Graphics Displays, Sound Displays, Haptic Feedback.

Human Factors in VR: Methodology and Terminology, User Performance Studies, VR Health and Safety Issues, VR and Society

Unit V:

Augmented Reality Applications, What Makes a Good Augmented Reality Application? Application Areas, Magic Books, Magic Windows and Doors, Applying Augmented Reality to a

Problem, Evaluating Augmented Reality Applications, VR Applications in Manufacturing, Applications of VR in Robotics.

Text Books:

1. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013.
2. Burdea, G. C. and P. Coffet. Virtual Reality Technology, Second Edition. Wiley-IEEE Press, 2003/2006.

Reference Books:

1. LaValle, "Virtual Reality", Cambridge University Press, 2016.
2. Alan B Craig, William R Sherman and Jeffrey D Will, "Developing Virtual Reality Applications: Foundations of Effective Design", Morgan Kaufmann, 2009.
3. John Vince, "Virtual Reality Systems ", Pearson Education Asia, 2007.
4. Anand R., "Augmented and Virtual Reality", Khanna Publishing House, Delhi.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

CYBER SECURITY

(PROFESSIONAL ELECTIVE III)

Course Code: GR24D5038 **L/T/P/C: 3/0/0/3**

I YEAR II SEMESTER

Course Outcomes:

1. Demonstrate importance and challenges of Cyber security.
2. Investigate cybercrime and collect evidences.
3. Identify security risks and take preventive steps.
4. Demonstrate knowledge of forensic tools and software.
5. Knowledge about Indian IT act and International law.

UNIT I

Introduction to Cyber Security: Introduction to Cyber Security, Importance and challenges in Cyber Security, Cyberspace, Cyber threats, Cyber warfare, CIA Triad, Cyber Terrorism, Cyber Security of Critical Infrastructure, Cyber security - Organizational Implications.

UNIT II

Hackers and Cyber Crimes: Types of Hackers, Hackers and Crackers, Cyber-Attacks and Vulnerabilities, Malware threats, Sniffing, Gaining Access, Escalating Privileges, Executing Applications, Hiding Files, Covering Tracks, Worms, Trojans, Viruses, Backdoors.

UNIT III

Ethical Hacking and Social Engineering: Ethical Hacking Concepts and Scopes, Threats and Attack Vectors, Information Assurance, Threat Modelling, Enterprise Information Security Architecture, Vulnerability Assessment and Penetration Testing, Types of Social Engineering, Insider Attack, Preventing Insider Threats, Social Engineering Targets and Defence Strategies.

UNIT IV

Cyber Forensics and Auditing: Introduction to Cyber Forensics, Computer Equipment and associated storage media, Role of forensics Investigator, Forensics Investigation Process, and Collecting Network based Evidence, Writing Computer Forensics Reports, Auditing, Plan an audit against a set of audit criteria, Information Security Management System Management. Introduction to ISO 27001:2013

UNIT V

Cyber Ethics and Laws: Introduction to Cyber Laws, E-Commerce and E-Governance, Certifying Authority and Controller, Offences under IT Act, Computer Offences and its penalty under IT Act 2000, Intellectual Property Rights in Cyberspace.

TEXT BOOKS:

1. Donaldson, S., Siegel, S., Williams, C.K., Aslam, A., Enterprise Cybersecurity -How to Build a Successful Cyber defense Program Against Advanced Threats, A-press .
2. Nina Godbole, Sumit Belapure, Cyber Security, Willey

REFERENCE BOOKS:

1. Hacking the Hacker, Roger Grimes, Wiley
2. Cyber Law By Bare Act, Govt Of India, It Act 2000.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING ANDTECHNOLOGY

NATURAL LANGUAGE PROCESSING

(PROFESSIONAL ELECTIVE III)

Course Code: GR24D5039 **L/T/P/C: 3/0/0/3**

I YEAR II SEMESTER

Course Outcomes:

1. Summarize the role of natural language processing in various applications and explain language modeling.
2. Apply word level analysis, syntactic analysis and semantic analysis on natural language processing.
3. Discuss discourse processing of text.
4. Illustrate the automation of natural language generation and machine translation of Indian languages.
5. Infer information retrieval systems and utilize lexical resources for processing natural language text.

UNIT I

Overview: Origins and challenges of NLP, Language and Grammar, Processing Indian Languages, NLP Applications, Information Retrieval.

Language Modeling: Introduction, Various Grammar-based Language Models, Statistical Language Model.

UNIT II

Word Level Analysis: Introduction, Regular Expressions, Finite State Automata, Morphological Parsing, Spelling Error Detection and correction, Words and Word classes, Part of Speech Tagging.

Syntactic Analysis: Introduction, Context-free Grammar, Constituency, Parsing, Probabilistic Parsing.

UNIT III

Semantic Analysis: Introduction, Meaning Representation, Lexical Semantics, Ambiguity, Word Sense Disambiguation Discourse Processing: Introduction, Cohesion, Reference Resolution, Discourse Coherence and Structure

UNIT IV

Natural Language Generation: Introduction, Architecture of NLG Systems, Generation Tasks and Representations, Application of NLG.

Machine Translation: Introduction, Problems in Machine Translation, Characteristics of Indian Languages, Machine Translation Approaches, Translation involving Indian Languages

UNIT V

Information Retrieval: Introduction, Design features of Information Retrieval Systems, Classical, Non-classical, Alternative Models of Information Retrieval, Evaluation

Lexical Resources: Introduction, WordNet, Frame Net, Stemmers, POS Tagger, Research Corpora.

TEXT BOOKS:

1. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.
2. Multilingual natural Language Processing Applications: From Theory to Practice – Daniel M. Bikel and Imed Zitouni, Pearson Publication.

REFERENCE BOOKS:

1. Daniel Jurafsky and James H Martin,"Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", Prentice Hall, 2nd Edition,2008.
2. James Allen, Benjamin/cummings, "Natural Language Understanding", 2nd edition, 19

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
CLOUD COMPUTING AND APPLICATIONS
(PROFESSIONAL ELECTIVE - IV)

Course Code: GR24D5040 **L/T/P/C: 3/0/0/3**

I YEAR II SEMESTER

Course Outcomes:

1. Demonstrate the key dimensions, advantages and challenges of Cloud computing.
2. Explain and characterize different types of clouds.
3. Examine the different services offered by cloud and exploring the state of art of major cloud players.
4. Provide cloud computing solutions for individual users as well as enterprises.
5. Present the assessment of the economics, financial, and technological implications for selecting cloud computing for an organization.

UNIT I

UNDERSTANDING CLOUD COMPUTING: Cloud Computing –Introduction about Cloud Computing –Cloud Architecture–Cloud Storage–Why Cloud Computing Matters–Advantages of Cloud Computing –Disadvantages of Cloud Computing –Companies in the Cloud Today – Cloud Services.

UNIT II

DEVELOPING CLOUD SERVICES: Web-Based Application –Pros and Cons of Cloud Service Development –Types of Cloud service Development –Software as a Service –Platform as a Service –Web Services –On-Demand Computing –Discovering Cloud Services Development.
Services and Tools –Amazon Ec2 –Google App Engine –IBM Clouds, Virtualization.

UNIT III

CLOUD COMPUTING FOR EVERYONE: Centralizing Email Communications– Collaborating on Schedules –Collaborating on To-Do Lists –Collaborating Contact Lists – Cloud Computing for the Community –Collaborating on Group Projects and Events –Cloud Computing for the Corporation.

UNIT IV

USING CLOUD SERVICES: Collaborating on Calendars, Schedules and Task Management –Exploring Online Scheduling Applications –Exploring Online Planning and Task Management – Collaborating on Event Management –Collaborating on Contact Management –Collaborating on Project Management –Collaborating on Word Processing -Collaborating on Databases –Storing And Sharing Files.

UNIT V

OTHER WAYS TO COLLABORATE ONLINE: Collaborating via Web-Based Communication Tools –Evaluating Web Mail Services –Evaluating Web Conference Tools – Collaborating via Social Networks and Groupware –Collaborating via blogs and Wikis.

TEXT BOOKS:

1. "Cloud Computing: Principles and Paradigms", Raj Kumar Bunya, James Bromberg, Andrej Kosciusko, Wiley, New York, USA.
2. Michael Miller, Cloud Computing: Web-Based Applications That Change the Way You Work ND Collaborate Online, Qu Publishing, August 2008.

REFERENCE BOOKS:

1. Kumar Sarah, "Cloud Computing –Insights into New Era Infrastructure", Wiley Indian Edition, 2011.
2. Haley Beard, Cloud Computing Best Practices for Managing and Measuring Processes For On-demand Computing, Applications and Data Centers in the Cloud with SLAs.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
BLOCKCHAIN TECHNOLOGY
(PROFESSIONAL ELECTIVE - IV)

Course Code: GR24D5041 **L/T/P/C: 3/0/0/3**

I YEAR II SEMESTER

Course Outcomes:

1. Summarize the fundamental concepts of Blockchain, Consensus mechanism and Cryptocurrency.
2. Illustrate the application of public blockchain system and smart contract in industry.
3. Comprehend the characteristics of private blockchain, consortium blockchain and Initial Coin Offering Platforms.
4. Demonstrate the security, privacy challenges and applications of blockchain
5. Develop blockchain programs using Python and Hyperledger Fabric for real time applications.

UNIT-I

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

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

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

UNIT-II

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

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

UNIT-III

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

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

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

UNIT-IV

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

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

UNIT-V

Blockchain Case Studies: Case Study 1 – Retail, Case Study 2 – Banking and Financial Services, Case Study 3 – Healthcare, Case Study 4 – Energy and Utilities.

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

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

Text books:

1. “Blockchain Technology”, Chandramouli Subramanian, Asha A.George, Abhilash K A andMeena Karthikeyan, Universities Press.

Reference books:

1. Blockchain Blueprint for Economy, Melanie Swan, SPD O'reilly.
2. Blockchain for Business, Jai Singh Arun, Jerry Cuomo, Nitin Gaur, Pearson Addition Wesley.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ROBOTIC PROCESS AUTOMATION
(PROFESSIONAL ELECTIVE - IV)

Course Code: GR24D5042 **L/T/P/C: 3/0/0/3**

I YEAR II SEMESTER

Course Outcomes:

1. Describe RPA, where it can be applied and how it's implemented.
2. Identify and understand Web Control Room and Client Introduction.
3. Understand how to handle various devices and the workload.
4. Analyse Bot creators, Web recorders and task editors.
5. Gain skills in managing RPA projects.

UNIT I

Introduction to Robotic Process Automation & Bot Creation Introduction to RPA and Use cases – Automation Anywhere Enterprise Platform – Advanced features and capabilities – Ways to create Bots.

UNIT II

Web Control Room and Client Introduction - Features Panel - Dashboard (Home, Bots, Devices, Audit, Workload, Insights) - Features Panel – Activity (View Tasks in Progress and Scheduled Tasks) - Bots (View Bots Uploaded and Credentials).

UNIT III

Devices (View Development and Runtime Clients and Device Pools) - Workload (Queues and SLA Calculator) - Audit Log (View Activities Logged which are associated with Web CR) - Administration (Configure Settings, Users, Roles, License and Migration) - Demo of Exposed API's – Conclusion – Client introduction and Conclusion.

UNIT IV

Bot Creator Introduction – Recorders – Smart Recorders – Web Recorders – Screen Recorders - Task Editor – Variables - Command Library – Loop Command – Excel Command – Database Command - String Operation Command - XML Command.

UNIT V

Terminal Emulator Command - PDF Integration Command - FTP Command - PGP Command - Object Cloning Command - Error Handling Command - Manage Windows Control Command - Workflow Designer - Report Designer.

TEXT BOOKS:

1. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath: Create Software robots. with the leading RPA tool – UiPath Kindle Edition.

2. Alok Mani Tripathi, “Learning Robotic Process Automation”, Packt Publishing, 2018

REFERENCES:

1. Robotic Process Automation A Complete Guide - 2020 Edition Kindle Edition.
2. . Frank Casale , Rebecca Dilla, Heidi Jaynes , Lauren Livingston, “Introduction to Robotic Process Automation:a Primer”, Institute of Robotic Process Automation,1st Edition 2015.
3. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive
4. Tasks & Become An RPA Consultant”, Independently Published, 1st Edition 2018.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ADVANCED ALGORITHMS LAB

Course Code: GR24D5044 **L/T/P/C: 0/0/4/2**

I YEAR II SEMESTER

Course Outcomes:

1. Analyze performance of different algorithms.
2. Determine the appropriate data structure for solving a particular set of problems.
3. Apply multiple algorithmic paradigms for advanced algorithmic problems solving.
4. Examine working of code for various mathematical techniques to solve the problems.
5. Categorize the different problems in various classes according to their complexity.

TASK 1: Apply Dijsktra's algorithm in developing code to find shortest path between two vertices of a graph

TASK 2: Develop a scenario where though no specific strategy is applied yet the logic need to be attacked to break it using brute force method.

TASK 3: Subdivide the problem of calculating the multiplication of two aadhar numbers using divide and conquer method.

TASK 4: Illustrate the working of multithreaded Stressans' method belonging to Divide and Conquer concept with suitable code.

TASK 5: Implement a solution for taking maximum items of different weights in to your basket in a supermarket using the Greedy method considering 0/1knapsack scenario.

TASK 6: Develop a solution code for row reduction algorithm for solving linear equations systems i.e. Gaussian elimination method.

TASK 7: Demonstrate the use of LU decomposition considering suitable application.

TASK 8: Apply Warshall algorithm to develop code that finds the shortest paths between all pairs of nodes in a directed weighted graph.

TASK 9: Illustrate the use of hash function based searching or matching patterns of text in Rabin Karp algorithm with appropriate code .

TASK 10: Explore the code for using degenerating property in string searching with the KMP algorithm.

TASK 11: Implement pattern checking being done from end in a text using Harspool algorithm

TASK 12: Illustrate the solution for a classic optimization problem that finds the maximum amount of flow that can be sent through an edge with help of max-flow problem.

TEXT BOOKS:

1. Design and Analysis of Algorithms, S.Sridhar, OXFORD University Press.
2. Data Structures and Algorithms in java, 3rd edition, A.Drozdek, Cengage Learning.

REFERENCES:

1. Introduction to Algorithms, second edition, T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein, PHI Pvt. Ltd./ Pearson Education.
3. Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni and Rajasekharam, Universities Press.
4. Design and Analysis of algorithms, Aho, Ullman and Hopcroft, Pearson education.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DEEP LEARNING LAB

Course Code: GR24D5061 **L/T/P/C: 0/0/4/2**

I YEAR II SEMESTER

Course Outcomes:

1. Illustrate Perceptron training algorithm and apply various activation functions.
2. Design multi-layer neural network with Back propagation algorithm and evaluate the performance of various optimization techniques.
3. Build Deep Learning models for binary and multiclass classification problems.
4. Compare the application of Deep learning models CNN, RNN, LSTM and GRU.
5. Use data encoding schemes and develop Deep learning models for real world applications.

TASK 1

Implement Perceptron training algorithm to classify flowers in IRIS dataset.

TASK 2

Implement Activation Functions in Neural Networks and analyse their usage.

TASK 3

Build a three-layer Artificial Neural Network by implementing the Back propagation algorithm.

TASK 4

Design a GRU-based deep learning model for IMDB dataset. Compare the performance of GRU based model with LSTM based model

TASK 5

Build a Deep Neural Network for multi class text classification using Reuters dataset

TASK 6

Design a model for MNIST hand written digit classification using Deep Convolution Neural networks.

TASK 7

Train a simple Recurrent Neural Network using an Embedding layer and a Simple RNN layer for movie review classification problem.

TASK 8
Build a Deep learning model using LSTM layer in Keras for IMDB dataset.

TASK 9
Design a Neural network with various optimization algorithms and analyse their performance using Keras.

TASK 10
Design a Deep Learning Model to classify the movie reviews as Positive or Negative based on the text content of reviews using IMDB dataset.

TASK 11
Apply One Hot Encoding for categorical sequence data.

TASK 12
Design a Deep Learning framework for Object Detection.

TEXT BOOKS:

1. Deep Learning with Python, Francois Chollet, Manning Publications Co.
2. Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence
3. Algorithms with contributions by Nikhil Buduma , O'Reilly publications.
4. Deep Learning by Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press.

REFERENCES:

1. Deep Learning, Ian Good fellow,Yoshua Bengio and Aaron Courville, MIT Press, London, England 2.
2. Deep Learning: A Practitioner's Approach by Josh Patterson, Adam Gibs, O'Reilly publications
3. Bishop, C, M., Pattern Recognition and Machine Learning, Springer, 2006.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
MINI PROJECT

Course Code: GR24D5048 **L/T/P/C: 0/0/2/2**

I YEAR II SEMESTER

Course Outcomes:

1. Choose the problem domain in the specialized area under computer science and engineering.
2. Acquire and categorize the solution paradigms with help of case studies
3. Design and code using selected hardware, software and tools.
4. Execute, Implement and demonstrate the problem statement by using the selected hardware, software and tools.
5. Document the thesis and publish the final work in a peer reviewed journal.

Syllabus Contents:

Mini Project will have mid semester presentation and end semester presentation. Mid semester presentation will include identification of the problem based on the literature review on the topic referring to latest literature available.

End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions highlighting individuals' contribution. Continuous assessment of Mini Project at Mid Sem and End Sem will be monitored by the Departmental committee.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENGLISH FOR RESEARCH PAPER WRITING
(AUDIT COURSE)

Course Code: GR24D5053 **L/T/P/C: 2/0/0/2**

Course Outcomes:

1. Understand Research and its process.
2. Analyze the basic fundamentals of research paper writing.
3. Comprehend the steps and methods involved in research process.
4. Explore various skills necessary that are necessary for doing research.
5. Demonstrate how to write quality research papers along with other research areas.

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

UNIT II
Clarifying Who Did What, Highlighting Your Findings, Hedging and Critiquing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts and writing an Introduction.

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

UNIT IV
A. Key skills that are needed when writing a Title, an Abstract, an Introduction, and Review of the Literature,
B. Skills that are needed when writing the Methods, the Results, the Discussion, and the Conclusion.

UNIT V
Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

Text Books:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press

Reference Books:

1. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book .
2. Ian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DISASTER MANAGEMENT
(AUDIT COURSE)

Course Code: GR24D5054 **L/T/P/C: 2/0/0/2**

Course Outcomes:

1. Integrate knowledge and to analyze, evaluate and manage the different public health aspects of disaster events at a local and global levels, even when limited information is available.
2. Describe, analyze and evaluate the environmental, social, cultural, economic, legal and organizational aspects influencing vulnerabilities and capacities to face disasters.
3. Describe theoretically and practically the processes of disaster management (disaster risk reduction, response, and recovery) and relate their interconnections, particularly in the field of the Public Health aspects of the disasters.
4. Illustrate how to manage the Public Health aspects of the disasters.
5. Analyze, and communicate information on risks, relief needs and lessons learned from earlier disasters in order to formulate strategies for mitigation in future scenarios with the ability to clearly present and discuss their conclusions and the knowledge and arguments behind them

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

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

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

UNIT IV
Disaster Preparedness and Management: Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental AndCommunity Preparedness.

UNIT V
Risk Assessment: Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co- Operation in Risk Assessment and Warning, People's Participation in RiskAssessment. Strategies for Survival. Concept and Strategies of Disaster Mitigation, Emerging Trendsin Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

TEXT BOOK:

1. R. Nishith, Singh AK, “Disaster Management in India: Perspectives, issues and strategies “’New Royal bookCompany.

REFERENCES:

1. Sahni, Pardeep Et.Al. (Eds.),” Disaster Mitigation Experiences And Reflections”, Prentice Hall Of India, NewDelhi.
2. Goel S. L. , Disaster Administration And Management Text And Case Studies” ,Deep &Deep Publication Pvt. Ltd., NewDelhi.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
SANSKRIT FOR TECHNICAL KNOWLEDGE
(AUDIT COURSE)

Course Code: GR24D5055 **L/T/P/C: 2/0/0/2**

Course Outcomes*:*

1. Understanding basic Sanskrit alphabets and Understand tenses in Sanskrit Language.
2. Explore roots of Sanskrit language.
3. Analyze engineering fundamentals in Sanskrit.
4. Demonstrate how to write sentences in Sanskrit.
5. Explore Ancient Sanskrit literature about science & technology.

UNIT I

Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences

UNIT II

Order, Introduction of roots, Technical information about Sanskrit Literature

UNIT III

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics and Applications of OCR for Sanskrit and Indian Languages, Tool and Techniques, Survey

UNIT IV

Interactive Sanskrit Teaching Learning Tools: Interactive Sanskrit Learning Tools, Introduction, Why Interactive Tools for Sanskrit? E-learning, Basics of Multimedia, Web based tools development HTML, Web page etc., Tools and Techniques

UNIT V

Standard for Indian Languages (Unicode) Unicode Typing in Devanagari Scripts, Typing Tools and Software, Text Processing and Preservation Tools, Text Processing, Preservation, Techniques, Text Processing and Preservation, Tools and Techniques, Survey

Text Books:

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, NewDelhi

2. “Teach Yourself Sanskrit” Prathama Deeksha-VempatiKutumbshastri, RashtriyaSanskrit Sansthanam, New DelhiPublication
3. “India’s Glorious Scientific Tradition” Suresh Soni, Ocean books (P) Ltd., NewDelhi.

Reference Books

1. Bharti A., R. Sangal, V. Chaitanya, “NL, Complexity Theory and Logic” in Foundations of Software Technology and Theoretical Computer Science, Springer,1990.
2. Tools developed by Computational Linguistics Group, Department of Sanskrit,University of Delhi, Delhi-110007 available at: http://sanskrit.du.ac.in
3. Content creation and E-learning in Indian languages: a model: http://eprints.rclis.org/7189/1/vijayakumarjk_01.pdf

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

VALUE EDUCATION
(AUDIT COURSE)

Course Code: GR24D5056 **L/T/P/C: 2/0/0/2**

Course Outcomes:

1. Knowledge of self-development
2. Learn the importance of Human Values
3. Developing the Professionalism Ethics, Risks, Responsibilities and Life Skills.
4. Student will be able to realize the significance of ethical human conduct and self-development
5. Students will be able to inculcate positive thinking, dignity of labor and religious tolerance.

UNIT I

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

UNIT II

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

UNIT III

Personality and Behaviour Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature

UNIT IV

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

UNIT V

Introduction to Professional Ethics: Basic Concepts, Governing Ethics, Personal & Professional Ethics, Ethical Dilemmas, Life Skills, Emotional Intelligence, Thoughts of Ethics, Value Education, Dimensions of Ethics, Profession and professionalism, Professional

Associations, Professional Risks, Professional Accountabilities, Professional Success, Ethics and Profession.

Text Books

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

Reference Books

1. Jagdish Chand, “Value Education”
2. N. Venkataiah, “ Value Education”, APH Publishing, 1998 - Education

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

INDIAN CONSTITUTION
(AUDIT COURSE)

Course Code: GR24D5057 **L/T/P/C: 2/0/0/2**

Course Outcomes:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
4. Discuss the passage of the Hindu Code Bill of1956.
5. Discuss the significance of Election Commission of India.

UNIT I

History of Making of the Indian Constitution: History Drafting Committee, (Composition & Working)

UNIT II

Philosophy of the Indian Constitution: Preamble Salient Features

UNIT III

Contours of Constitutional Rights &Duties: Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT IV

Organs of Governance and composition of judiciary: Parliament- Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor,

Council of Ministers, composition of judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions

UNIT V

Local Administration and Election Commission: 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

Election Commission: Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning

Text Books

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition,2015.

Reference Books

1. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis,2014.
2. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis,2015.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

PEDAGOGY STUDIES
(AUDIT COURSE)

Course Code: GR24D5058 **L/T/P/C: 2/0/0/2**

Course Outcomes:

1. What pedagogical practices are being used by teachers in formal classrooms in developing countries?
2. What pedagogical practices are being used by teachers in informal classrooms in developing countries?
3. Synergy from the work force.
4. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
5. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

UNIT I

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions**.** Overview of methodology and Searching.

UNIT II

Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

UNIT III

Evidence on the effectiveness of pedagogical practices, Methodology for the in-depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT IV

Professional development: alignment with classroom practices and follow- up support, Peer support, Support from the head teacher and the community, Curriculum and assessment, Barriers to learning: limited resources and large class sizes

UNIT V

Research gaps and future directions: Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

Text Books

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.

2. Agrawal M (2004) curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3):361-379.

3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London:DFID.

Reference Books

1. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3):272–282.

2. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston:Blackwell.

3. Chavan M (2003) Read India: A mass scale, rapid, ‘learning to read’campaign.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

STRESS MANAGEMENT BY YOGA
(AUDIT COURSE)

Course Code: GR24D5059 **L/T/P/C: 2/0/0/2**

Course Outcomes:

1. Develop healthy mind in a healthy body thus improving social health also improve efficiently.
2. Develop body awareness. Learn how to use their bodies in a healthy way. Perform well in sports and academics.
3. Will balance, flexibility, and stamina, strengthen muscles and connective tissues enabling good posture.
4. Manage stress through breathing, awareness, meditation and healthy movement.
5. Build concentration, confidence and positive self-image

UNIT I

Definitions of Eight parts of yoga. (Ashtanga): Ashtanga, the eight limbs of yoga, is Patanjali's classification of classical yoga, as set out in his Yoga Sutras. He defined the eight limbs as yama (abstinences), niyama (observances), asana (postures), pranayama (breathing), pratyahara (withdrawal), dharana (concentration), dhyana (meditation) and Samadhi (absorption).

UNIT II.

Orientation to Patanjala Yoga sutra: Introduction to Yoga sutra - Nature of Yoga science, Definition of yoga, the nature of seer in pure and modified state, Vrittis - Nature, classification, definition, method to control of chittavrittis. Samprajnata Samadhi and its classification, Iswarapranidhana - a means to attain Samadhi, definition and quality of Iswara. Astanga yoga-Vama, Niyama, Asana, Pranayama, Ratyahara-Bahiranga Yoga, Dharana, Dhyana, Samadhi-Antaranga Yoga, Powers Introduction.

UNIT III

Orientation of Hath yoga pradipika : Hath yoga - Introduction, relationship of Hath yoga and Raja yoga, greatness of Hath yoga, Hath yogi parampara, importance of Hath and its secrecy, place of Hath yoga Practice, Destructives and constructive of yoga, Yama and Niyama, Asana, methods of Hath yoga Practice, Mitahara, Pathya and Apathya. Rules in food taking, Hath yoga achievements. Paranayama - Benefits of Pranayama, Nadishuddi and Pranayama. Duration and time for pranayama practice, Gradation of Pranayama, Sweat and Pranayama, Food during pranayama practice, Yukta and Ayukta pranayama, Nadishuddi, Satkriya-Neti,

Dhouti, Basti, Nauli, Trataka, Kapalbhati, Gajakarani, Importance of Pranayama practice. Symtoms of Nadishuddhi, Manonnani, Varieties of Kumbhaka-Methods of practice, Classification of their benefits, Hathayogasiddhilakshanam. Kundalini as base for all yoga, Results of Kundalini prabyodha, Synonyms for Susumna, Mudras Bandhas-classification, benefits and methods of practice, Nadanusandhana.

UNIT IV

Yam and Niyam. Do`s and Don'ts in life. Ahinsa, satya, astheya, bramhacharya & aparigraha Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT V

Asan and Pranayam - Various yoga poses and their benefits for mind & body. Regularization of breathing techniques and its effects-Types of pranayama

Text Books

1. 'Yogic Asanas for Group Training - Part-I" : Janardan Swami YogabhyasiMandal,Nagpur

2. "Rajayoga or conquering the Internal Nature" by SwamiVivekananda, AdvaitaAshrama(Publication Department),Kolkata

3. Rajayoga - Swami Vivekananda - Ramakrishna Ashrama Publications.

Reference Books

1. HathayogaPradipika of Swatmarama - Kaivalyadhama, Lonavala

2. The Science of Yoga - Taimini - Theosophical Publishing House, Adyar, Madras.

3. Yogasutras of Patanjali - HariharanandaAranya, University of Calcutta Press, Calcutta.

4. Patanjal Yoga PradeepaOmananda Tirtha- Geeta Press, Gorakhpur.

5. Gherandasamhita - Bihar School of Yoga, Munger, Bihar.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

(AUDIT COURSE)

Course Code: GR24D5060 **L/T/P/C: 2/0/0/2**

Course Outcomes

1. Study of Shrimad- Bhagwad-Gita wiil help the student in developing his personality and achieve the highest goal in life
2. The person who has studied Geeta will lead the nation and mankind to peace and prosperity
3. Study of Neethishatakam will help in developing versatile personality of students
4. To develop self-developing attitude towards work without self-aggrandizement and to develop suffering free meditative mind
5. To develop tranquil attitude in all favorable and unfavorable situations and to develop high spiritual intelligence

UNIT I

Neetisatakam-Holistic development of personality

- Verses- 19,20,21,22 (wisdom)
- Verses- 29,31,32 (pride & heroism)
- Verses- 26,28,63,65 (virtue)

UNIT II

Neetisatakam-Holistic development of personality

- Verses- 52,53,59 (dont's)
- Verses- 71,73,75,78 (do's)

UNIT III

Approach to day to day work and duties.

- Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48,
- Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35,
- Chapter 18-Verses 45, 46, 48.

UNIT IV

Statements of basic knowledge.

- Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68
- Chapter 12 -Verses 13, 14, 15, 16,17, 18

- Personality of Role model. Shrimad Bhagwad Geeta:

UNIT V

- Chapter2-Verses 17, Chapter 3-Verses 36,37,42,
- Chapter 4-Verses 18, 38,39
- Chapter18 – Verses 37,38,63

TEXT BOOK:

1. "Srimad Bhagavad Gita" by Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata.

REFERENCES BOOK:

1. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

II YEAR

I SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

INFORMATION STORAGE AND RETRIEVAL

(PROFESSIONAL ELECTIVE V)

Course Code: GR24D5062 **L/T/P/C: 3/0/0/3**

II YEAR I SEMESTER

Course Outcomes:

1. Use IRS capabilities and information visualization technologies.
2. Demonstrate the use of Cataloging and Indexing.
3. Differentiate software text search algorithms and hardware text search systems.
4. Analyze the accuracy for various clustering algorithms.
5. Construct multimedia retrieval systems**.**

UNIT I

Introduction: Definition, Objectives, Functional Overview, Relationship to DBMS, Digital libraries and Data Warehouses,

Information Retrieval System Capabilities - Search, Browse, Miscellaneous.

UNIT II

Cataloging and Indexing: Objectives, Indexing Process, Automatic Indexing, Information Extraction

Automatic Indexing: Classes of automatic indexing, Statistical indexing, Natural language, Concept indexing, Hypertext linkages

Data Structures: Introduction, Stemming Algorithms, Inverted file structures, N-gram data structure, PAT data structure, Signature file structure, Hypertext data structure

UNIT III

Document and Term Clustering: Introduction, Thesaurus generation, Item clustering, Hierarchy of clusters

User Search Techniques: Search statements and binding, Similarity measures and ranking, Relevance feedback, Selective dissemination of information search, weighted searches of Boolean systems, Searching the Internet and hypertext

Information Visualization: Introduction, Cognition and perception, Information visualization technologies.

UNIT IV

Text Search Algorithms: Introduction, Software text search algorithms, Hardware text search systems.

Information System Evaluation: Introduction, Measures used in system evaluation, Measurement example – TREC results.

UNIT V

Multimedia Information Retrieval: Models and Languages – Data Modeling, Query Languages, Indexing and Searching

Libraries and Bibliographical Systems: Online IR Systems, OPACs, Digital Libraries.

TEXT BOOKS:

1. Information Storage and Retrieval Systems: Theory and Implementation By Kowalski, Gerald, Mark T Maybury Kluwer Academic Press, 2000.
2. Modern Information Retrieval Ricardo Baeza-Yates, Pearson Education, 2007
3. Information Retrieval: Algorithms and Heuristics By David A Grossman and OphirFrieder, 2nd Edition, Springer International Edition, 2004.

REFERENCE BOOKS:

1. Information Retrieval Data Structures and Algorithms By William B Frakes, Ricardo Baeza-Yates, Pearson Education, 1992.
2. Information Storage &RetievalBy Robert Korfhage – John Wiley & Sons.
3. Introduction to Information Retrieval By Christopher D. Manning and PrabhakarRaghavan, Cambridge University Press, 2008.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DIGITAL FORENSICS

(PROFESSIONAL ELECTIVE-V)

Course Code: GR24D5046 **L/T/P/C: 3/0/0/3**

II YEAR I SEMESTER

Course Outcomes:

1. Interpret and appropriately apply the laws and procedures associated with identifying, acquiring, examining and presenting digital evidence.
2. Create a method for gathering, assessing and applying new and existing legislation and industry trends specific to the practice of digital forensics.
3. Illustrate the document findings and prepare clear, concise forensic reports suitable for legal proceedings.
4. Develop an understanding of legal requirements, chain of custody procedures.
5. Apply knowledge and skills through practical exercises, case studies, and simulated forensic investigations to reinforce learning.

UNIT I

Computer Forensics Fundamentals

Introduction to Computer Forensics, Use of Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources/Employment Proceedings, Computer Forensics Services, Benefits of Professional Forensics Methodology, Steps taken by Computer Forensics Specialists, Types of Computer Forensics Technology: Types of Military Computer Forensic Technology, Types of Law Enforcement — Computer Forensic Technology — Types of Business Computer Forensic Technology Computer Forensics Evidence and Capture: Data Recovery Defined — Data Back-up and Recovery — The Role of Back-up in Data Recovery — The Data-Recovery Solution.

UNIT - II

Evidence Collection and Data Seizure

Why Collect Evidence? Collection Options — Obstacles — Types of Evidence — The Rules of Evidence — Volatile Evidence — General Procedure — Collection and Archiving — Methods of Collection — Artifacts — Collection Steps — Controlling Contamination: The Chain of Custody Duplication and Preservation of Digital Evidence: Preserving the Digital Crime Scene — Computer Evidence Processing Steps — Legal Aspects of Collecting and Preserving Computer Forensic Evidence Computer Image Verification and Authentication: Special Needs of Evidential Authentication — Practical Consideration —Practical Implementation.

UNIT - III

Computer Forensics analysis and validation
Determining what data to collect and analyze, validating forensic data, addressing data-hiding techniques, performing remote acquisitions.

Network Forensics
Network forensics overview, performing live acquisitions, developing standard procedures for network forensics, using network tools, examining the honeynet project.

Processing Crime and Incident Scenes
Identifying digital evidence, collecting evidence in private-sector incident scenes, processing law enforcement crime scenes, preparing for a search, securing a computer incident or crime scene, seizing digital evidence at the scene, storing digital evidence, obtaining a digital hash, reviewing a case.

UNIT - IV

Current Computer Forensic tools
Evaluating computer forensic tool needs, computer forensics software tools, computer forensics hardware tools, validating and testing forensics software E-Mail Investigations: Exploring the role of e-mail in investigation, exploring the roles of the client and server in email, investigating e-mail crimes and violations, understanding e-mail servers, using specialized e-mail forensic tools.
Cell phone and mobile device forensics Understanding mobile device forensics, understanding acquisition procedures for cell phones and mobile devices.

UNIT – V
Working with Windows and DOS Systems Understanding file systems, exploring Microsoft File Structures, Examining NTFS disks, Understanding whole disk encryption, windows registry, Microsoft startup tasks, MS-DOS startup tasks, virtual machines.

Textbooks:
1. Computer Forensics, Computer Crime Investigation by John R. Vacca, Firewall Media, New Delhi.
2. Computer Forensics and Investigations by Nelson, Phillips Enfinger, Steuart, CENGAGE Learning

References:
1. Real Digital Forensics by Keith J. Jones, Richard Bejtiich, Curtis W. Rose, AddisonWesley Pearson Education 2. Forensic Compiling, A Tractitioneris Guide by Tony Sammes and Brian Jenkinson, Springer International edition.
3. Computer Evidence Collection & Presentation by Christopher L.T. Brown, Firewall Media.
4. Homeland Security, Techniques & Technologies by Jesus Mena, Firewall Media.
5. Software Forensics Collecting Evidence from the Scene of a Digital Crime by Robert M. Slade, TMH 2005 6. Windows Forensics by Chad Steel, Wiley India Edition.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
HIGH PERFORMANCE COMPUTING
(PROFESSIONAL ELECTIVE - V)

Course Code: GR24D5047 **L/T/P/C: 3/0/0/3**

II YEAR I SEMESTER

Course Outcomes:

1. Understand the basic concepts of parallelism such as SIMD,SIMT,SPMD.
2. Analyze the data decomposition techniques such as data level parallelism, task level parallelism and data flow parallelism.
3. Illustrate the process of implementation of shared memory programming and to know the real time design issues.
4. Develop parallel programs using MPI/OMP in a multicore system.
5. Design the General-purpose computing on graphics processing units in real time processing.

UNIT I

Parallel Processing Concepts: Levels of parallelism (instruction, transaction, task, thread, memory, function), Models: SIMD, MIMD, SIMT, SPMD, Dataflow Models, Demand-driven Computation etc., Architectures: N-wide superscalar architectures, multi-core, multi-threaded, Motivating high performance applications.

UNIT II

Designing Parallel Programs: Automatic vs. Manual Parallelization, Understand the Problem and the Program, Partitioning, Communications, Synchronization, Data Dependencies, Load Balancing, Granularity, Limits and Costs of Parallel Programming, Performance Analysis and Optimization tuning.

UNIT III

Shared memory programming: Fundamentals of Shared Memory Programming, Basic Open MP concepts, PARALLEL directive, Data scoping rules, Basic Open MP constructs/directives/calls, Examples: Parallelizing an existing code using Open MP, More advanced Open MP directives & functions, Open MP Performance issues, Running threaded/Open MP programs on multicore system.

UNIT IV

Distributed memory programming: Fundamentals of message passing concepts, MPI message passing APIs, send, receive, collective operations. Groups, Contexts and Communicators, Topologies, Runtime and Environment Management, MPI profiling interface and tracing, Open MP 3.0 enhancements.

UNIT V

GPU Programming with CUDA and Opens – Introduction to GPGPU Programming and CUDA: Programming Model, CUDA API, CUDA Memory Model, Short introduction to Opens. Application case study. Future of Computing: Pataskala computing.

TEXT BOOKS:

1. Parallel Computer Architecture: A hardware/Software Approach", by David Culler Jaswinder Pal Singh, Morgan Kaufmann, 1999.(I&II)
2. CUDA by Example: An Introduction to General Purpose GPU Programming, by Jason Sanders and Edwards Kandrot, Addison Wesley, 2011.(unit- V)
3. Using MPI - 2nd Edition: Portable Parallel Programming with the Message Passing Interface by, William Gropp, Ewing L. Lusk, and Anthony Skjellum. Scientific and Engineering Computation, 2nd edition, 1999(unit-IV).

REFERENCE BOOKS:

1. Using OpenMP: Portable Shared Memory Parallel Programming by Barbara Chapman, Gabriele Jost and Rudvander Pas. Scientific and Engineering Computation, 2nd edition(unit-III)
2. Parallel Programming: Techniques and Application Using Networked Workstations and Parallel Computers, 2nd edition, by B. Wilkinson and M. Allen, Prentice Hall Inc., 2005
3. Heterogeneous Computing with OpenCL. Benedict Gaster, Lee Howes, David R. Kaeli, Perhaad Mistry, Dana Schaa, Elsevier, 2011.
4. Scalable Parallel Computing, by Kai Hwang, McGraw Hill 1998.
5. Introduction to Parallel Computing, Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, 2nd edition, Addison-Welsey, 2003.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ADVANCED COMPUTER NETWORKS

(OPEN ELECTIVE)

Course Code: GR24D5052 **L/T/P/C:3/0/0/3**

II YEAR I SEMESTER

Course outcomes:

1. Understanding of holistic approach to computer networking.
2. Demonstrate the computer network protocols and their applications.
3. Design simulation concepts related to packet forwarding in networks.
4. Explore advanced concepts in wireless and mobile networking.
5. Implement emerging trends and technologies in computer networks.

UNIT I

Data-link protocols: Ethernet, Token Ring and Wireless (802.11). Wireless Networks and Mobile IP: Infrastructure of Wireless Networks, Wireless LAN Technologies, IEEE 802.11 Wireless Standard, Cellular Networks, Mobile IP, Wireless Mesh Networks (WMNs), Multiple access schemes Routing and Internetworking: Network–Layer Routing, Least-Cost-Path algorithms, Non-Least-Cost-Path algorithms, Intra-domain Routing Protocols, Inter-domain Routing Protocols, Congestion Control at Network Layer.

UNIT - II

Transport and Application Layer Protocols: Client-Server and Peer-To-Peer Application Communication, Protocols on the transport layer, reliable communication. Routing packets through a LAN and WAN. Transport Layer, Transmission Control Protocol (TCP), User Datagram Protocol (UDP), Mobile Transport Protocols, Principles of Network Applications, TCP Congestion Control.

UNIT- III

The Web and HTTP, File Transfer: FTP, Electronic Mail in the Internet, Domain Name System (DNS), P2P File Sharing, Socket Programming with TCP and UDP, building a Simple Web Server Creating simulated networks and passing packets through them using different routing techniques. Installing and using network monitoring tools.

UNIT - IV

Wireless and Mobile Networks: Introduction, Wireless links and Network Characteristics - CDMA, Wifi: 802.11 Wireless LANS, Cellular internet access, Mobility management: Principles.

UNIT - V

Multimedia networking: Multimedia networking applications, streaming stored video, Voice-over-IP, Protocols for real-time conversational applications.

TEXT BOOKS:

1. Computer Networking: A Top-Down Approach, James F. Kuros and Keith W. Ross, Pearson, 6th Edition, 2012.
2. Computer Networks and Internets, Duglas E. Comer, 6th Edition, Pearson.

REFERENCES BOOKS:

1. A Practical Guide to Advanced Networking, Jeffrey S. Beasley and Piyasat Nilkaew, Pearson, 3rd Edition, 2012
2. Computer Networks, Andrew S. Tanenbaum, David J. Wetherall, Prentice Hall.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

COST MANAGEMENT OF ENGINEERING PROJECTS

(OPEN ELECTIVE)

Course Code: GR24D5051 **L/T/P/C:3/0/0/3**

II YEAR I SEMESTER

Course outcomes:

1. Discuss various construction costs to manage a construction project.
2. Summarize different construction activities and its application related to cost based on the field requirements.
3. Identify Cost Behaviour of various types of cost and Quality Management.
4. Identifying various construction Budgets involved Cost Management process.
5. Discussing various types of Techniques and Problem-solving techniques involved in Construction.

UNIT I

Introduction: Overview of the Strategic Cost Management Process, Cost concepts in decision-making; relevant cost, Differential cost, Incremental cost, Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

UNIT II

Project: Meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning; Project execution as conglomeration of technical and non-technical activities; Detailed Engineering activities; Pre project execution main clearances and documents; Project team - Role of each member; Project contracts; Bar charts and Network diagram; Project commissioning - mechanical and process.

UNIT III

Cost Behaviour and Profit Planning: Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis and Cost-Volume-Profit Analysis (theory only). Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity- Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis (theory only).

UNIT IV

Budgetary Control: Flexible Budgets; Performance budgets; Zero-based budgets; Measurement of Divisional profitability pricing decisions including transfer pricing.

UNIT V

Qualitative and Quantitative Techniques: Quantitative techniques for cost management, Linear Programming, PERT / CPM, Transportation and Assignment, problems (theory only), Simulation, Learning Curve theory.

Text Books:

1. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting, Pearson publications,3rd edition,1998.
2. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd, 6th edition,2021.
3. Srikant Datar, Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi, 16th edition, 2017.

Reference Books:

1. Charles T. Horngren and George Foster, Advanced Management Accounting, prentice Hall, 13th edition, 2008.
2. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher, 3rd edition, 2012.