Academic Regulations
Programme Structure
and
Detailed Syllabus

Master of Technology (M.Tech.)
in
Data Science

(Two Year Regular Programme)

(Applicable for Batches admitted from 2022)

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 GR22
(Applicable for Batches Admitted from 2022-23)

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	Electrical and Electronics Engineering	43	M.Tech. Power Electronics
3	Mechanical Engineering	52	M.Tech. Design for Manufacturing
4	Electronics and Communication Engineering	57	M.Tech. VLSI
5	Computer Science and Engineering	58	M.Tech. Computer Science and Engineering
6	Information Technology	B0	M.Tech. Data Science

GR22 Regulations shall govern the above programmes offered by the Departments with effect from the students admitted to the programmes in 2022-23 academic year is given below

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

2. **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

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. Out of 100 marks, 40 marks are for internal evaluation and 60 marks are for external evaluation. 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).

- 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).

7. **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.

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

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

10. **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.

11. **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 $\geq$ 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) S_k the SGPA of kth 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.,

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

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

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

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

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

12. **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

13. **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.

14. **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.

15. **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.

16. **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.

17. **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.

INFORMATION TECHNOLOGY

M.Tech Data Science

GR22 Regulations – Course Structure

I M. Tech (DS) - I Semester

S.No	BOS	Group	CourseCode	Course Name	Credits				Hours				Int.	Ext	Total Marks
					L	T	P	Total	L	T	P	Total			
1	IT	PC	GR22D5117	Statistical Methods forData Science	3	0	0	3	3	0	0	3	40	60	100
2	IT	PC	GR22D5118	Fundamentals of DataScience	3	0	0	3	3	0	0	3	40	60	100
3		**PE I**		**Professional Elective – I**	3	0	0	3	3	0	0	3	40	60	100
4		**PEII**		**Professional Elective – II**	3	0	0	3	3	0	0	3	40	60	100
5	ENG	PC	GR22D5011	Research Methodology andIPR	2	0	0	2	2	0	0	2	40	60	100
6	IT	PC	GR22D5125	Advanced Data Structures and Algorithms Lab using Python	0	0	2	2	0	0	4	4	40	60	100
			GR22D5126	Informational RetrievalSystems lab											
			GR22D5127	Data Preparation andAnalysis Lab											
7	IT	PC	GR22D5128	Fundamentals of DataScience Lab	0	0	2	2	0	0	4	4	40	60	100
		Total			**14**	**0**	**4**	**18**	**14**	**0**	**8**	**22**	**280**	**420**	**700**
8		Audit		Audit course -1	0	0	0	0	2	0	0	2	40	60	100

PROFESSIONAL ELECTIVE – I				
S. No.	**BOS**	**Group**	**Course Code**	**Course**
1	IT	PE	GR22D5119	Advanced Data Structures and Algorithms
2	IT	PE	GR22D5120	Informational Retrieval Systems
3	IT	PE	GR22D5121	Data Preparation and Analysis

PROFESSIONAL ELECTIVE – II				
S. No.	**BOS**	**Group**	**Course Code**	**Course**
1	IT	PE	GR22D5122	Artificial Intelligence
2	IT	PE	GR22D5123	Data Security and Access Control
3	IT	PE	GR22D5124	Principles of Distributed Computing

I M. Tech (DS) - II Semester

S.No	BOS	Group	CourseCode	Course Name	Credits				Hours				Int.	Ext	Total Marks
					L	T	P	To tal	L	T	P	To tal			
1	IT	PC	GR22D5129	Big Data Analytics	3	0	0	3	3	0	0	3	40	60	100
2	IT	PC	GR22D5130	Machine Learning	3	0	0	3	3	0	0	3	40	60	100
3		**PEIII**		**Professional Elective-III**	3	0	0	3	3	0	0	3	40	60	100
4		**PE IV**		**Professional Elective –IV**	3	0	0	3	3	0	0	3	40	60	100
5	IT	PC	GR22D5137	Soft Computing Lab	0	0	2	2	0	0	4	4	40	60	100
			GR22D5138	Web Analyticsand Development Lab											
			GR22D5139	Natural Language Processing Lab											
6	IT	PC	GR22D5140	Machine Learning and Big Data Analytics Lab	0	0	2	2	0	0	4	4	40	60	100
7	PW	PW	GR22D5144	Mini Project	0	0	2	2	0	0	4	4	40	60	100
	Total				12	0	6	18	12	0	12	24	280	420	700
8	Audit	Audit		Audit course -2	0	0	0	0	2	0	0	2	40	60	100

PROFESSIONAL ELECTIVE – III				
S. No.	BOS	Group	Course Code	Course
1	IT	PE	GR22D5131	Image processing and Computer Vision Applications
2	IT	PE	GR22D5132	Cyber Forensics
3	IT	PE	GR22D5133	Anomaly Detection Algorithms

PROFESSIONAL ELECTIVE – IV				
S. No.	BOS	Group	Course Code	Course
1	IT	PE	GR22D5134	Natural Language Processing and Linguistic Techniques
2	IT	PE	GR22D5135	Web Analytics and Development
3	IT	PE	GR22D5136	Soft Computing

II M. Tech (DS) - I Semester

S.No	BOS	Group	CourseCode	Course Name	Credits				Hours				Int	Ext	Total Marks
					L	T	P	Total	L	T	P	Total			
1		PE V		**Professional Elective –V**	3	0	0	3	3	0	0	3	40	60	100
2		OE	GR22D5147	1. Cost Management Of Engineering Projects	3	0	0	3	3	0	0	3	40	60	100
			GR22D5148	2. Industrial Safety											
			GR22D5149	3. Operations Research											
			GR22D5150	4. Artificial Neural Networks And Fuzzy Systems											
			GR22D5151	5. Cyber Security											
			GR22D5152	6. Internet Of Things Architecture And Design Principles											
3		PW	GR22D5145	Dissertation Phase – I	0	0	10	10	0	0	20	20	40	60	100
			Total		6	0	10	**16**	6	**0**	**20**	**26**	**120**	**180**	**300**

PROFESSIONAL ELECTIVE – V				
S. No.	**BOS**	**Group**	**Course Code**	**Course**
1	IT	PE	GR22D5141	Cloud Computing
2	IT	PE	GR22D5142	Deep Learning and Applications
3	IT	PE	GR22D5143	Business Intelligence

II M. Tech (DS) - II Semester

S.No	BOS	Group	Course Code	Course Name	Credits				Hours				Int	Ext	Total Marks
					L	T	P	Total	L	T	P	Total			
1		PW	GR22D5146	Dissertation Phase – II	0	0	16	16	0	0	32	32	40	60	100
			Total		0	0	16	**16**	**0**	**0**	**32**	**32**	**40**	**60**	**100**

Audit Courses 1 & 2

1	GR22D5153	English for Research Paper Writing
2	GR22D5154	Disaster Management
3	GR22D5155	Sanskrit for Technical Knowledge
4	GR22D5156	Value Education
5	GR22D5157	Indian Constitution
6	GR22D5158	Pedagogy Studies
7	GR22D5159	Stress Management by Yoga
8	GR22D5160	Personality Development through Life EnlightenmentSkills

I YEAR

I SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

STATISTICAL METHODS FOR DATA SCIENCE

Course Code: GR22D5117   **L/T/P/C:3/0/0/3**
I Year I Semester

Course Objectives:
1. To understand the mathematical fundamentals that is prerequisites for a variety of courses like Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning.
2. To develop the understanding of the mathematical and logical basis to many modern techniques in information technology like machine learning, programming language design, and concurrency.
3. Developing an appreciation for the use of to multivariate statistical models like regression and classification problems, principal components analysis, problem of over fitting model.
4. To study various sampling and classification problems.
5. Designing and Developing planar Graphs, Euler circuits, Graph Coloring, Hamiltonian graphs and their applications

Course Outcomes:
1. Understand 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.
5. To be familiar in calculating number of possible outcomes of elementary combinatorial processes such as permutations and combinations.

UNIT I
Introduction to Probability Theory: Overview of Probability, Distribution properties and arithmetic Probability mass, density, and cumulative distribution functions, parametric families of distributions, Expected value, variance, conditional expectation.

UNIT II
Introduction to Statistics and Sampling Techniques : Basics of Statistics, Random samples, sampling distributions of estimators, Methods of Moments and Maximum Likelihood

UNIT III
Statistical inference, Introduction to multivariate statistical models: Statistics in data mining for business insights, Prediction, Classification, Clustering, regression and classification problems, principal components analysis, The problem of over fitting model assessment.

UNIT IV
Graph Theory: distance metrics like- Euclidean, Pearson, Geodesic and Mahalanob is Isomorphism, Planar graphs, graph Coloring, Hamilton circuits and Euler cycles Permutations and Combinations with and without repetition.

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.

References 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

FUNDAMENTALS OF DATA SCIENCE

Course Code: GR22D5118   **L/T/P/C:3/0/0/3**

Course Objectives:
1.   Provide with the knowledge and expertise to become a proficient data scientist.
2.   Demonstrate an understanding of Data Collection and Management techniques.
3.   Demonstrate statistics and machine learning concepts that are vital for data science.
4.   Critically evaluate data visualizations based on their design and use, for communicating stories from data.
5.   Explore Applications and Latest Technologies of Data Science.

Course Outcomes:
1.   Apply appropriate tools in real world for Data Science Applications /projects.
2.   Explain the concepts and strategies of data collection, management and storage
3.   Apply the concepts of statistics to understand the features and nature of datasets.
4.   Compare and apply Data Visualization techniques for better insights on the Datasets
5.   Analyze the Real-world problems for the application of Data Science techniques

UNIT I
Introduction to Data Science: Introduction to Data Science, Data Science Terminology, Data Science Process, Data Science Project Roles, Data Science Projects in Industry.

UNIT II
Data Collection and Management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, Using multiple data sources.

UNIT III
Data Analysis: Data – Matrix, Attributes, algebraic, geometric view, probabilistic view of data. Introduction to statistics, Central tendencies and distributions. Data Analysis : Univariate, Bivariate, Muti-variate Analysis of Numerical and Categorical Attributes Graph Data Concepts, Topological attributes and Centrality analysis.

UNIT IV
Data Visualization: Introduction of visual perception, visual representation of data, Gestalt principles, information overloads. Creating visual representations, visualization reference model, visual mapping, visual analytics, Design of visualization applications.

UNIT V
Applications and Recent Trends: Applications of Data Science, Technologies for visualization, Recent trends in various data collection and analysis techniques, various visualization techniques, application development methods used in data science.

Text Books:
1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk from the Frontline. O'Reilly.
2. Jure Leskovek, AnandRajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press.

Reference Books:
1. Joel Grus, Data Science from Scratch, O'Reilly Publications.
2. Davy Ceilen, Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools, DreamTech Publications.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ADVANCED DATA STRUCTURES AND ALGORITHMS
(Professional Elective-I)

Course Code: GR22D5119   **L/T/P/C:3/0/0/3**
I Year I Semester

Prerequisites:
- Abstract data types: lists, stacks, queues, trees, search trees
- Priority queues: heaps. Sorting and searching.
- Graphs: representation and algorithms.

Course Objectives:
1. The fundamental design, analysis, and implementation of basic data structures.
2. Basic concepts in the specification and analysis of programs.
3. Principles for good program design, especially the uses of data abstraction.
4. Significance of algorithms in the computer field
5. Various aspects of algorithm development

Course Outcomes: After completion of the course, students would be able to:
1. Understand performance evaluation of various algorithms.
2. Illustrate various Data Structures operations.
3. Implement various Hashing Techniques.
4. Develop and analyze algorithms for various Tree structures such as Red-black trees, B- trees
5. Develop algorithms for text processing application

UNIT I
Introduction to Python and Algorithm Analysis : Python Overview, Objects in Python, Expressions, Operators, Precedence, Control flow, Functions, Input and Output (Console Input and Output, Files), Exception handling, Iterators and Generators, Conditional Expressions, List comprehension, Packing and Unpacking of Sequences, Scopes and Namespaces, Modules and the Import Statement. Object Oriented Programming- Object oriented design goals, Object oriented design Principles, Class Definitions, Inheritance, Namespaces and Object Orientation, Shallow and Deep Copying.
Algorithms, Algorithm analysis- time complexity and space complexity, Asymptotic Notation-Big Oh, Omega and Theta notations, Algorithm Analysis Examples.
Data structures-Linear and nonlinear data structures, ADT concept, Array based Sequences and Link based sequences, Singly linked lists and Doubly linked lists -Insertion, and Deletion operations, Circularly linked lists.

UNIT II
Stack / Queue Data Structures : The Stack ADT, Array-Based Implementation (Python list), Singly linked list Implementation, infix to postfix conversion using Stack, Recursion-Examples, analyzing recursive algorithms, Examples of Recursion-Linear recursion, Binary recursion, and Multiple recursion, Eliminating tail recursion, Queue ADT, array and linked list Implementations, Circular queue-insertion and deletion, Deque ADT, Doubly linked list Implementation.

UNIT III
Searching and Sorting : Searching–Linear and binary search methods, Maps and Dictionaries, Hash Tables-Hash functions, Collision Handling Schemes-Open Addressing, Separate Chaining, Python Hash Table Implementation, Sets, Multisets, and Multimaps.

Sorting –Bubble sort, Selection sort, Insertion sort, Quick sort, Merge sort, Comparison of sorting methods.

UNIT IV
Trees and Graphs : Trees- Tree Definitions and Properties, Binary tree ADT, Properties of Binary trees, Array-Based representation, Linked structure for Binary trees, Binary tree traversal algorithms, Implementing Binary tree traversals in Python. Priority queue ADT, implementation using Heaps, Python Heap implementation, Sorting with a Priority Queue-Heap sort.
Graphs- Graphs terminology, Graph ADT, Data Structures for Graphs, Graph traversals-dfs and bfs, Applications of Graphs-Minimum cost spanning tree using Kruskal's algorithm, Dijkstra's algorithm for Single Source Shortest Path Problem.

UNIT V
Search Trees : Search trees- Binary search trees-Binary search tree ADT, insertion, deletion and searching operations, Python implementation, Balanced search trees - AVL trees-Definition and examples only, Red Black trees –Definition and examples only, B-Trees-definition and examples only, Tries (examples only), Comparison of Search trees.
Text Compression-Huffman coding and decoding, Pattern matching algorithms-KMP algorithm and Boyer-Moore Algorithm.

TEXT BOOKS:
1. Data structures and Algorithms in Python, M.T.Goodrich, R.Tomassia and Michael H. Goldwasser, Wiley Student Edition.
2. Data structures and Algorithms using Python, Rance D.Necaise, Wiley Student Edition

REFERENCES:
1. Introduction to Programming in Python, Robert Sedgewick, Kevin Wayne and Robert Dondero, Pearson.
2. Python Programming, Sheetal Taneja and Naveen Kumar, Pearson.
3. Exploring Python, Timothy A.Budd, Tata McGraw-Hill Edition.
4. Think Python, Allen B.Downey, O'Reilly,SPD.
5. Python Programming, Reema Thareja, Oxford University Press.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

INFORMATIONAL RETRIEVAL SYSTEMS
(Professional Elective-I)

Course Code: GR22D5120   **L/T/P/C:3/0/0/3**
I Year I Semester

Course Objective:
1. Introduce information retrieval models.
2. Introduce information retrieval models query languages.
3. Application of web search and information retrieval in social networks.
4. To minimize the overhead of a user locating needed information.
5. Measures associates with IR systems.

Course Outcomes:
1. Toidentifybasictheoriesandanalysistoolsastheyapplytoinformationretrieal
2. To develop understanding of problems and potentials of current IR systems.
3. To learn and appreciate different retrieval algorithms and data structures used in information retrieval systems.
4. To apply various indexing, matching, organizing, and evaluating methods to IR problem.
5. To become aware of current experimental and theoretical IR research.

UNIT I
Introduction to Information Retrieval : Information retrieval model, Information retrieval evaluation, Searching the Web Document Representation, Query languages and query operation, Meta-data search

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

UNIT III
Indexing and Searching:Indexing and searching, Scoring and ranking feature vectors, Similarity measures, Relevance feedback

UNIT IV
Ontologies : Ontology, domain specific search, parallel and distributed information retrieval

UNIT V
Text and multimedia Retrieval: Text and multimedia languages, Social networks, Recent trends in Web search and Information retrieval techniques

References:
1. C. D. Manning, P. Raghavan and H. Schütze, Introduction to Information Retrieval, Cambridge University Press, 2008 (available athttp://nlp.stanford.edu/IR-book).
2. Chakrabarti, S. (2002). Mining the web: Mining the Web: Discovering knowledge from hypertext data. Morgan-kaufman.
3. B. Croft, D. Metzler, T. Strohman, Search Engines: Information Retrieval in Practice, Addison-Wesley, 2009 (available athttp://ciir.cs.umass.edu/irbook/).

4. R. Baeza-Yates, B. Ribeiro-Neto, Modern Information Retrieval, Addison-Wesley, 2011 2nd Edition).
5. Information Storage and Retrieval Systems: Theory and Implementation By Kowalski, Gerald, Mark T Maybury Kluwer Academic Press, 2000.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DATA PREPARATION AND ANALYSIS
(Professional Elective-I)

Course Code: GR22D5121   **L/T/P/C:3/0/0/3**
I Year I Semester

Course Objectives :
1. To Introduce to Data Collection Techniques.
2. To make understand the need of data pre-processing
3. To understand Statistical Hypothesis tests and Data Transformation
4. To prepare the data for analysis and develop meaningful Data Visualizations.
5. To explore Properties and Techniques of Data Evaluation.

Course Outcomes :
After completion of the course, students would be able to:
1. Understand scalability and real-time issues in different forms of data.
2. Explore different techniques to clean up the data
3. Interpret different kinds of statistical techniques
4. Explore the Visualization techniques for Data Preparation
5. Demonstrate the Techniques of Evaluating the datasets.

UNIT I
Data Gathering and Preparation: Data formats, parsing and transformation, Scalability and real-time issues.

UNIT II
Data Cleaning/Preprocessing: Need for Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation.

UNIT III
Exploratory Analysis: Descriptive and comparative statistics, Clustering and association, Hypothesis generation.

UNIT IV
Visualization: Designing visualizations, Time series, Geo located data, Correlations and connections, Hierarchies and networks, interactivity.

UNIT V
Introduction, General properties of evaluation research, Evaluation designs: Accuracy, Coverage, confidence, novelty, diversity, scalability, serendipity, Evaluation on historical datasets, Offline evaluations.

Text Books:
1. Cathy O'Neil and Rachel Schutt, Doing Data Science, Straight Talk from The Frontline, O'Reilly.
2. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman, Mining of Massive Datasets. v2.1, Cambridge University Press.
3. Jiawei Han and Micheline Kamber, Morgan Kaufmann , Data Mining-Concepts and Techniques, Publishers, Elsevier, Second Edition, 2006.

Reference Books:

1. Joel Grus, Data Science from Scratch, O'Reilly Publications
2. Davy Ceilen, Introducing Data Science: Big Data, Machine Learning and More, Using Python Tools, DreamTech Publications,
3. E. Tufte, The Visual Display of Quantitative Information, Graphics Press.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ARTIFICIAL INTELLIGENCE
(Professional Elective-II)

Course Code: GR22D5122   **L/T/P/C:3/0/0/3**
I Year I Semester

Course Objectives:
1. To learn the difference between optimal reasoning Vs human like reasoning.
2. To understand the notions of state space representation, exhaustive search, heuristic search along with the time and space complexities.
3. To learn different knowledge representation techniques.
4. To understand Game Playing, Theorem Proving, Expert Systems and Natural Language Processing.
5. To understand the applications of AI.

Course Outcomes:
1. Understand the major areas and challenges of AI.
2. Understand and apply different knowledge representation in AI.
3. Understand the process of learning with knowledge.
4. Able to learn the natural language processing.
5. Apply the knowledge of AI in real world problems**.**

UNIT I
Introduction: What is AI? Foundations of AI, History of AI, Agents and environments, The nature of the Environment, Problem solving Agents, Problem Formulation, Search Strategies, Web APIs, Data APIs and Web Scrapping

UNIT II
Knowledge and Reasoning: Knowledge-based Agents, Representation, Reasoning and Logic, Prepositional logic, First-order logic, Using First-order logic, Inference in First-order logic, forward and Backward Chaining

UNIT III
Learning: Learning from observations, Forms of Learning, Inductive Learning, Learning decision trees, why learning works, Learning in Neural and Belief networks
Introduction to Fuzzy logic, Fuzzy logic architecture, membership functions, Fuzzy logic in AI, Introduction to Expert Systems.

UNIT IV
Practical Natural Language Processing: Practical applications, Efficient parsing, Scaling up the lexicon, Scaling up the Grammar, Ambiguity, Perception, Image formation, Image processing operations for Early vision, Speech recognition and Speech Synthesis, Deep Learning: Auto-encoders, Voice Assistant, Building a Speech Recognizer, Characterization of Audio Signals, Deep Learning-

UNIT V
Robotics: Introduction, Tasks, parts, effectors, Sensors, Architectures, Configuration spaces, Navigation and motion planning, Introduction to AI based programming Tools

Text Books
1. Stuart Russell, Peter Norvig: "Artificial Intelligence: A Modern Approach",2nd Edition, Pearson Education, 2007

References
1. Artificial Neural Networks B. Yagna Narayana, PHI
2. Artificial Intelligence, 2nd Edition, E.Rich and K.Knight (TMH).
3. Artificial Intelligence and Expert Systems – Patterson PHI.
4. Expert Systems: Principles and Programming- Fourth Edn, Giarrantana/ Riley, Thomson.
5. PROLOGProgrammingforArtificialIntelligence.IvanBratka-ThirdEdition–Pearson Education.
6. Neural Networks Simon Haykin PHI

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DATA SECURITY AND ACCESS CONTROL
(Professional Elective-II)

Course Code: GR22D5123   **L/T/P/C:3/0/0/3**
I Year I Semester

Course Objectives:
1. Fundamentals of data base security.
2. Various access control techniques
3. Design models for different access control
4. Security management system issues for smartcards.
5. Recent trends in data base security

Course Outcomes:
1. Understand and implement classical models and Algorithms.
2. Analyze the data, identify the problems and choose the relevant models and algorithms to apply.
3. Assess the strengths and weaknesses of various access control models and to analyze their behavior.
4. Assess the strengths and weaknesses of smart card system and their usage.
5. Understanding of recent trends in data base security.

UNIT I
Introduction: Introduction to Access Control, Purpose and fundamentals of access control, brief history, Policies of Access Control, Models of Access Control, and Mechanisms, Discretionary Access Control (DAC), Non- Discretionary Access Control, Mandatory Access Control (MAC). Capabilities and Limitations of Access Control Mechanisms: Access Control List (ACL) and Limitations, Capability List and Limitations.

UNIT II
Role based Access Control: Role-Based Access Control (RBAC) and Limitations, Core RBAC, Hierarchical RBAC, Statically Constrained RBAC, Dynamically Constrained RBAC, Limitations of RBAC. Comparing RBAC to DAC and MAC Access control policy.

UNIT III
Models: Biba's integrity model, Clark-Wilson model, Domain type enforcement model, mapping the enterprise view to the system view, Role hierarchies- inheritance schemes, hierarchy structures and inheritance forms, using SoD in real system Temporal Constraints in RBAC, MAC AND DAC. Case study: Multiline Insurance Company.

UNIT IV
Smart Card Based Information Security: Smart Card based Information Security, Smart card operating system fundamentals, design and implementation principles, memory organization, smart card files, file management, atomic operation, smart card data transmission ATR, PPS Security techniques- user identification, smart card security, quality assurance and testing, smart card life cycle-5 phases, smart card terminals.

UNIT V

Recent Trends: Recent trends in Database security and access control mechanisms. Recent Trends related to data security management, vulnerabilities in different DBMS.

Text Books:

1. David F. Ferraiolo, D. Richard Kuhn, Ramaswamy Chandramouli, Role Based Access Control.
2. Hossein Bidgoli, Handbook of Information Security, Threats, Vulnerabilities, Prevention, Detection and Management Vol -3, Wiley,2006.

References Books:

1. http://www.smartcard.co.uk/tutorials/sct-itsc.pdf: Smart Card Tutorial.
2. Messaoud Benantar, Access Control Systems: Security, Identity management and Trust models, Springer, 2006.

References:

1. R.S. Sandhu, E.J. Coyne, H.L. Feinstein, C.E. Youman (1996), **Role-Based Access Control Models**, *IEEE Computer* 29(2), (February1996)
2. http://www.smartcardbasics.com/smart-card-security.html
3. http://www.fit.vutbr.cz/~cvrcek/confers98/datasem/datasem.html.cz
4. http://www.softpanorama.org/Access_control/Security_models/biba_model.shtml
5. https://en.wikipedia.org/wiki/Clark%E2%80%93Wilson_model

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

PRINCIPLES OF DISTRIBUTED COMPUTING
(Professional Elective-II)

Course Code: GR22D5124   **L/T/P/C:3/0/0/3**
I Year I Semester

Prerequisites:
- Basic understanding of Computer Networks
- Basic Understanding of Object Oriented concepts

Course Objectives:
1. Ability to understand the distributed and remote computing environment.
2. Ability to different distributed computing paradigms.
3. Understanding of distributed document based systems and distributed multimedia systems.
4. Ability to understand basic concept of Grid Computing
5. Ability to understand basic concept of Cluster Computing

Course Outcomes:
1. Compare and differentiate between different computing techniques
2. Understand the different computing paradigms
3. Demonstrate of the remote method invocation and its comparison with CORBA
4. Define and study the Distributed Document Based systems and distributed multimedia systems.
5. Understand the outline of the Grid computing and cluster computing concept.

UNIT I
Introduction: Evolution of Distributed Computing Systems, System models, issues in design of Distributed Systems, Distributed computing environment, web based distributed model. The different forms of computing, monolithical, distributed, parallel and cooperative computing, meaning of distributed computing, the architecture of distributed applications. Computer networks and operating system concepts related to distributed systems and web based protocols.

UNIT II
IPC and Distributed Computing Paradigms: Inter process Communication: Message Passing and its features, IPC message format, IPC synchronization, distributed applications- message passing paradigm, the client-server paradigm, the peer to peer paradigm, the message passing (MOM) paradigm- point to point message model and the publisher- subscriber message model. The distributed Object Paradigms- RMI, ORB, the object space paradigm, the mobile agent paradigm, the network service paradigm, the collaborative application, choosing a paradigm for an application.
Remote Communication: Introduction, RPC basics, RPC implementation, RPC Communication.

UNIT III
Distributed Object Space Paradigm: Message passing verses distributed objects, an archetypal distributed object architecture, distributed object system, RMI, the RMI java architecture, java RMI API, a simple RMI application, steps for building an RMI application, testing and debugging,

comparison of RMI and socket API.

Introduction to CORBA distributed architectures, The CORBA object interface, Inter-ORB protocols, object servers and object clients, CORBA object references, CORBA Naming Service, CORBA object services, object Adapters, Java IDL, An example CORBA application. Steps and methods used in implementing a CORBA object-based application.

UNIT IV

Distributed Document-based System: WWW and Lotus Notes, Distributed Coordination based System- Introduction to coordination system models, TIB, JINI, comparison of TIB and JINI, Software agents, agents technology, mobile agents.

Distributed Multimedia Systems: Characteristics of Multimedia data, QOS of services management, Resource management, stream adaptation.

UNIT V

Grid Computing: Definition of Grid,grid types–computational grid,data grid,grid benefits and applications drawbacks of grid computing, grid components, grid architecture and standards and its relation with various distributed technologies. Introduction to Open Grid Services Architecture (OGSA) – Motivation – Functionality Requirements – Practical & Detailed view of OGSA/OGSI

Cluster and cloud Computing: Parallel computing overview, cluster computing – Introduction, Cluster architecture, parallel programming models and paradigms, applications of clusters. An introduction to Cloud computing- General benefits and architecture.

Text Books:
1. Distributed computing principles and applications, M.L.Liu, Pearson Edition.
2. Distributed computing principles and applications A.STanenbaum.
3. Client/ Server programming with java and CORBA, second edition, R.Orfali and Dan Harkey, john white and sons.
4. Grid Computing, J.Joseph&C.Fellenstein, Pearsoneducation.
5. High Performance Cluster Computing, RajkumarBuyya, Pearson education.

Reference Books:
1. A networking approach to grid computing, D.Minoli,wiley.
2. Java programming with CORBA 3rd edition.
3. Java Network Programming:E.R.Harold,2[nd]edition,O'Reilly,SPD
4. Distributed Systems, Concepts and Design, 3[rd]Edition G.Colouris, J.Dollimore, Pearson. Education
5. Java Programming with CORBA,3[rd]edition , Brose, Vogel,Duddy, WileyDreamTech

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

RESEARCH METHODOLOGY AND IPR

Course Code: GR22D5011   **L/T/P/C: 2/0/0/2**

I Year I Semester

Course objectives:
1. To familiarise students with the different aspects of research.
2. To provide an idea of good scientific writing and proper presentation skills.
3. To provide an understanding of philosophical questions behind scientific research.
4. To provide a brief background on the historical legacy of science.
5. To Provide an insight of nature of Intellectual Property and new developments in IPR.

Course Outcomes:
1. Understand research problem formulation and analyze research related information and follow research ethics.
2. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
3. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasize the need of information about Intellectual Property Right to be promoted among students in general & engineering.
4. Understand the nature of Intellectual Property and IPR in International scenario.
5. Understand that IPR protection provides an incentive to inventors for further and design the administration of patent system and new Developments in IPR.

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

UNIT II
Effective literature studies approaches, analysis Plagiarism, Research ethics, Citation

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

Text books and references:

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. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guidefor beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Mayall, "Industrial Design", McGraw Hill, 1992.
6. Niebel, "Product Design", McGraw Hill, 1974.
7. Asimov, "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ADVANCED DATA STRUCTURES AND ALGORITHMS LAB USING PYTHON
(Professional Elective Lab - I)

Course Code: GR22D5125   **L/T/P/C:0/0/4/2**
I Year I Semester

Course Objectives:
1. The fundamental design, analysis, and implementation of advanced data structures.
2. Basic concepts in the specification and analysis of programs.
3. Principles for good program design, especially the uses of data abstraction.
4. To familiarize students with advanced paradigms and data structures used to solve algorithmic problems.
5. Students should be able to come up with analysis of efficiency and proofs of correctness.

Course Outcomes:
1. Demonstrate various Searching and Sorting algorithms.
2. Implement various operations on different Data Structures.
3. Design all the functions of binary tree traversal.
4. Develop Binary Search tree operations, dfs and bfs.
5. Analysis the algorithms for Text processing and minimum cost.

Experiments
1. Write Python programs to implement the following using an array (List).
a) Stack ADT   b) Queue ADT
2. Write a Python program that reads an infix expression and converts the expression to postfix form. (Use stack ADT).
3. Write a Python program to implement circular queue ADT.
4. Write a Python program that uses both a stack and a queue to test whether the given string is a palindrome or not.
5. Write Python programs to implement the following using a singly linked list.
a) Stack ADT   b) Queue ADT.
6. Write a Python program to implement priority queue ADT.
7. Write a Python program to perform the following operations:
a) Construct a binary search tree of elements.
b) Search for a key element in the above binary search tree.
c) Delete an element from the above binary search tree.
8. Write Python programs for implementing the following sorting methods:
a) Bubble sort. b) Merge sort   c) Insertion sort d) Quick sort
9. Write Python programs that use both recursive and non-recursive functions for implementing the following searching methods:
   a) Linear search b) Binary search
10. Write Python programs that use recursive and non-recursive functions to traverse the given binary tree in.
a) Preorder b) Inorder   c) Postorder
11. Write Python programs for the implementation of bfs and dfs for a given graph.
12. Write a Python to implement Dijkstra's algorithm for Single source shortest path problem.
13. Write a Python program that implements Kruskal's algorithm to generate minimum cost spanning tree.
14. Write a Python program that implements KMP algorithm for pattern matching.

Text Books/References

1. Data structures and Algorithms using Python, Rance D.Necaise, Wiley Student Edition.
2. Introduction to Programming in Python, Robert Sedgewick, Kevin Wayne Robert Dondero, Pearson.
3. Python Programming, Sheetal Taneja and Naveen Kumar, Pearson.
4. Exploring Python, Timothy A.Budd, Tata McGraw-Hill Edition.
5. Think Python, Allen B.Downey, O'Reilly,SPD.
6. Python Programming, Reema Thareja, Oxford University Press. Introduction to Programming using Python, Y. Daniel Liang, Pearson

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

INFORMATIONAL RETRIEVAL SYSTEMS LAB
(Professional Elective Lab - I)

Course Code: GR22D5126   **L/T/P/C:0/0/4/2**
I Year I Semester

Course Objective:
1. Understand of algorithms and data structures, including theoretical analysis of runtime complexity, with a particular focus on look-up data structures such as inverted indexes, postings lists, and trees.
2. Understand machine learning algorithms and probabilistic models, with a focus on vector space models, multinomial distributions and Bayes rule, classification, clustering, and discriminative learning-to-rank algorithms.
3. Understand Natural language processing of input documents and user queries, including spelling correction.
4. Understand Random walk algorithms on graphs, such as Google's Page Rank.
5. Understand integration of abstract models into one end-to-end retrieval system that is capable of crawling Web pages for indexing for efficient document retrieval with a user-provided key word query.

Course Outcomes:
1. Learn algorithms and data structures with a focus on look-up data structures such as inverted indexes, postings lists, and trees.
2. Learn Machine learning algorithms and probabilistic models, with a focus on vector space models, Bayes rule, classification, clustering, and discriminating learning-to-rank algorithms.
3. Learn Natural language processing of input documents and user queries
4. Learn Random walk algorithms on graphs, such as Google's PageRank.
5. Learn capable of crawling Web pages for indexing for efficient document retrieval with a user-provided keyword query.

Experiments
1. Write a program implement various distance similarity measures between documents.
a) Euclidean distance
b) Cosine similarity
c) Jaccard similarity

2. Write a Program to represent data using N-Gram data structure?
a) Uni-gram
b) Bi-gram
c) Tri-gram using overlapping and non-overlapping character/word sequences
d) Write a program to represent text documents using Vector Space Model and implement various weight mechanism to get into normalized format?

3. Write a program for pre-processing of a Text Document: stop word removal and show content words from high frequency to low frequency? Display top Nwords.
4. WriteaprogramtorepresentdataasInvertedFilestructureformatandRetrieveefficiently based on query vector?
5. Write a program to apply Porter Stemming algorithm on the given documents?
6. Write a program to create a web crawler to retrieve documents from web.

7. Write a program to implement Latent Semantic Indexing using SVD to provide catalog and indexing for a different document based on query document.
8. Write a program to implement various proximity search mechanism for effective search and retrieval of documents based on query?

Note: The above experiments can be implemented using Java/Python

References:
1. C. D. Manning, P. Raghavan and H. Schütze, Introduction to Information Retrieval, Cambridge University Press, 2008 (available athttp://nlp.stanford.edu/IR-book).
2. Chakrabarti, S. (2002). Mining the web: Mining the Web: Discovering knowledge from hyper text tdata.Morgan-kaufman.
3. B. Croft, D. Metzler, T. Strohman, Search Engines: Information Retrieval in Practice, Addison-Wesley, 2009 (available athttp://ciir.cs.umass.edu/irbook/).
4. R. Baeza-Yates, B. Ribeiro-Neto, Modern Information Retrieval, Addison-Wesley, 2011 (2nd Edition).
5. Information Storage and Retrieval Systems: Theory and Implementation ByKowalski, Gerald, Mark T Maybury Kluwer Academic Press, 2000.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DATA PREPARATION AND ANALYSIS LAB
(Professional Elective Lab - I)

Course Code: GR22D5127   **L/T/P/C:0/0/4/2**
I Year I Semester

Course Objective:
1. To familiarize Python Libraries for Data Collection
2. To Apply different Data Cleaning methods for Data Preparation
3. To Apply appropriate statistical methods for Data Preparation
4. To Understand characteristics of Data by Data Visualization techniques
5. To Identify and apply appropriate Libraries for Data Analysis

Course Outcomes:
1. Apply appropriate tools for Data Collection and Manipulation
2. Will be able to identify and apply appropriate Data Cleaning techniques for Data Preparation
3. Elucidate statistical measures to Analyze the nature of Data.
4. Implement Data Visualization Methods for getting insights of Data.
5. Will be able to Analyze Data by implementing Concepts of Data Preparation.

LAB EXPERIMENTS:

1. Write a Program in Python to Manipulate, Aggregate and Analyze data using Numpy
2. Write a Program in Python to Handle and Analyze data using Pandas
3. Write a Program in Python to Read and write different types of Files(csv, json, txt etc).
4. Write a Program in Python to handle Missing Values in Data .
5. Write a Program in Python to perform Uni-variate analysis on data.
6. Write a Program in Python to perform Bi-variate analysis on data.
7. Write a Program in Python to Perform Make sense of Data using Descriptive Analysis
8. Write a Program in Python to Make sense of Data by Visualization Methods – I
9. Write a Program in Python to Make sense of Data by Visualization Methods– II
10. Write a Program in Python to perform Regression Analysis on Data.
11. Write a Program in Python to Prepare Data from Text Documents for Text Data Analysis
12. Write a Program in Python to Prepare Data from Image for Image Data Analysis

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

FUNDAMENTALSS OF DATA SCIENCE LAB

Course Code: GR22D5128   **L/T/P/C: 0/0/4/2**
I Year I Semester

Course Objectives:
1. Comprehend the Python Data Structures and Libraries, to Collect, Manipulate the data.
2. Explore Statistical and Probabilistic methods to understand Characteristics of data
3. Elucidate Data Analysis techniques to derive insights of Data
4. Identify different techniques for data analysis and data visualization.
5. Discuss the applications of Data Science for real world problems.

Course Outcomes:
After completion of the course, students would be able to:
1. Demonstrate import/export different types of data.
2. Apply appropriate data collection and pre-processing methods.
3. Identify different data analysis Techniques suitable for a given applications
4. Demonstrate data visualization techniques for Data Analysis.
5. Illustrate Implementations of Data Science Case studies

The following exercises are to be done.
TASK 1
  1. a. Write program to create a list, manipulate and slices it.
  b. Create a new list and add elements to it from another list, and creates a matrix from two lists
  c. Create same a, b steps for Tuple and Dictionary

TASK 2
  2. Write a program for Accessing/Importing and Exporting Data (CSV, JSON, Excel Files).

TASK 3
  3. Demonstrate Linear algebraic, Probabilistic View of Data in Python

TASK 4
  4. Apply basic statistical methods on Sample Datasets.

TASK 5
  5. Given the *iris dataset*:https://archive.ics.uci.edu/ml/datasets/iris
      i. How many rows does it contain? How many columns?
      ii. Compute the average petal length
      iii.Compute the average of all numerical columns
      iv. Extract the petal length outliers (i.e. those rows whose petal length is 50% longer than the averagepetal length)
      v. Compute the standard deviation of all columns, for each iris species
      vi. Extract the petal length outliers (as above) for each iris species
      vii. Extract the group-wise petal length outliers, i.e. find the outliers (as above) for each iris species
      using group by (), aggregate (), and merge ().
      viii.Write a python program to compute all the functionalities of the above-mentioned data.

TASK 6

6. Demonstrate Data Preprocessing techniques for a given Dataset

TASK 7:

7. The following table gives the size of the floor area (ha) and the price ($A000), for 15 houses sold in the Canberra (Australia) suburb of Aranda in 1999.

area	sale	price
1	694	192.0
2	905	215.0
3	802	215.0
4	1366	274.0
5	716	112.7
6	963	185.0
7	821	212.0
8	714	220.0
9	1018	276.0
10	887	260.0
11	790	221.5
12	696	255.0
13	771	260.0
14	1006	293.0
15	1191	375.0

Explore with different formats of data and describe the procedure of storing of data

Type these data into a data frame with column names area, sale and Price.

(a) Plot sale. Price versus area.

(b) Use the hist () command to plot a histogram of the sale prices.

(c) Repeat (a) and (b) after taking logarithms of sale prices.

(d) The two histograms emphasize different parts of the range of sale prices. Describe the differences.

TASK 8

8. Demonstrate Exploratory Data Analysis on Iris Dataset.

TASK 9

9. Consider the sample data

people=('G1','G2','G3','G4','G5','G6','G7','G8')

segments=4

multi-dimensional data= [[3.40022085, 7.70632498, 6.4097905, 10.51648577, 7.5330039, 7.1123587, 12.77792868, 3.44773477], [11.24811149, 5.03778215, 6.65808464, 12.32220677, 7.45964195, 6.79685302, 7.24578743, 3.69371847], [3.94253354, 4.74763549, 11.73529246, 4.6465543, 12.9952182, 4.63832778, 11.16849999, 8.56883433], [4.24409799, 12.71746612, 11.3772169, 9.00514257, 10.47084185, 10.97567589, 3.98287652, 8.80552122]]

Write a Python program to create stack bar plot and add label to each section.

TASK 10

10. Consider the above Iris data set, write a python script to arrange the attributes in hierarchical structure and perform clustering with similar attributes.

TASK 11

11. Develop an application to a Text Data Analysis using Python Tools.

TASK 12

12. Develop an application to a Recommendation system using Python Tools.

Text Books:

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk from The Frontline. O'Reilly.
2. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman.Mining of Massive Datasets. v2.1, Cambridge University Press.

Reference Books:

1. Joel Grus, Data Science from Scratch, O'Reilly Publications.
2. Davy Ceilen, Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools, DreamTech Publications.

I YEAR
II SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

BIG DATA ANALYTICS

Course Code: GR22D5129   **L/T/P/C:3/0/0/3**
I Year II Semester

Prerequisites:
Students should have knowledge of one Programming Language (Java preferably)
- Acquaintance with SQL(Queries and subqueries)
- Exposure to Linux Environment.

Course Objectives:
1. To Describe the Big Data Platform and its Use case.
2. Understand the storage & retrieval of data that is modeled in different ways.
3. Explain HDFS and accessing HDFS, Processing Big Data using Map Reduce
4. Inception about Hbase, Cassandra Pig and Hive Architectures.
5. Explore Machine Learning Techniques on Big Data

Course Outcomes:
1. Illustrate the Big Data Analytic techniques for useful Business Applications.
2. Explain NoSql Big Data Management
3. Describe working of Hadoop HDFS and Map Reduce Framework
4. Perform Store/Access data using Hadoop Eco-system HBase, Hive, Pig
5. Demonstrate Analytical techniques on Big Data.

UNIT I
What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, Analytical BigData ,Pitfalls of Traditional Data Processing, Characteristics of Big Data, Overview of Big Data Technologies, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics.

UNIT II
Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures. Data Ingestion using Sqoop and Flume

Map Reduce : Map Reduce workflows, Unit tests with MRUnit, test data and local tests, anatomy of Map Reduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, Map Reduce types, input formats, output formats ,Hadoop Big-Data Solutions, .Big Data Frameworks-Hadoop, Spark Hadoop's Architecture, Hadoop Ecosystem components and their functions

UNIT III
Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schema less databases, materialized views, distribution models, sharding, master-slave replication, peer-peer replication, sharding and replication, consistency,

relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations.

UNIT IV
Hbase, data model and implementations, Hbase clients, Hbase examples, praxis. Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration.
Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts. Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries.

UNIT V
Introduction to Spark, Spark Basics, Pyspark concepts.fs
Predictive Analytics for Big Data, Regression Techniques, Classification Techniques, Visual data analysis techniques and interpretation.

Text Books:

1. V.K. Jain, Big Data and Hadoop, Khanna Book Publishing, Delhi.
2. Anil Maheshwari, Data Analytics, McGraw.

References Books:

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, Big Data, Big Analytics: Emerging.
2. Tom White, Hadoop: the definitive guide, 4th edition, Shorff publications.
3. Business Intelligence and Analytic Trends for Today's Businesses, Wiley,2013.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

MACHINE LEARNING

Course Code: GR22D5130   **L/T/P/C:3/0/0/3**
I Year II Semester

Course Objective
1. To understand the basic terminology and theory underlying machine learning.
2. To understand a range of machine learning algorithms along with their strengths and weaknesses.
3. To be able to apply machine learning algorithms to solve problems of moderate complexity.
4. ToExploresupervisedandunsupervisedlearningparadigmsofmachinelearning.
5. To explore Deep learning techniques and various feature extraction strategies.

Course Outcome
1. Ability to understand what is learning and why it is essential to the design of intelligent machines.
2. Ability to design and implement various machine learning algorithms in a wide range of real-world applications.
3. To compare pros and cons of various machine learning techniques and to get an insight of when to apply a machine learning approach.
4. To mathematically analyze various machine learning approaches and paradigms.
5. Acquire knowledge deep learning and be able to implement deep learning models for language, vision, speech, decision-making.

UNIT I
Introduction to Machine learning: Supervised learning, Unsupervised learning, Reinforcement learning. Deep learning. Terminology: regularization, overfitting, underfitting, bias-variance tradeoff, feature selection, feature normalization, confusion matrix, cross-validation, learning curves, gradient checking, computer vision

UNIT II
Supervised learning (Regression/Classification): Basic methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Naive Bayes Linear models: Linear Regression, Logistic Regression, Classification and Regression Trees(CART), Linear Discriminant Analysis, Multiple Linear Regression and Polynomial Regression.
Generalized Linear Models Support Vector Machines, Nonlinearity and Kernel Methods, Beyond Binary Classification: Multi-class/Structured Outputs, Ranking

UNIT III
Unsupervised Learning: Clustering: K-means/Kernel K-means, Hierarchical Clustering, Agglomerative Clustering, Density-based Clustering, DBScan& Spectral Clustering, Dimensionality Reduction: PCA and kernel PCA Matrix Factorization and Matrix Completion, Generative Models (mixture models and latent factor models)

UNIT IV
Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests), Maximum

Likelihood estimation, Bayesian estimation-bias, and variance tradeoff, Root Mean Square Error, R2 score, Confusion Matrix, Precision and Recall scores, ROC curves, AUC, Hyperparameter optimization.

UNIT V
Recommender Systems: Traditional and non-personalized RSs.
Content-based recommender systems: The long-tail principle. Domain-specific challenges in recommender systems. Content-based recommender systems. Advantages and drawbacks. Basic components of content-based RSs. Feature selection. Item representation Methods for learning user profiles.
Collaborative Filtering (CF)-based RSs: Mathematical foundations Mathematical optimization in CF RSs. Optimization objective. Baseline predictor through least squares. Regularization and overfitting. Learn how to use statistics and machine learning to detect anomalies in data.

Text Books
1. Machine Learning – Tom M. Mitchell, -MGH
2. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press,2012
3. R.S.Suttonand, A.G.Barto. Reinforcement Learning- An Introduction. MIT press. 1998.

Reference Books
1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer2009
2. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007.
3. Machine Learning Yearning, Andrew Ng

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

IMAGE PROCESSING AND COMPUTER VISION APPLICATIONS
(Professional Elective-III)

Course Code: GR22D5131 **L/T/P/C: 3/0/0/3**
I Year II Semester

Course Objectives:
1. To study the image fundamentals and mathematical transforms necessary for image processing.
2. To study the image transformation techniques
3. To study image restoration procedures.
4. To give an understanding of image processing for computer vision
5. To Focus on early processing of images and the determination of structure: edges, lines, shapes.

Course Outcomes
1. Review the fundamental concepts of a digital image processing system.
2. Analyze images in the spatial and frequency domain using various transforms.
3. Evaluate the techniques for image Restoration
4. Interpret image feature detection and segmentation with representation of various techniques.
5. describe basic methods of computer vision related to image recognition

UNIT I
Introduction and Fundamentals : Introduction: What is Digital Image Processing, Examples of Fields that Use Digital Image Processing, Fundamental Steps in Digital Image Processing, of an Image Processing System.
Digital Image Fundamentals: Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships Between Pixels, Basic Mathematical Tools Used in Digital Image Processing

UNIT II
Image Transformation : Intensity Transformations and Spatial:Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing (Lowpass) Spatial Filters, Sharpening (Highpass) Spatial Filters.
Filtering in the Frequency: Some Properties of the 2-D DFT and IDFT ,The Basics of Filtering in the Frequency Domain ,Image Smoothing Using Lowpass Frequency Domain, Image Sharpening Using Highpass Filters

UNIT III
Image Restoration and Reconstruction : Image Restoration and Reconstruction: A Model of the Image Degradation/Restoration process ,Noise Models, Restoration in the Presence of Noise Only. Spatial Filtering, Periodic Noise Reduction Using Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function ,Inverse Filtering

UNIT IV
Feature detection and matching : Feature detection and matching: Points and patches , Edges and contours, Contour tracking ,Lines and vanishing points ,Segmentation.

UNIT V
Recognition : Instance recognition , Image classification ,Object detection , Semantic segmentation ,Video understanding , Vision and language

Text Books:
1. Rafael C. Gonzalez and Richard E. Woods' Digital Image Processing, Fourth Edition, Global Edition,Pearson,2018.
2. Richard Szeliski. Computer Vision: Algorithms and Applications. Springer, New York, 2nd edition, 2022.

References:
1. Forsyth & Ponce, "Computer Vision-A Modern Approach", Pearson Education.
2. M.K. Bhuyan , " Computer Vision and Image Processing: Fundamentals and Applications", CRC Press, USA, ISBN 9780815370840 - CAT# K338147.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

CYBER FORENSICS
(Professional Elective-III)

Course code: GR22D5132   **L/T/P/C: 3/0/0/3**
I Year II Semester

Prerequisites:
1. Student should be aware of Information Security concepts
2. Student required Computer programming and Information science

Course Objectives::
1. Learn the security issues network layer and transport layer.
2. Be exposed to security issues of the application layer.
3. Learn computer forensics.
4. Be familiar with forensics tools.
5. Learn to analyze and validate forensics data.

Course Outcomes:
After completing this course the student must demonstrate the knowledge and ability to:
1. Discuss the security issues network layer and transport layer.
2. Apply security principles in the application layer.
3. Explain computer forensics.
4. Use forensics tools.
5. Analyze and validate forensics data.

UNIT I
Network Layer Security & Transport Layer Security IPSec Protocol - IP Authentication Header - IP ESP - Key Management Protocol for IPSec. Transport layer Security: SSL protocol, Cryptographic Computations – TLS Protocol.

UNIT II
E-Mail Security & Firewalls PGP - S/MIME - Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology- Types of Firewalls - Firewall designs - SET for E-Commerce Transactions.

UNIT III
Introduction to Computer Forensics Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of CF techniques - Incident and incident response methodology - Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team. - Forensics Technology and Systems - Understanding Computer Investigation – Data Acquisition.

UNIT IV
Evidence Collection and Forensics Tools Processing Crime and Incident Scenes – Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/Hardware Tools.

UNIT V
Analysis and Validation Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics.

Text Books:
1. Man Young Rhee, "Internet Security: Cryptographic Principles", "Algorithms and Protocols", Wiley Publications, 2003.
2. Nelson, Phillips, Enfinger, Steuart, "Computer Forensics and Investigations", Cengage Learning, India Edition, 2008.

References:
1. John R.Vacca, "Computer Forensics", Cengage Learning, 2005.
2. Richard E.Smith, "Internet Cryptography", 3rd Edition Pearson Education, 2008.
3. Marjie T.Britz, "Computer Forensics and Cyber Crime": An Introduction", 3rd Edition, Prentice Hall, 2013.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ANOMALY DETECTION ALGORITHMS
(Professional Elective-III)

Course Code: GR22D5133   **L/T/P/C: 3/0/0/3**
I Year II Semester

Course Objectives:
1. To identifies any unusual behavior or pattern and used in many of anomaly detection for Maintenance, and Monitoring.
2. To Analytics the solutions for Anomaly Detection and find a correlation between anomalies and predicting anomaly in the IT Infrastructure using Machine Learning and Deep Learning.
3. To Evaluate different techniques and types of anomaly detection through Unsupervised and Supervised Machine Learning for Anomaly Detection.
4. To provide recommendations based on recorded information on the users' preferences.
5. Widely applied to several domains and applications to assist decision making by recommending items tailored to user preferences.

Course Outcomes:
1. To *detect* both global *anomalies* that extend beyond the expected seasonal minimum and maximum and local *anomalies*
2. Ability to enhance the Unsupervised methods of *anomaly detection* to detect anomalies in an unlabeled test set of data based solely on the intrinsic properties of that data.
3. ability to predict whether a particular user would prefer an item or not based on the user's profile
4. ability to Content-Based *recommender system* tries to guess the *features* or behavior of a user
5. Ability to enable the Recommender systems are beneficial to both service providers and users.

UNIT I
Understanding and detecting anomalies in data: Define various types of anomalies, Discuss the applications of anomaly detection, Explain the statistics and mathematics required.
Building upon probability theory and geometry to identify anomalies: Describe probabilistic models for anomaly detection, apply extreme value analysis and angle-based techniques, Use Python to perform anomaly detection on one- and two-dimensional data.

UNIT II
Use linear models instead of probabilistic and geometric models: Apply linear regression models and principal component analysis, Use support vectors machines (SVMs) for anomaly detection.
Exploring the usage of additional methods based on distance to identify abnormal data: Describe proximity-based methods and the local outlier factor (LOF), Apply the k-nearest neighbors (KNN) algorithm and k-means clustering.

UNIT III
Working with difficult problems that involve high-dimensional data: Understand the difficulties with high-dimensional problems, Apply the subspace method with feature bagging and the isolation forest algorithm.
Find out how to use supervised learning models and how to work with classifications: Implement cost-sensitive learning algorithms, apply adaptive resampling and boosting methods

UNIT IV
Explore how to classify temporal and streaming data: Implement statistical process control, apply streaming anomaly detection using autoregressive models

UNIT IV
Measure the performance of an anomaly detection system: Evaluate different techniques and types of anomaly detection, Perform analysis on a wide variety of data detection.

Text Books

1. Kishan G. Mehrotra, Chilukuri K. Mohan, HuaMing Huang, Anomaly Detection Principles and Algorithms, Springer, 2017
2. C.C. Aggarwal, Recommender Systems: The Textbook, Springer, 2016.
3. F. Ricci, L Rokach, B. Shapira and P.B. Kantor, Recommender systems handbook, Springer 2010.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

NATURAL LANGUAGE PROCESSING AND LINGUISTIC TECHNIQUES
(Professional Elective-IV)

Course Code: GR22D5134   **L/T/P/C: 3/0/0/3**
I Year II Semester

Course Objectives
1. Understand Natural Language Processing (Understanding).
2. Probabilistic model of defining language and techniques.(Application)
3. Application of context free grammar and language parsing(Application)
4. Implement probabilistic and language parsing(Application)
5. Differentiation of semantic and discourse in terms of NLP.(Analyze)

Course Outcomes
1. Apply the principles and Process of Human Languages such as English and other Indian Languages using computers.
2. Realize semantics and pragmatics of English language for text processing
3. Perform POS tagging for a given natural language and select a suitable language modelling technique based on the structure of the language
4. Demonstrate the state of the art algorithms and techniques for text based processing of natural language with respect to morphology
5. Develop a statistical methods for real world applications and explore deep learning based NLP

UNIT I
Natural Language Processing and keras : Natural Language Processing: Definition of Natural Language, Challenge of Natural Language, From Linguistics to Natural Language Processing, Natural Language Processing.
How to Develop Deep Learning Models With Keras: Keras Model Life-Cycle, Keras Functional Models, Standard Network Models.

UNIT II
Data Preparation
How to Clean Text Manually and with NLTK: Manual Tokenization, Tokenization and Cleaning with NLTK, Additional Text Cleaning Considerations.
How to Prepare Text Data with scikit-learn: The Bag-of-Words Model, Word Counts with Count Vectorizer , Word Frequencies with Tfidf Vectorizer, Hashing with Hashing Vectorizer
How to Prepare Text Data with scikit-learn: The Bag-of-Words Model, Word Counts with Count Vectorizer, Word Frequencies with Tfidf Vectorizer, Hashing with Hashing Vectorizer

UNIT III
Bag-of-Words
The Bag-of-Words Model:The Problem with Text ,What is a Bag-of-Words,Example of the Bag-of-Words Model ,Managing Vocabulary, Scoring Words,Limitations of Bag-of-Words.
Case study: How to Prepare Movie Review Data for Sentiment Analysis

UNIT IV
Word Embeddings and Language Modeling
Word Embeddings: The Word Embedding Model, How to Develop Word Embeddings with Gensim, How to Learn and Load Word Embeddings in Keras
Language Modeling: Neural Language Modeling, How to Develop a Character-Based Neural Language Model, How to Develop a Word-Based Neural Language Model

UNIT V
Image Captioning
Neural Image Caption Generation, Neural Network Models for Caption Generation, How to Load and Use a Pre-Trained Object Recognition Model, How to Evaluate Generated Text With the BLEU Score, How to Prepare a Photo Caption Dataset For Modeling.

Text Books:
1. Jason Brownlee, Deep Learning for Natural Language Processing,2017.,Publisher:Machine Learning Mastery,
2. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", Universities Press Private Limited, India, 2nd Edition, 2008.

Reference
1. Practical Natural Language Processing: A Comprehensive Guide to Building Real-World NLP Systems (Greyscale Indian Edition) Paperback – 17 July 2020,by Sowmya Vajjala (Author), Bodhisattwa Majumder (Author), Anuj Gupta (Author), Harshit Surana (Author)
2. Natural Language Processing Fundamentals: Build intelligent applications that can interpret the human language to deliver impactful results Paperback – Import, 30 March 2019,by Sohom Ghosh (Author), Dwight,Gunning (Author)
3. Natural Language Processing Paperback – 1 January 2019
   by Ela Kumar (Author)Goodman, Hedetniemi, "Introduction to the Design and Analysis of Algorithms", Tata McGraw Hill, New Delhi, India, 1st Edition, 2002.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

WEB ANALYTICS AND DEVELOPMENT
(Professional Elective-IV)

Course Code: GR22D5135   **L/T/P/C: 3/0/0/3**

I Year II Semester

Course Objectives
1. To Identify and demonstrate key web analytics' performance metrics.
2. Learn how to use and deploy web/social/mobile analytics platforms
3. To confidently analyze IR techniques for the web, including crawling, link-based algorithms
4. To conduct qualitative research and deliver actionable, data-driven business insights
5. The critical elements of web, social, mobile, and content analytics to optimize organization's ability to make highly informed business decisions.

Course Outcomes:
1. Familiarize with core research in Social and web analytics.
2. Learn and understand various web analytic tools.
3. Be able to decode data and arrive at an effective social media strategy
4. Analyze social network analysis and data-driven business insights.
5. Analyze problems of social network analysis, and suggest methods to establish causality in networkstudies

UNIT I
Introduction Social network and Web data and methods, Web analytics at e-Business scale, Basic Segmentation and metrics, Collection of Web Data, Basic Dashboards, Graph and Matrices, Basic measures for individuals and networks, Information Visualization

UNIT II
Web Analytics tools: Click Stream Analysis, A/B testing, Online Surveys, Web Analytics Ecosystem

UNIT III
Web Search and Retrieval: Search Engine Optimization, Web Crawling and indexing, Ranking Algorithms, Web traffic models, Web Analytics Data Acquisition and Conversions, Tracking Mobile visitors, Web Analytics Reports
.
UNIT IV
Making Connection: Link Analysis, Random Graphs and Network evolution, Social Connects: Affiliation and identity.

UNIT V
Connection: Connection Search, Collapse, Robustness Social involvements and diffusion of Innovation, Geo Social Data and Cohort Analysis

Text Books:
1. Analyzing Social Media Networks with NodeXL: Insights from a Connected World Paperback – Import, 24 July 2019
2. Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity 1st Edition, Kindle Edition by Avinash Kaushik

References Books:

1. David Easley & J. Kleinberg, Networks, Crowds, and Markets: Reasoning About a Highly Connected World, New York: Cambridge University Press, 2010.

2. S. Wasserman &K. Faust, Social network analysis: Methods and applications. New York: Cambridge University Press, 1994.

3. P. R. Monge& N. S. Contractor, Theories of communication networks. New York: Oxford University Press, 2003.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

SOFT COMPUTING
(Professional Elective-IV)

Course Code: GR22D5136   **L/T/P/C:3/0/0/3**
I Year II Semester

Course Objectives:
1. To introduce soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario.
2. To implement soft computing-based solutions for real-world problems.
3. To give students knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms.
4. To integrate soft Computing Techniques
5. To solve complex problems with soft computing techniques

Course Outcomes:
1. Study the transition from conventional to computational intelligence
2. Design logic gates using Fuzzy logic
3. Implement Single layer feed forward and multi-layer forward networks
4. Solving optimization problems using GA in Machine Learning
5. Applications of Soft computing to solve problems in varieties of application   domains.

UNIT I
Introduction to Soft Computing: Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics

UNIT II
Fuzzy Logic: Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.

UNIT III
Neural Networks: Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks: Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advances in Neural networks

UNIT IV
Genetic Algorithms: Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning: Machine Learning Approach to Knowledge Acquisition.

UNIT V
Recent Trends: Recent Trends in deep learning, various classifiers, neural networks and genetic algorithm, Implementation of recently proposed soft computing techniques.

Text Books:
1. Jyh: Shing Roger Jang, Chuen, Tsai Sun, EijiMizutani, Neuro: Fuzzy and Soft Computing, Prentice Hall of India,2003.
2. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic: Theory and Applications, Prentice Hall, 1995.

Reference Books:
1. Samir Roy, Introduction to Soft Computing: Neuro-Fuzzy and Genetic Algorithms, Pearson Publications.
2. B.K. Tripathy, Soft Computing Advances and Applications, Cambridge University Press.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

` **SOFT COMPUTING LAB**
Professional Elective – IV Lab

Course Code: GR22D5137   **L/T/P/C:0/0/4/2**
I Year II Semester

Course Objectives:
1. To give students knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms.
2. To integrate soft Computing Techniques
3. To solve complex problems with soft computing techniques
4. To understand different saturating functions.
5. To analyze feed forward networks.

Course Outcomes:
1. Study and Analysis different models.
2. Implement Forward Propagation and Backward Propagation networks.
3. Analyze Different learning rules.
4. Understand Fuzzy logic rules and Fuzzy membership functions.
5. Design logic gates using Fuzzy logic.

The following Tasks are to be done.
1. Write A Program for Implementing Linear Saturating Function.
2. Write A Program to Implement Logic Gates.
3. Study and Analysis of Fuzzy Vs Crisp Logic.
4. To study fuzzy control, principle of Fuzzy Control Design and rule-based Fuzzy Inference System (FIS)
5. Write A Program of Perceptron Training Algorithm.
6. Study and Analysis Of CPN.
7. Write A Program to Implement Hebb's Rule.
8. Write A Program to Implement Delta Rule.
9. Write A Program to implement Forward Propagation Algorithm
10. Write A Program for Error Back Propagation Algorithm (EBPA) Learning.
11. Write a program to implement Hopfield Network.
12. Study and Analysis of Genetic Algorithm Life Cycle.
13. Study and Analysis of Art Model.

Text Books:
1. Jyh: Shing Roger Jang, Chuen: Tsai Sun, EijiMizutani, Neuro: Fuzzy and Soft Computing, Prentice: Hall of India,2003.
2. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic: Theory and Applications, Prentice Hall, 1995.

Reference Books:
1. Samir Roy, Introduction to Soft Computing: Neuro-Fuzzy and Genetic Algorithms, Pearson Publications.
2. B.K. Tripathy, Soft Computing Advances and Applications, Cambridge University Press

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

WEB ANALYTICS AND DEVELOPMENT LAB
Professional Elective – IV Lab

Course Code: GR22D5138   **L/T/P/C:0/0/4/2**
I Year II Semester

Course Objectives:
1. To understand the key fabric of the Web.
2. To understand and analyze the click stream data, online surveys, usability research.
3. To understand preprocessing of data.
4. To understand Navigation analysis (funnel reports, heat maps, etc).
5. To confidently analyze and provide business solutions

Course Outcomes:
1. Familiarize with core research in Social and web analytics.
2. Learn and understand various web analytic tools.
3. Analyze the data, identifying various issues proposed solutions with optimization.
4. Analyze social network analysis using graph theory.
5. Identify various innovation approaches of web and social analytics.

The following tasks are to be done.

1. Write a Python program to test if a given page is found or not on the server.

2. Write a Python program to download IMDB's Top 250 data (movie name, Initial release, director name and stars).

3. Demonstrate collection of Information (web Crawling) from web like twitter.

4. Write python script to preprocess the data collected from twitter.

5. Write a python script for Page Ranking algorithm.

6. Consider a fraud detection use case: You have a database of clients, and would like to know how they are connected to each other. Especially, you know some clients are involved in complex fraud structure, but visualizing the data at an individual level does not bring out evidence of fraud. The fraudsters look like other usual clients.
From the above use case perform the following
a) Create a graph from user database.
b) Custom visualization that helps us see strange patterns.
c) Risky pattern detection.
d) Create visualizations and automating analyses for the business.

7. Create a Python Script to demonstrate
a) Graph Plotting
b) Plotting two or more lines on same plot

8. Create a Python Script to demonstrate Customization of Plots

9. Create a Python Script to demonstrate Bar Chart
a) Histogram
b) Scatter plot
c) Pie-chart

10. Create a Python Script to demonstrate Plotting curves of given equation

11. Write a Python Script to demonstrate Cohort Analysis.

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NATURAL LANGUAGE PROCESSING LAB
Professional Elective – IV Lab

Course Code: GR22D5139   **L/T/P/C:0/0/4/2**
I Year II Semester

Course Objectives
1. Understand the basic terminology and theory underlying natural language processing
2. Understand approaches of building our own datasets using NLP
3. Understand approaches to N-gram, stemming, lemmatization and morphological parsing of NLP
4. Understand approaches part of speech tagging, parsing syntax and semantics in NLP.
5. Understand approaches to text classification, clustering, topic modelling and summarization with in NLP.

Course Outcomes
1. Apply skills of python for Simple language processing with the Natural Language Tool Kit (NLTK) and Textblob modules.
2. Develop understanding transforming text to numeric vectors using Scikitlearn machine learning library for building current NLP systems
3. Ability to understand morphology and wordnet concepts for building high level text based applications
4. Ability to apply part of speech tagging, parsing syntax and semantics in NLP.
5. Ability to apply a approaches to build text classification / clustering / summarization / topic modelling within NLP.

Note : Use Python I/O files, TextBlob, NLTK, SK learn libraries for building the following applications.
1. Write a program to parse the given data set into words, characters and N gram using data structure?.
2. Write a program to remove stop-words and apply the concepts of Stemming, Lemmatization and POS Tagging for the given dataset.
3. Write a program to convert given data into numeric format (CSV format) using Vector Space Model for text normalization?
4. Write a program to find Text Similarity between two or more documents using distance measures?
5. Write a program for Text classification on Twenty News Groups dataset?
6. Write a program for Text classification on Movie review data set?
7. Write a program to classify the given mail is ham/spam using Text classification on Email data set?
8. Write a program to build a Sentiment Analyser on a given data set using Supervised Learning?
9. Write a program to build a Text Summarization application on a given dataset?
10. Write a program to build a Topic Modeling application on a given dataset?
11. Write a program to build Text Clustering application on given dataset?
12. Write a program to create our own CSV file from the given Text data set using Python file?
13.Write a program to build an application on Sentiment Analysis on Twitter dataset using CNN?
14.Write a program to build Text Sequence generation on a given data set using RNN?

Textbooks/References

1. Practical Computer Vision Applications Using Deep Learning with CNNs by Fawzy Gad
2. Natural Language Processing Recipes by Akshay Kulakarni

Online resources

1. https://www.nltk.org/
2. http://mlreference.com/spacy
3. https://textblob.readthedocs.io/en/dev/
4. https://scikit-learn.org/stable/index.html

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

MACHINE LEARNING AND BIG DATA ANALYTICS LAB

Course Code: GR22D5140   **L/T/P/C:0/0/4/2**
I Year II Semester

Course Objectives:
1. Learn, understand, and practice big data analytics.
2. Understand Machine learning techniques, and scaling up machine learning approaches.
3. Understand machine learning approaches, which include the study of modern computing big data technologies
4. Scaling up machine learning techniques focusing on industry applications.
5. Understand conceptualization and summarization of big data and machine learning trivial data versus big data, big data computing technologies

Course outcomes:
1. Ability to understand what is learning and why it is essential to the design of intelligent machines.
2. Ability to design and implement various machine learning algorithms in a wide range of real-world applications.
3. Install Hadoop and perform basic file management task Implement basic data structures in Hadoop
4. Implement map reduce concept using matrix multiplication Install Pig and perform basic operations.
5. Install Hive and perform basic operations.

1. Problem Statement:

Step 1:
Create a database with 100 instances containing numeric values as per following values as per following details given in Tables 1 Name this file as *data_employee.*

Employee_id	Age	Basic pay	No.Of clients	Years of Service	Performance Score
1					
2					
3					
..					

Range of this attributes are as follows:
1. Employee_id : 1-100
2. Age   :25-62
3. Basicpay   :15,600-67000
4. No. of clients:1-1000
5. YearsofSeices:0-40
6. PerformanceScore:0/1 Step2:
1. To create missing values in the data, remove the data entry from the cell as indicated below in Table
2. (This dataset will be later useful to practice preprocessing on the data)
Table 2

Instance No/ record No	Attribute values to be deleted
Instance 1	Age, Basic Pay, Years of Service
Instance 2	Basic Pay, Age
Instance 12	Age
Instance 51	Years of Service
Instance 54	Age
Instance 56	No. of Clients, Years of Service
Instance 81	Age, Years of Service
Instance 83	Years of Service ,Age
Instance 91	Years of Service ,Age
Instance 99	No. of Clients, Basic Pay ,Age

For example : Consider data example as per Table 3 having 2 instances.Table 4 illustrates the deletion of values of attributes to generate missing values.

Table3

Employee_id	Age	BasicPay (Monthly)	No. of Clients	Years of Services	Performance Score
1	30	32000	20	5	1
2	40	22000	1	3	1

Table4

Employee_id	Age	BasicPay (Monthly)	No. of Clients	Years of Services	Performance Score
1			20		1
2			1	3	1
...					

3. Dataset generated is to be named as*data_after_missing_values*

Expected Outcome:
1.   A complete dataset named data_employee has been generated for further analysis
2.   For further preprocessing a dataset named data_after_missing_values is also generated.

2. Problem Statement:
Step 1: Refer to the dataset *data_after_missing_values*and handle missing values in it. The missing values in the created dataset can be handled in following 3 ways:
1. Fill all the missing values by a default value. Default values for four attributes are given as:
a.   100 for Age
b.   1000for BasicPay
c.   100 for No of Clients
d.   50 for Years of Service

For example : Table 5 illustrates the filling of missing values using default values of the two sample instances given in Table 4.
Table 5

Employee_id	Age	BasicPay (Monthly)	No. of Clients	Years of Services	Performance Score
1	100	1000	20	50	1
2	100	1000	1	3	1
...					

Name this file as *PS_IB_I*

2. Fill all the missing values in the column by mean value of all the existing values of the attributes

a. Fill missing values of column Basic Pay using all the existing values of attribute Basic Pay

b. Similarly, fill missing value of column No of Clients,Years of Service and Age using all the existing values of attribute No. of Clients,Years of Service and Age

Suppose, mean value of attribute, Age, Basic Pay, No of Clients and Years of Service are 50,4500,10 and 13 respectively. (Use file*data_after_missing_values*)

Table 6 illustrates the filling of missing values using mean value of the corresponding attribute for two sample instances shown in Table 4.

Employee_id	Age	BasicPay (Monthly)	No. of Clients	Years of Services	Performance Score
1	50	45000	20	13	1
2	50	45000	1	3	1
...					

Name the generated file as PS_1B_2

c. Fill all the missing values by median value of all the existing value of the attribute. For example:Fill missing values of Basic Pay using all the existing value of attribute Basic Pay

d. Similarly fill missing value of No.of Clients,Years of Service and Age using all the existing values of attribute No. of Clients, Years of Service and Age

For example:

Suppose, median value of attribute Age, Basic Pay, No of Clients and Years of Service are 30,15000,10 and 11 respectively .(Use file *data_after_missing_values)*

Table 7illustrates the filling of missing values using mean value of the corresponding attribute for two sample instances shown in Table 4.

Table 7

Employee_id	Age	BasicPay (Monthly)	No. of Clients	Years of Services	Performance Score
1	50	45000	20	13	1
2	50	45000	1	3	1
...					

Name the generated file as *PS_1B_3*

Expected Outcome : Clean and completely preprocessed datasets named *PS_1B_i,* PS_1B_2 and PS_1B_3 are generated

3. **Problem statement:**

Clean and completely preprocessed datasets named PS_1B_1, PS_1B_2 and PS_1B_3 generated in Practical Session 1A and 1B are to be used

Refer to the dataset PS_1B_1, PS_1B_2 and PS_1B_3. To apply a Classification Model follow

the steps below:
1. Use the dataset PS_1B_1and apply a classification model such as k-NN on three attribute si.eAge,Basicpay and No.of Clients for predicting the values in target class.
2. Use 'Performance Score' as targetclass
3. Finsouttheaccuracyscorei.ecorrectnessofpredictionsusingtheformulagiven below:
Accuracy score=correct number of predictions / total no. of instances
For example: Table 1 illustrates the two sample instances of the data PS_1B_1.

Table 1

Employee_id	Age	Basic pay	No.Of clients	Years of Service	Performance Score
1	100	1000	20	50	1
2	100	1000	20	3	0
..					

On applying k-NN(on PS_1B_1.), generate new column named Predicted Performance Score as shown in Table 2.

Table 2

Age	Basic pay	No. Of clients	Performance Score	Predicted Performance Score
100	1000	20	1	1
100	1000	20	0	1

Evaluate the accuracy i.e Accuracy =1/2=50%
4. Store the accuracy of the data in the variable named*Accuracy_1*.
5. RepeatSteps1 to4 forthedatasetsPS_1B_2andPS_1B_3andsavetherespective accuracy scores in variables *Accuracy_2*and*Accuracy_3*

Expected Outcome :Datasets with differently resolved missing values give different accuracies. Some methods for resolving missing values perform better than the others. Observe Variables named *Accuracy_, Accuracy_2*and *Accuracy_3*

4. Problem statement:
Clean and completely preprocessed datasets named PS_1B_1,PS_1B_2 and PS_1B_3generated in Practical Session 1A and 1B are to be used
Refer to the dataset PS_1B_1, PS_1B_2 and PS_1B_3. To apply a Classification Model follow the steps below
1. UsethedatasetPS_1B_1andapplyaclassificationmodelsuchask-Meansontwo attributes i.e No of Clients and Years of Services for identifying the similar rows together
2. Use Euclidean Distance measure for evaluating the centroid of each cluster
The formula for Distance between a point X(x1,x2,etc.) and a point Y(y1,y2,etc.) is given as

$$D=\sqrt{\sum^{2}(xi-yi)2}$$
$i=1$
3. Calculate Accuracy score for each of the cluster formed

Accuracy Score for each cluster= *Maximum number of instances of target class (0/1) in the cluster / Total number of instances in the cluster*

Note: Use Performance score as target class

4. Repeat step 1 to 3 for all values of k from 2 to6

For example: Table 1 illustrates the 3 sample instances of the data PS_1B_1.

Table 1

Employee_id	Age	Basic pay	No.Of clients	Years of Service	Performance Score
1	100	1000	20	50	1
2	100	1000	1	3	0
3	80	90	31	21	1
..					

Accuracy ore for Cluster 1= 1/2 = 0.5 Accuracy ore for Cluster 2= 1/1 = 1

5. Repeat steps 1 to 4 for the datasets PS_1B_2 andPS_1B_2

Expected Outcomes:

1. Clustering is performed on the datsetPS_1B_1,PS_1B_2 andPS_1B_3
2. AccuraciesforeachclustersondatasetsPS_1B_1,PS_1B_2andPS_1B_3are calculated

5. Problem Statement:

Use clean and completely preprocessed datasets named PS_1B_1, PS_1B_2 and PS_1B_3
Perform the following exercise:

1. Use the data setPS_1B_1andapplyz-scoretransformationonvariabes:Age,Basic Pay (Monthly), Years of Service and No. of Clients

Formula for z-score is given as:

$Z=(x-\mu)/\sigma$

Where x is the input feature , z is the transformed value of x, μ is mean and σ is standard deviation.

2. Name this new data file as *standardized*_PS_1dataset

3. Perform feature engineering by applying a suitable dimensionality reduction method such as PCA (Principal Component Analysis) on the *standardized* PS_1B_1dataset.Perform the following steps:

1. Identify 2 principal components out of the four transformed variables of *standardized*_PS_1 dataset , using PCA.
2. Store the generated 2 principal components in variables *PC1* and*PC2*

4. Create a new file named reduced_PSI and store the values of PC1,PC2 along with the target variable named *Performance Score* in thefile

For example: Table 1 shows 2 sample instances of file *reduced_PS1*

Table 1

PC1	PC2	Performance Score
1.8	1.04	0
2.3	1.18	1

5. Apply regression analysis on *reduced_PS1d*ataset taking PC1and PC2 as input variables i.e X_1 and X_2 and *performance Score* as Output variable,Y_1

$Y_i=\beta_0+ \beta_1X_1+\epsilon_i$

For our data we have i=2

6. Calculate the intercept ϵ and coefficients. Also, calculate predicted Y using the calculated intercept and coefficient values and name it as *predicted_Performance_score*

7. Calculate the Mean Absolute Error for Actual and predicted Performance score Formula for MAE is given as:

$$MAE = \sum_{i=1}^{n} (Performance score - Predicted performance_{score})/n$$

Where n is the number of instances in the data

8. Repeat steps 1-7 for datasets PS_1B_2 andPS_1B_3

Expected Outcome:

1. Dimensionally reduction is performed using PCA on the datasets PS_1B_1,PS_1B_2, and PS_1B_3

2. Number of dimensions in each of the datasets PS_1B_1,PS_1B_2,andPS_1B_3are reduced to 2, whereas earlier it was4

6. Problem Statement:

Suppose a user wants to find relevant documents / article for a particular query from a given huge collection of documents. Then it becomes very difficult to search manually , as it will require a lot of efforts. So to search efficiently and automatically we require a recommendation system that will recommend a document / article in response to a particular query

Exercise 1: Pre-processing Text Step 1: Create three records for the following text belonging to 3 different documents

No. of Documents	
Document 1	Broad to Rogers no run around the wicket Rogers back and across the off stump to block up the wicket
Document 2	Swann to Watson no run covers up on the off stump up the wicket
Document 3	Meth to ShahriarNafees , no run, on a good length on the off, drives that on the up towards extra cover

Step 2: Remove stop words from the given set of documents as shown in Table 1.

Stop words list	A, about, above, after, again , against, all, am, an , and, any, are, aren't ,as, at, it, will, for ,me, how, off, no, the ,to ,up

Table 1 :Stop word list

Document before the stop word removal	Swann to Watson no run comes up on the off stump up the wicket
Document after the stop word removal	"Swann", "Watson", "covers", "stump", "wicket'

Table 1 : Example of removing the stop words from document 1

Step 3: Consider the following Query Q1: how many wickets Swann Watson took while bowling around the wickets?
Step 4:Repeat 1 & 2

Tokenize the documents and remove the stop words in similar way as we have done in first step

Exercise 2: Using the pre-Processed text for Analysis

Step 1: Provide TF-IDF score to each documents

TF: Term Frequency, which measures how frequently a term occurs in a document . Since every document is different in length , it is possible that a term would appear much more times in long documents that the shorter ones. Thus, the term frequency is often divided by the document length (aka, the total number of terms in the document) as a way of normalization
TF(t)=(Number of times term t appears in a document)/(Total number of terms in the document)
IDF: Inverse Document Frequency , which measures how important a term is. While computing TF, all terms are considered equally important . However it is known that certain terms such as "is",",off" and "that", may appear a lot of times but have little importance. Thus we need to weigh down the frequent terms while scale up the rare ones, by computing the following
IDF(t)=log_e (Total number of documents / number of documents with term t in it)

Document_1	Td-idf score
Swann to Watson no run covers up on the off stump up the wicket	('covers',0.34112294132833015), ('stump,0.24271178228501236'), ('wicket,0.24271178228501236'), ('Swann',0.197822850123), ('Watson',0.1987822850123)

Table 3:Tf-idf calculation on document_1.txt

After that find the similar document out of document_1, document_2, document_3 which matches the query
Hint: (Use Euclidean distance for finding similarity)

7. Implement the following file management tasks in Hadoop:

   o   Adding files and directories
   o   Retrieving files
   o   Deleting files

Hint: A typical Hadoop workflow creates data files (such as log files) elsewhere and copies them into HDFS using one of the above command line utilities.

8.   RunabasicWordCountMapReduceprogramtounderstandMapReduceParadigm.
9.   Write a Map Reduce program that mines weather data and prints Maximum Temperature.
10.   Write a Map Reduce Program to Find Designation wise Average Salary of Employees in an organization.
11.   Run Pig, use Pig to perform sort, group, join, project, and filter data.
12.   Run Hive, use Hive to create, alter, and drop databases, tables, views, functions, and indexes.
13.   Demonstrate Data Processing using PigScript.
14.   Demonstrate UDF creation and usage using PigScript.

Text Books:
1.   V.K. Jain, Big Data and Hadoop, Khanna Book Publishing, Delhi.
2.   Maheshwari, Data Analytics, McGraw

II YEAR
I SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

CLOUD COMPUTING
(Professional Elective-V)

Course Code: GR22D5141   **L/T/P/C:3/0/0/3**
II Year I Semester

Course Objectives: To learn how to use Cloud Services.
1. Understanding the implementation of Virtualization.
2. Implementing the Task Scheduling algorithms.
3. Apply the algorithms to build Private Cloud.
4. Broadly educate to know the impact of engineering on legal and societal issues involved.
5. Understanding the issues involved in addressing the security issues of cloud computing.

Course Outcomes:
1. Analyze the Cloud computing setup with it's vulnerabilities and applications using different architectures.
2. Design different workflows according to requirements and apply map reduce programming model. Apply and design suitable Virtualization concept, Cloud Resource Management and design scheduling algorithms.
3. Create combinatorial auctions for cloud resources and design scheduling algorithms for computing clouds
4. Assess cloud Storage systems and Cloud security, the risks involved, its impact and develop cloud application
5. Broadly educate to know the impact of engineering on legal and societal issues involved in addressing the security issues of cloud computing.

UNIT I
Understanding Cloud Computing: Cloud Origins and Influences, Basic Concepts and Terminology, Goals and Benefits, Risks and Challenges Fundamental Concepts and Models: Roles and Boundaries, Cloud Characteristics, Cloud Delivery Models, Cloud Deployment Models.

UNIT II
Cloud-Enabling Technology: Data Centre Technology, Virtualization Technology, Web Technology, Multitenant Technology, Service Technology.

UNIT III
Cloud Infrastructure Mechanisms: Logical Network Perimeter, Virtual Server, Cloud Storage Device, Cloud Usage Monitor, Resource Replication.

UNIT IV
Fundamental Cloud Architectures: Workload Distribution Architecture, Resource Pooling Architecture, Dynamic Scalability Architecture, Elastic Resource Capacity Architecture, Service Load Balancing Architecture, Cloud Bursting Architecture, Elastic Disk Provisioning Architecture, Redundant Storage Architecture.

UNIT V
Cloud Security: Infrastructure Security, Data Security and storage, Identity and access management, Access Control, trust, reputation, risk,

Text Book(s)
1. Thomas Erl, Ricardo Puttini, ZaighamMahmood, Cloud Computing:Concepts, Technology & Architecture, PrenticeHall.
2. John W. Rittinghouse, James F.Ransome, Cloud Computing: Implementation, Management and Security, CRC Press,2012.

References
1 .Anthony T.Velte, Toby J Velte Robert Elsenpeter, Cloud Computing a practical approach, TMH2010
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, Emereo Pty Limited, July2008.
3. GautamShroff, Enterprise Cloud Computing: Technology, Architecture, applications, Cambridge University Press,2010.
4. Ronald Krutz Russell Dean Vines, Cloud Security:A comprehensive guide to Secure cloud computing,Wiley,2010.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DEEP LEARNING AND APPLICATIONS
(Professional Elective-V)

Course Code: GR22D5142   **L/T/P/C:3/0/0/3**
 II Year I Semester

Course Objectives:
1. Introduce major deep learning algorithms, the problem settings, and their applications to solve real world problems.
2. Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.
3. Implement deep learning algorithms and solve real-world problems.
4. Students will learn to implement, train, and validate their own neural network.
5. To improve the understanding of the on-going research in computer vision and multimedia field.

Course Outcomes:
1. Understand the fundamental principles, theory and approaches for learning with deep neural Networks.
2. Understand the main variants of deep learning (such Convolutional and recurrent architectures), and their typical applications.
3. Analyze the key concepts, issues and practices when training and modeling with deep architectures; as well as have hands-on experience in using deeplearning.
4. Implement basic versions of some of the core deep network algorithms (such as back propagation).
5. Evaluate how deep learning fits within the context of other ML approaches and what learning tasks it is suited and not well suited to perform Vision and NLP applications

UNIT I
Introduction to Deep Neural Networks: Feed forward Neural networks. Gradient descent and the back propagation algorithm, Intuition of Neural Networks Loss functions, Optimization, Unit saturation, aka 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 and Recurrent Neural Networks: Architectures, convolution / pooling layers, LSTM, GRU, Encoder Decoder architectures, Function Approximation, Cost Function, Convolutional Neural Network, Training Neural Networks, Understanding Neural Networks Through Deep Visualization, Back Propagation, DeepFace and FaceNet

UNIT III
Deep Unsupervised Learning: Auto encoders (standard, sparse, denoising, contractive,etc.), Variational Auto encoders, Adversarial Generative Networks, Auto encoder and DBM, Attention and memory models, Dynamic memory networks, Deep Convolutional Features for Iris Recognition, Single Shot Multibox Detector

UNIT IV
Deep Belief Networks: Auto Encoders, Denoising Auto encoders, Stacked Auto encoders, Energy Based Models, Restricted Boltzmann Machines, Sampling in an RBM, Justifying Greedy-Layer Wise Pre-Training, Max Pooling, engine of neural networks-gradient-based optimization, Sequencing Processing with convents

UNIT V
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 Words model (CBOW), Glove, Evaluations and Applications in word similarity, analogy reasoning, Parsing and Sentiment Analysis using Recursive Neural Networks, Sentence Classification using Convolutional Neural Networks
.
Text Books:
1. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning." An MIT Press book in preparation.(2015).
2. DeepLearning for Computer Vision:Expert techniques to train advanced neural networks using Tensor Flow and Keras by Rajalingappaa Shanmugamani, Packt Publishers

Reference Books:
1. Hochreiter, Sepp, and Jargen Schmidhuber. "Long short-term memory." Neural computation 9.8(1997).
2. Bengio, Yoshua. "Learning deep architectures for AI." Foundations and trends in Machine Learning 2.1(2009).

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

BUSINESS INTELLIGENCE
(Professional Elective-V)

Course Code: GR22D5143   **L/T/P/C:3/0/0/3**

II Year I Semester
Course Objectives :
1. Understand the Big Data Platform and its Use cases.
2. Provide HDFS Concepts and Interfacing with HDFS
3. Understand Map Reduce Jobs.
4. Provide an deep insight on Hodoop Eco System
5. Understand Machine Learning with Big Data

Course Outcomes :
1. Distinguishes applications and Analytic Challenges with Traditional Data and Big Data.
2. Manage Large Data Storage requirement on Hadoop Distributed File System.
3. Develop Map Reduce Jobs for Large data Processing in Hadoop Environment
4. Analyze Big Data Solutions using Hadoop Eco System
5. Apply Different types of Analytics on Big Data.

Pre-requisites :
Knowledge of a Programming Language (Java preferably), Practice of SQL (queries and sub queries), Data Warehousing and Mining knowledge.

UNIT I
Business Data and Decision Support Systems : Introduction to Business Data: What is data? Data and business, Big Data, Information and insight, challenges in data decision, operational and informational data, Data decision challenge.
Decision Support Systems, Decision Making Process – Characteristics and Phases of Decision making.

UNIT II
Business Intelligence : Business Intelligence and its components, Business Intelligence areas, Business Intelligence Implementation, BI Architecture, Business Intelligence and Integration Implementation, BI Tools. Business Analytics – Overview of Descriptive, Predictive and Prescriptive Analytics. Introduction to Big Data Analytics. Machine Learning.

UNIT III
Data Warehouse : Data Warehouse Definition, Characteristics of a DW, Data Marts, DW Architecture, DW Modelling and Design, Data Modelling Techniques, Accessing a Data Warehouse - OLAP, ROLAP, MOLAP, OLAP Query Techniques. DW for Decision Support systems,

UNIT IV
Data Visualization and Dashboards Design :Data Visualization Characteristics, Creating Data Visualization and Dash boards, Types of Basic and Composite charts for BI, Measuring, Monitoring and Management of Business, KPIs and Dashboards. Types of dashboards, common characteristics of Enterprise dashboard, design of enterprise dashboards and common pitfalls of Dashboard design.

UNIT V

Business Analytics : Emerging Trends and Future Directions. Location Based analytics for Organizations, Analytics Applications for Consumers, Recommendation Engines. Web 2.0 and Online Social Networking, Cloud Computing and BI, Impacts of analytics in organizations an overview, Issues of legality. Privacy and ethics, an overview of Analytics Eco system.

Text Books
1. Ramesh Sharada etal, Business Intelligence and Analytics, 10th edition, Pearson Publications.
2. Jiawei Han &MichelineKamber, Data Mining – Concepts and Techniques -, Morgan Kaufmann Publishers, Elsevier, Second Edition, 2006.

Reference Books

1. Chuck Ballard, Dirk Herreman, Don Schau, Rhonda Bell,Data Modeling Techniques for Data Warehousing , IBM [ebook]
2. Business Analytics : Data Analytics & Decision Making by S. Christian Albright and Wayne L. Winston.
3. Competing on Analytics – Davenport

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ARTIFICIAL NEURAL NETWORKS AND FUZZY SYSTEMS
(Open Elective I)

Course Code: GR22D5150   **L/T/P/C: 3/0/0/3**
II Year I Semester

Course Objective
1. To cater the knowledge of Neural Networks and Fuzzy Logic Control and use these for controlling real time systems.
2. To know about feedback networks.
3. To learn about the concept of fuzziness involved in various systems
4. To understand the concept of adequate knowledge about fuzzy set theory.
5. To learn about comprehensive knowledge of fuzzy logic control and adaptive fuzzy logic and to design the fuzzy control using genetic algorithm

Course Outcomes
1. To Expose the students to the concepts of feed forward neural networks
2. To provide adequate knowledge about feedback networks.
3. To teach about the concept of fuzziness involved in various systems.
4. To provide adequate knowledge about fuzzy set theory.
5. To provide comprehensive knowledge of fuzzy logic control and adaptive fuzzy logic and to design the fuzzy control using genetic algorithm.

UNIT I
Introduction to Neural Networks
Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Hodgkin-Huxley Neuron Model, Integrate-and-Fire Neuron Model, Spiking Neuron Model, Characteristics of ANN, McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN.

UNIT II
Essentials of Artificial Neural Networks
Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity, Neural
Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Types of Application.
Feed Forward Neural Networks
Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron Networks, Perceptron Convergence theorem, Limitations of the Perceptron Model, Applications

UNIT III
Multi Layered Feed Forward Neural Networks
Credit Assignment Problem, Generalized Delta Rule, Derivation of Back propagation (BP) Training, Summary of Back propagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements.
Associative Memories : Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory (Associative Matrix, Association Rules, Hamming Distance, The Linear Associator, Matrix Memories, Content Addressable Memory), Bidirectional

Associative Memory (BAM) Architecture, BAM Training Algorithms: Storage and Recall Algorithm, BAM Energy Function, Proof of BAM Stability Theorem Architecture of Hopfield Network: Discrete and Continuous versions, Storage and Recall Algorithm, Stability Analysis, Capacity of the Hopfield Network.

UNIT IV
Self Organizing Maps (SOM) and Adaptive Resonance Theory(ART)
Introduction, Competitive Learning, Vector Quantization, Self-Organized Learning Networks, Kohonen Networks, Training Algorithms, Linear Vector Quantization, Stability- Plasticity Dilemma, Feed forward competition, Feedback Competition, Instar, Outstar, ART1, ART2, Applications.
Classical& Fuzzy Sets Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions.

UNIT V
Fuzzy Logic System Components
Fuzzification, Membership value assignment, development of rule base and decision-making system, Defuzzification to crisp sets, Defuzzification methods. **Applications Neural network applications:** Process identification, Function Approximation, control and Process Monitoring, fault diagnosis and load forecasting. **Fuzzy logic applications:** Fuzzy logic control and Fuzzy classification.

Text Books
1. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by Rajasekharan and Rai – PHI Publication.
2. Introduction to Artificial Neural Systems - Jacek M. Zuarda, Jaico Publishing House,1997.

Reference Books
1. Neural and Fuzzy Systems: Foundation, Architectures and Applications, - N. Yadaiahand   S. Bapi Raju, Pearson Education
2. Neural Networks – James A Freeman and Davis Skapura, Pearson,2002.
3. Neural Networks – Simon Hykins , Pearson Education
4. Neural Engineering by C.Eliasmith and CH. Anderson, PHI
5. Neural Networks and Fuzzy Logic System by Bork Kosko, PHI Publications.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENGLISH FOR RESEARCH PAPER WRITING
(AUDIT COURSE)

Course Code: GR22D5153   **L/T/P/C : 2/0/0/0**

Course objectives:
1. Understand how to improve their writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a Title and ensure the good quality of paper at very first-time submission
4. Understand the process of research
5. Write quality research papers

Course Outcomes:
1. Give a view of what writing is all about
2. Understand Research and its process
3. Comprehend the steps and methods involved in research process
4. Have learned various skills necessary that are necessary for doing research
5. Have learned 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
Hedging and Critiquing, Paraphrasing and Plagiarism, Sections of a Paper

UNIT III
A**:** Abstracts and writing an Introduction, Review of the Literature, Methods and Results
B: Key skills that are needed when writing a Title, an Abstract, an Introduction, and Review of the Literature,

UNIT IV
A. Methods, the Results, Discussion, Conclusions, the Final Check, Clarifying Who Did What, Highlighting Your Findings
B. Key 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

Reference 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
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book.
4. 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 : GR22D5154   **L/T/P/C: 2/0/0/0**

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

Course Outcomes
1. Capacity to 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. Capacity to describe, analyze and evaluate the environmental, social, cultural, economic, legal and organizational aspects influencing vulnerabilities and capacities to face disasters.
3. Capacity to work theoretically and practically in 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. Capacity to manage the Public Health aspects of the disasters.
5. Capacity to obtain, 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 And Community Preparedness.

UNIT V

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

SUGGESTED READINGS:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

SANSKRIT FOR TECHNICAL KNOWLEDGE
(AUDIT COURSE)

Course Code: GR22D5155   **L/T/P/C: 2/0/0/0**

Course objectives
1. To get a working knowledge in illustrious Sanskrit, the scientific language in the world
2. Learning of Sanskrit to improve brain functioning
3. Learning of Sanskrit to develop the logic in mathematics, science & other subjects
4. Enhancing the memory power
5. The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

Course Outcomes
1. Understanding basic Sanskrit alphabets and Understand tenses in Sanskrit Language.
2. Enable students to understand roots of Sanskrit language.
3. Students learn engineering fundamentals in Sanskrit.
4. Students can attempt writing sentences in Sanskrit.
5. Ancient Sanskrit literature about science & technology can be understood

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

Suggested reading
1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.
4. Bharti A., R. Sangal, V. Chaitanya, "NL, Complexity Theory and Logic" in Foundations of Software Technology and Theoretical Computer Science, Springer, 1990.
5. Tools developed by Computational Linguistics Group, Department of Sanskrit, University of Delhi, Delhi-110007 available at: http://sanskrit.du.ac.in

6. Basic concept and issues of multimedia:
   http://www.newagepublishers.com/samplechapter/001697.pdf

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

VALUE EDUCATION
(AUDIT COURSE)

Course Code: GR22D5156   **L/T/P/C: 2/0/0/0**

Course Objectives:
1. Understand value of education and self-development
2. Imbibe good values in students
3. Let the should know about the importance of character
4. To understand the significance of human conduct and self-development
5. To enable students to imbibe and internalize the value and Ethical behaviour in personal and professional lives.

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.

Suggested reading

1. Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi
2. Jagdish Chand, "Value Education"
3. N. Venkataiah, " Value Education", APH Publishing, 1998 - Education

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

INDIAN CONSTITUTION
(AUDIT COURSE)

Course Code: GR22D5157   **L/T/P/C : 2/0/0/0**

Course Objectives:
1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals 'constitutional
3. Role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
4. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.
5. To understand the role and functioning of Election Commission of India.

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

Suggested Reading
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.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. 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: GR22D5158   **L/T/P/C : 2/0/0/0**

Course Objectives:
1. Review existing evidence on the review topic to inform Programme design and policy making
2. Undertaken by the DFID, other agencies and researchers.
3. Identify critical evidence gaps to guide the development.
4. Establishing coordination among people in order to execute pedagogy methods.
5. To study pedagogy as a separate discipline.

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 oflearners?
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.

Suggested Reading
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.
4. 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.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

STRESS MANAGEMENT BY YOGA
(AUDIT COURSE)

Course Code: GR22D5159   **L/T/P/C: 2/0/0/0**

Course Objectives:
1. To achieve overall health of body and mind.
2. To overcome stress.
3. To lower blood pressure and improve heart health.
4. Relaxation and Sleeping aid and to become non-violent and truthfulness.
5. To increase the levels of happiness and to eliminate all types of body pains.

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 chitta vrittis. 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 & aparigrahaShaucha, 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 pranayam

Suggested Reading
1. 'Yogic Asanas for Group Training - Part-I" : Janardan Swami Yogabhyasi Mandal,Nagpur
2. "Rajayoga or conquering the Internal Nature" by SwamiVivekananda, AdvaitaAshrama (Publication Department),Kolkata
3. Rajayoga - Swami Vivekananda - Ramakrishna Ashrama Publications.
4. Hathayoga Pradipika of Swatmarama - Kaivalyadhama, Lonavala
5. The Science of Yoga - Taimini - Theosophical Publishing House, Adyar, Madras.
6. Yogasutras of Patanjali - Hariharananda Aranya, University of Calcutta Press, Calcutta.
7. Patanjal Yoga Pradeepa Omananda Tirtha- Geeta Press, Gorakhpur.
8. Gherandasamhita - Bihar School of Yoga, Munger, Bihar.
9. Shivayogadipika - Sadashivabrahmendra, Ananda Ashramagranthavali, Choukhamba Press
10. Yoga Darshan : Swami Niranjanananda-Sri Panchadashanam Paramahamsa Alakh Bara, Deoghar.
11. Four chapters on Freedom (commentary on the Yoga sutras of Patanjali), Swami Satyananda(1983), Bihar School of Yoga, Munger.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS
(AUDIT COURSE)

Course Code: GR22D5160   **L/T/P/C: 2/0/0/0**

Course Objectives
1. To learn to achieve the highest goal happily
2. To become a person with stable mind, pleasing personality and determination
3. To awaken wisdom in students
4. To differentiate three types of happiness (Sukham)
5. To describe the character traits of a spiritual devotee

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 Books / References:
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