ACADEMIC REGULATIONS COURSE STRUCTURE AND DETAILED SYLLABUS

DATA SCIENCE

COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)

for

B.TECH FOUR YEAR DEGREE PROGRAMME

(Applicable for the batches admitted from 2022-2023

AR - 20

ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT
(An Autonomous Institution)

Approved by AICTE,

Recognized Under 2(f) & 12(b) of UGC
PermanentlyAffiliated to JNTUGV, Vizianagaram

K.Kotturu, Tekkali, Srikakulam -532201, Andhra Pradesh.

Vision of the Institute

To evolve into a premier engineering institute in the country by continuously enhancing the range of our competencies, expanding the gamut of our activities and extending the frontiers of our operations.

Mission of the Institute

Synergizing knowledge, technology and human resource, we impart the best quality education in Technology and Management. In the process, we make education more objective so that the efficiency for employability increases on a continued basis.

Vision of the Department

To develop competent and socially responsible engineers in the domain of Artificial Intelligence & Machine Learning, Data Science for noteworthy contributions to the society.

Mission of the Department

M1: To educate the students in fundamental principles of computing and develop the skills needed to solve practical problems using contemporary computer-based technologies.

M2: To provide State-of-the-art computing laboratory facilities to promote industry-institute interaction to enhance student's practical knowledge.

M3: To inculcate self-learning abilities, team spirit, and professional ethics among the students to serve society.

The **Programme Educational Objectives (PEOs)** for our Computer Science and Engineering (Data Science) program are to produce graduates who will:

PEO1. Graduates will have the ability to Analyse, Develop and Apply innovative ideas to solve real-world problems using Data Science techniques.

PEO2. To pursue higher studies, graduates will have the ability to contribute novel and scientific research-oriented methods in the Data Science area.

PEO3. Practice the profession with ethics and make them responsible professionals to promote industrial progress growth and societal transformation.

PROGRAM OUTCOMES (POs):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-Long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs):

By the completion of Computer Science program the student will be able to:

PSO1. Apply the fundamental knowledge for problem analysis and conduct investigations in CSE (Data Science) for sustainable development.

PSO2. Design and development of solutions by using modern software for the purpose of execution of the projects in specialized areas.

PSO3. Inculcate effective communication and ethics for lifelong learning with social awareness.

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Academic Regulations 2020 (AR20) for B. Tech
(Effective for the students admitted into I year from the Academic Year 2020-21 onwards)

1. Award of B.Tech Degree:

A student will be declared eligible for the award of the B. Tech. Degree if he/she fulfills the following academic regulations.

Registered for **160** credits and he/she must secure total **160** credits.

Students, who fail to complete their four-year course of study within **8** years or fail to acquire the **160** Credits for the award of the degree within **8** academic years from the year of their admission, shall forfeit their seat in B. Tech course and their admission shall stand cancelled.

2. Courses of study:

The following courses of study are offered at present with specialization in the B.Tech Course.

S. No.	Branch Code-Abbreviation	Branch
01	01-CE	Civil Engineering
02	02-EEE	Electrical and Electronics Engineering
03	03-ME	Mechanical Engineering
04	04-ECE	Electronics and Communication Engineering
05	05-CSE	Computer Science and Engineering
06	12-IT	Information Technology
07	42-CSM	CSE (Artificial Intelligence and Machine Learning)
08	44-CSD	CSE (Data Science)

And any other course as approved by the authorities of the University from time to time.

3. Credits (Semester system from I year onwards):

S. No	Course	Credits
1	Mandatory Course	0
2	Theory Course	3
3	Laboratory Course	1.5
4	Integrated Course	4.5
5	Interdisciplinary/Open Elective Course	3
6	Skill-Oriented/Skill-Advanced/Soft Skills Course	2
7	Internship	1.5/03
8	Project work	12

4. Interdisciplinary/Open Electives:

There are two interdisciplinary electives in II year II semester and III year I semester and one open elective in IV year I semester. The student can choose any one interdisciplinary elective/open elective courses offered in the respective semester. The pattern of Midterm examinations and End examinations of these courses is similar to regular theory courses and the valuation is purely internal.

5. MOOCs:

Explore all possibilities to run at least one subject in every semester from II year I semester onwards as a MOOCs.

6. NCC/NSS activities:

All undergraduate students shall register for NCC/NSS activities. A student will be required to participate in an activity for two hours in a week during II year I semester or II year II semester and evaluated during the II year II Semester. Grade shall be awarded as Satisfactory or Unsatisfactory in the mark sheet on the basis of participation, attendance, performance and behavior. If a student gets an unsatisfactory Grade, he/she shall repeat the above activity in the subsequent years, in order to complete the degree requirements.

7. Evaluation Methodology:

The performance of a student in each semester shall be evaluated with a maximum of **100** marks for theory course, laboratory and other courses. The project work shall be evaluated for **200** marks.

Mandatory Courses:

Mandatory course is one among the compulsory courses and does not carry any Credits. The list of mandatory courses is shown below:

- Induction Program
- Constitution of India
- Environmental Science
- Human Values

No marks or letter grade shall be allotted for all mandatory non-credit courses.

Theory course (100 marks):

For theory course, the distribution shall be **40** marks for internal midterm evaluation and **60** marks for the External End Examinations. Out of **40** internal midterm marks, **25** marks are allotted for descriptive exam, **10** marks for two assignments (**5** marks for each assignment) or one case study (group-wise), and **5** marks for objective test.

Pattern for Internal Midterm Examinations (25 marks):

For theory courses of each semester, there shall be **2** Midterm exams. Each descriptive exam is to be held for **30** marks and will be scaled down to **25** marks, with the duration of **90** minutes.

For final calculation of internal marks, weightage of **70%** will be given to the student who performed well either in first Midterm or second Midterm and **30%** weightage will be given to other Midterm examination.

Midterm paper contains three descriptive type questions with internal choice. Each question carries **10** marks (3×10=30M). The first Midterm examination will be conducted usually after 8 weeks of instruction or after completion of 50% syllabus (i.e. first 3 Units), and the second Midterm examination will be conducted usually at the end of instruction after completion of remaining 50% syllabus (i.e. remaining 3 Units).

Objective test (5 marks):

For theory courses of each semester, there shall be **2** Objective tests to be conducted along with Midterm exam. Each Objective test is to be held for **10** marks with the duration of **10** minutes and will be scaled down to **5** marks.

For final calculation of objective test marks, weightage of **70%** will be given to the student who performed well either in first objective test or second objective test and **30%** weightage will be given to other objective test.

Pattern for External End Examinations (60 marks):

The question paper shall have descriptive type questions for **60** marks. There shall be one question from each unit with internal choice. Each question carries **10** marks. Each course shall consist of six units of syllabus. The student should answer total **6** questions. (6X10M=60M)

Laboratory Course (100 marks):

For laboratory course, there shall be continuous evaluation during the semester for **40** internal marks and **60** semester end examination marks. Out of the **40** marks for internal, **25** marks for day–to–day evaluation, **5** marks for record and **10** marks to be awarded for internal laboratory written test. The end examination shall be conducted by the teacher concerned and external examiner from outside the college.

For the course Engineering Graphics and Design, the distribution shall be **40** marks for internal evaluation (**20** marks for day–to–day evaluation, and **20** marks for internal tests) and **60** marks for end examination.

For the award of marks for internal tests, weightage of **70%** will be given to the student who performed well either in first test or second test and **30%** weightage will be given to other test.

Integrated Course (100 marks):

Integrated courses are exclusively designed to provide a unique learning experience of layered learning where students have a chance to practice while learning. These courses are designed by blending both theory and laboratory components one over the other.

Assessment for **100** marks as given below:

Category	Marks	Assessment
Internal	20	Internal assessment of Laboratory carried out for 40 marks will be scaled down to 20 marks.
	20	Internal assessment of Theory carried out for 40 marks will be scaled down to 20 marks.
End examination	40	End examination of Laboratory carried out for 60 marks will be scaled down to 40 marks.
	20	End examination of Theory carried out for 60 marks will be scaled down to 20 marks.

For Integrated courses, the evaluation of Theory and Laboratory are carried out separately as per evaluation method given in 7.2 and 7.3.

A candidate shall be declared to have passed in integrated course if he/she secures a minimum of **40%** aggregate marks i.e. **40** out of **100** (Internal & Semester-end examination marks put together), subject to a minimum of **35%** marks i.e. **21** marks out of **60** in semester-end examination; in addition to that he/she has to secure minimum of **14** marks (out of **40**) in Laboratory end examination and minimum of **7** marks (out of **20**) in Theory end examination.

Skill Oriented/Skill Advanced Course (100 marks):

Out of a total of **100** marks for the Skill-Oriented/Skill-Advanced Course, **40** marks shall be for the internal evaluation and **60** marks for semester-end examination.

The internal evaluation shall be made on the basis of seminar given by each student on the topic of his/her Skill-Oriented/Skill-Advanced Course, which was evaluated by internal committee constituted by HOD.

The semester-end examination (Viva-Voce) shall be conducted by the committee, consists of an External examiner, Head of the department and Internal supervisor of the Skill-Oriented/Skill-Advanced Course.

Soft Skills (100 marks):

One Soft Skills course is there in III year II semester and Soft skills shall be evaluated for **100** marks. Evaluation pattern of Soft Skills course is similar to the Theory course and evaluation is purely internal.

Internship (100 marks):

All the students shall undergo Community Internship as well as Industrial Internship. Community Internship is for a minimum period of **2** weeks after II year II Semester and Industrial Internship is for a minimum period of **4** weeks after III year II Semester.

Self study report for the Community Internship after the II year II Semester shall be submitted and evaluated during the III year I Semester and Self study report for the Industrial Internship after the III year II Semester shall be submitted and evaluated during the IV year I Semester.

The Self study report will be evaluated for a total of **100** marks consisting of **40** marks for internal assessment and **60** marks for semester-end examination.

Internal assessment for **40** marks shall be done by: internal supervisor in case of community internship and internship supervisor in industry in case of internship in an industry based on day to day observation.

The semester-end examination (Viva-Voce) shall be conducted by the committee, consisting of an External examiner, Head of the department and Internal supervisor of the Internship.

Project (200 marks):

Out of a total of 200 marks for the Project, **80** marks shall be for Project Internal Evaluation and **120** marks for the semester-end Examination.

The Internal Evaluation shall be made on the basis of two seminars given by each student on the topic of his project which was evaluated by an internal committee. Out of **80** internal marks: **20** marks allotted for literature survey, **30** marks for results and analysis, **15** marks for first seminar (usually after 8 weeks) and **15** marks for second seminar (at the end of the semester).

The semester-end examination (Viva – Voce) shall be conducted by the committee, consisting of an External examiner, Head of the Department and Supervisor of the Project. The evaluation of project shall be made at the end of IV year.

Honors/Minor Programme:

The curriculum provides flexibility to enable the competent students to register for B. Tech. degree with Honors/Minor by earning additional 20 credits which are over and above 160 credits for the award of B. Tech. (Regular) degree. The students registered for B. Tech (Honors) shall not be permitted to register for Minor or vice versa.

He/She shall register Honors/Minor during II B.Tech II semester provided he/she secures ≥ 8 CGPA and clearing all the courses in single attempt till II B.Tech I semester. In case of students admitted through lateral entry, the CGPA compliance will be considered from II B.Tech I semester onwards.

If a student is detained due to lack of attendance, he/she shall not be permitted to register the courses of Honors/Minor.

All the students who maintain ≥ 8 CGPA are eligible to enroll for B. Tech with Honors/Minor; however, registration for Honors/Minor degree will be limited to maximum of 35% of the total intake in a particular batch of students.

The students shall have the scope to earn these additional 20 credits from II year II semester to IV year I semester and at any point of time if he/she wishes to withdraw from B. Tech (Honors/Minor) program, the additional credits acquired till that time will get lapsed and cannot be used to compensate with those 160 credits needed for the award of B.Tech degree.

To acquire 20 additional credits, the students shall register for four 4-credit courses under the list of the courses offered by the respective departments and acquire the balance 4 credits by taking two MOOCs NPTEL courses with not less than 8 weeks duration. The student can complete these two MOOCs NPTEL courses during II year II semester to IV year I semester and evaluated and included in the IV year II Semester grade memo.

For the award of B. Tech. degree with Honors the additional 20 credits shall be earned by taking the courses offered by the respective department of study in one domain. A set of four courses are offered under each of the domains preferably from the new emerging areas as recommended by the BoS.

For the award of B. Tech degree with Minor the additional 20 credits shall be earned by taking the inter-disciplinary courses offered preferably from the new emerging areas by other departments.

These additional courses offered by the program may change from time to time based on the demand and resources availability. The courses may be offered in different modes i.e. guided learning/taught courses/Blended mode or combination.

Evaluation methodology of Honors/Minor courses will be similar to the regular B.Tech theory course/laboratory course/integrated course. No Supplementary examination for the courses offered in B.Tech Honors/Minor Program. If a student fails in a course (offered under B.Tech Honors/Minor Program), that course will not be reflected in Grade Memo. The courses passed under Honors/Minor program will not be counted for CGPA/SGPA calculation.

The student who acquires 20 additional credits and maintained ≥ 8 CGPA and acquiring 160 credits in regular B.Tech course and clearing all the courses in single attempt will be awarded the B.Tech degree with Honors/Minor. Any student who fails to fulfill these conditions will automatically get deregistered for B. Tech (Honors)/B.Tech (Minor) without any notification.

Honors/Minor shall not be awarded under any circumstances without completing the regular B. Tech programme in which a student got admitted.

The student is not permitted to repeat any course offered by any department to fulfil credit requirement for Honors/Minor program.

8. Attendance Requirements:

A student shall be eligible to appear for the semester-end examinations, if he/she acquires a minimum of **75%** of attendance in aggregate of all the subjects.

Condonation of shortage of attendance in aggregate up to **10%** (**65%** and above and below **75%**) in each semester with genuine reasons shall be approved by a committee duly appointed by the college. The condonation approved otherwise can be reviewed by the College Academic Committee. A fee stipulated by the college shall be payable towards condonation of shortage of attendance.

Shortage of Attendance below **65%** in aggregate shall in NO case be condoned.

A Student will not be promoted to the next semester unless he satisfies the attendance requirement of the present semester. He/she may seek re-admission for that semester when offered next.

The overall attendance in each semester of regular B. Tech course and Honors/Minor course shall be computed separately.

A student shall maintain an attendance of 75% in each course of Honors/Minor to appear for semester end examination of Honors/Minor. Condonation of shortage of attendance up to **10%** (**65%** and above and below **75%**) in each course with genuine reasons shall be approved by a committee duly appointed by the college. A separate fee stipulated by the college shall be payable towards condonation of shortage of attendance in Honors/Minor.

A student detained due to lack of attendance in Honors/Minor course shall not be permitted to continue Honors/Minor programme, but he/she can continue regular B. Tech programme.

9. Minimum Academic Requirements:

Conditions for pass and award of credits for a course:

A candidate shall be declared to have passed in individual course if he/she secures a minimum of **40%** aggregate marks i.e. **40** out of **100** (internal & semester-end examination marks put together), subject to a minimum of **35%** marks i.e. **21** marks out of **60** in semester-end examination.

On passing a course of a programme, the student shall earn assigned credits in that Course.

Method of Awarding Letter Grades and Grade Points for a Course:

A letter grade and grade points will be awarded to a student in each course based on his/her performance as per the grading system given below.

Table: Grading System for B.Tech Programme

Marks Range	Level	Letter Grade	Grade Points
>= 90%	Outstanding	A+	10
80 – 89%	Excellent	A	9
70 – 79%	Very Good	B	8
60 – 69%	Good	C	7
50 – 59%	Fair	D	6
40 – 49%	Satisfactory	E	5
< 40%	Fail	F	0
-	Absent	AB	0

Calculation of Semester Grade Points Average (SGPA) for semester:

The performance of each student at the end of the each semester is indicated in terms of SGPA.

The SGPA is calculated as below:

$$SGPA = \frac{\Sigma(CR \times GP)}{\Sigma CR} \quad \text{(for all courses passed in a semester)}$$

Where CR = Credits of a Course
GP = Grade points awarded for a course

Calculation of Cumulative Grade Points Average (CGPA) and Award of Divisionfor entire programme:

The CGPA is calculated as below:

$$CGPA = \frac{\Sigma(CR \times GP)}{\Sigma CR} \quad \text{(for the entire programme)}$$

Where CR = Credits of a course
GP = Grade points awarded for a course

- Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.
- As per the AICTE regulations, conversion of CGPA into equivalent percentage as follows:
  Equivalent Percentage = (CGPA – 0.75) x 10

Award of Class:

Class Awarded	CGPA to be secured	Remarks
First Class with Distinction	≥ 7.75 (Without any supplementary appearance)	From the CGPA secured from 160 Credits
First Class	≥ 6.75	
Second Class	≥ 5.75 and < 6.75	
Pass Class	≥ 5.0 and < 5.75	

Supplementary Examinations:

Supplementary examinations will be conducted in every semester.

Conditions for Promotion:

(i) A student will be promoted to second year if he/she satisfies the minimum attendance requirement.

(ii) A student shall be promoted from II to III year only if he fulfills the academic requirement of total **50%** credits (if the number of credits is in fraction, it will be rounded off to a lower digit) from regular and supplementary examinations of I year and II year examinations, irrespective of whether the candidate takes the examination or not.

(iii) A student shall be promoted from III year to IV year only if he fulfills the academic requirements of total **50%** credits (if number of credits is in fraction, it will be rounded off to lower digit) from regular and supplementary examinations of I Year, II Year and III Year examinations, irrespective of whether the candidate takes the examinations or not.

10. Course pattern:

(i) The entire course of study is of four academic years and each year will have TWO Semesters (Total EIGHT Semesters).

(ii) A student is eligible to appear for the end examination in a subject, but when absent for it or failed in the end examinations he/she may appear for that subject's supplementary examinations, when offered.

(iii) When a student is detained due to lack of credits / shortage of attendance, he may be re-admitted when the semester is offered after fulfillment of academic regulations. Whereas the academic regulations hold well with the regulations he/she first admitted.

11. Minimum Instruction Days:

The minimum instruction days for each semester shall be **90**.

12. There shall be no branch transfer after the completion of admission process.

13. General:

(i) Wherever the words “he,” “him,” “his,” occur in the regulations, they include “she,” “her,” “hers” as well.

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

(iii) In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the principal is final.

(iv) 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.

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Academic Regulations 2020 (AR20) for B. Tech (Lateral Entry Scheme)
(Effective for the students admitted into II year from the Academic Year 2021-22 onwards)

1. Award of B. Tech. Degree:

A student will be declared eligible for the award of the B. Tech. Degree if he/she fulfills the following academic regulations.

Registered for **121** credits and he/she must secure total **121** credits.

Students, who fail to complete their three-year course of study within **6** years or fail to acquire **121** Credits for the award of the degree within **6** academic years from the year of their admission shall forfeit their seat in B. Tech course and their admission shall stand cancelled.

2. Promotion Rule:

A lateral entry student will be promoted from II year to III year if he satisfies the minimum required attendance in II year.

A student shall be promoted from III year to IV year only if he fulfills the academic requirements of total **50%** of credits (if the number of credits is in fraction, it will be rounded off to lower digit) from the II Year and III Year examinations, irrespective of whether the candidate takes the examinations or not.

3. All other regulations as applicable for B. Tech. four- year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme)

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DISCIPLINARY ACTION FOR MALPRACTICES / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/Improper conduct	Punishment
1	If the student possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the student which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
	If the student gives assistance or guidance or receives it from any other student orally or by any other body language methods or communicates through cell phone with any student or students in or outside the exam hall with respect to any matter	Expulsion from the examination hall and cancellation of the performance in that subject only. In case of an outsider, he will be handed over to the police and a case is registered against him.
2	If the student has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the student is appearing	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year.
3	If the student impersonates any other student in connection with the examination	The student who has impersonated shall be expelled from examination hall. The student is also debarred and forfeits the seat. The performance of the original student, who has been impersonated, shall be cancelled in all the subjects of the examination (including practical's and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all semester-end examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of the seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4	If the student smuggles the answer book or additional sheet or takes out or arranges to send out the question paper or answer book or additional sheet during or after the examination	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all semester-end examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of the seat.
5	If the student uses objectionable, abusive or offensive language in the answer script or in letters to the examiners or writes to the examiner requesting him to award pass marks	Cancellation of the performance in that subject.
6	If the student refuses to obey the orders of the Chief Superintendent/Assistant -Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walkout or instigates others to walk out or threatens the officer-in charge or any person on duty in or outside the examination hall or causes any injury to any of his relatives either by words spoken or written or by signs or by visible representation, assaults the officer-in-charge or any person on duty in or outside the examination hall or any of his relatives, or indulges in any other act of misconduct or mischief which results in damage or destruction of property in the examination hall or any part of the	In case of students of the college, they shall be expelled from examination hall and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The students also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.

	college campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination	
7	If the student leaves the exam hall taking away answer script or intentionally tears off the script or any part thereof inside or outside the examination hall	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all university examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of the seat.
8	If the student possesses any lethal weapon or firearm in the examination hall	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred and forfeits the seat.
9	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clauses 6, 7, 8	In case of student of the college, expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the college will be handed over to police and. a police case will be registered against them.
10	If the student comes in a drunken condition to the examination hall	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny	Cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work of that semester/year examinations.

ADITYA INSTITUTE OF TECHNOLOGY & MANAGEMENT, TEKKALI – 532201

(An Autonomous Institution)

B.Tech COURSE STRUCTURE (AR – 20)

Department of CSE (Data Science)

I YEAR I SEMESTER

Category	Code	Theory/Lab	L	T	P	C
MC	20MCT101	Induction Program	3 weeks			0
HSSC	20HST101	English	3	0	0	3
BSC	20BST101	Linear Algebra and Calculus	2	1	0	3
BSC	20BST107	Chemistry	3	0	0	3
ESC	20**ESI102**	Programming for problem solving	3	0	3	4.5
ESC	20ESL103	Engineering Graphics & Design	1	0	4	3
HSSC	20HSL101	Language Proficiency Lab	0	0	3	1.5
BSC	20BSL102	Chemistry Lab	0	0	3	1.5
Total			**12**	**1**	**13**	**19.5**

I YEAR II SEMESTER

Category	Code	Theory/Lab	L	T	P	C
MC	20MCT103	Constitution of India	2	0	0	0
BSC	20BST102	Differential Equations	2	1	0	3
BSC	20BST105	Applied Physics	3	0	0	3
PC	20CST101	Data Structures and Algorithms	3	0	0	3
ESC	20EST101	Basic Electrical Engineering	3	0	0	3
ESC	20ESL104	IT Workshop	1	0	4	3
BSC	20BSL101	Physics Lab	0	0	3	1.5
ESC	20ESL101	Basic Electrical Engineering Lab	0	0	3	1.5
PC	20CSL101	Data Structures and Algorithms Lab	0	0	3	1.5
		Total	**14**	**1**	**13**	**19.5**

II YEAR I SEMESTER

Category	Code	Theory/Lab	L	T	P	C
MC	20MCT202	Environmental Science	2	0	0	0
ESC	**20ESI204**	Python Programming	3	0	3	4.5
ESC	20EST205	Digital Logic Design	3	0	0	3
PC	20CST202	Discrete Mathematics	2	1	0	3
PC	20CST203	Computer Organization and Architecture	3	0	0	3
PC	20CDT201	Data Base Management Systems	3	0	0	3
ESC	20ESL205	Digital Logic Design Lab	0	0	3	1.5
PC	20CDL201	Data Base Management Systems Lab	0	0	3	1.5
SC	20CDS201	Skill Oriented Course – I	1	0	2	2
		Total	**17**	**1**	**11**	**21.5**

II YEAR II SEMESTER

Category	Code	Theory/Lab	L	T	P	C
MC	20MCS204	NCC/NSS	2	0	0	0
MC	20MCT204	Human Values	2	0	0	0
BSC	20BST204	Probability & Statistics with R	3	0	0	3
PC	20CDT202	Data Warehousing and Data Mining	2	1	0	3
PC	20CDT203	Object Oriented Programming	3	0	0	3
PC	20CDT204	Fundamentals of Data Science	3	0	0	3
OE	20IET21X	Interdisciplinary Elective – I	3	0	0	3
BSC	20BSL203	Probability & Statistics with R Lab	0	0	3	1.5
PC	20CDL202	Object Oriented Programming through Java Lab	0	0	3	1.5
PC	20CDL203	Fundamentals of Data Science Lab	0	0	3	1.5
SC	20CDS202	Skill Oriented Course – II	1	0	2	2
		Total	**19**	**1**	**11**	**21.5**
Community Internship (2 weeks) (Mandatory) during summer vacation						

Subject Code	Interdisciplinary Elective – I	Offered for Dept.
20IET211	Transform Theory	MECH/CIVIL
20IET212	Numerical Methods	ECE/EEE
20IET213	Introduction to Number Theory	CSE/IT/CSM/CSD
20IET214	Elements of building planning	MECH
20IET215	Remote Sensing	ECE/EEE/CSE/IT/CSM/CSD
20IET216	Mathematical Simulation and Modeling	ECE/MECH/CIVIL/CSE/IT/CSM/CSD
20IET217	Fundamentals of Material Science	ECE/EEE/CIVIL/CSE/IT/CSM/CSD
20IET218	Introduction to Electronic Measurements	EEE/MECH/CIVIL/CSE/IT/CSM/CSD
20IET219	UNIX Utilities	ECE/EEE/MECH/CIVIL
20IET21A	Fundamentals Data Structures	ECE/EEE/MECH/CIVIL
20IET21B	Advanced Coding – I	CSE/IT/CSM/CSD
20IET21C	Competitive Programming – I	ECE/EEE/MECH/CIVIL

III YEAR I SEMESTER

Category	Code	Theory/Lab	L	T	P	C
PC	20CDT305	Compiler Design	3	0	0	3
PC	20CDT306	Operating Systems	3	0	0	3
PC	20CDT307	Machine Learning	3	0	0	3
PE	20CDE31X	Professional Elective – I	3	0	0	3
OE	20IET32X	Interdisciplinary Elective – II	3	0	0	3
PC	20CDL304	Operating Systems & Compiler Design Lab	0	0	3	1.5
PC	20CDL305	Machine Learning Lab	0	0	3	1.5
SC	20CDS303	Skill Advanced Course – I	1	0	2	2
I/P	20CDP301	Community Internship	0	0	0	1.5
		Total	**16**	**0**	**8**	**21.5**

Professional Elective – I

CODE	COURSE
20CDE311	Software Engineering and Agile Approach
20CDE312	Object Oriented Analysis and Design(OOAD)
20CDE313	DevOps
20CDE314	Computer Networks

Subject Code	Interdisciplinary Elective – II	Offered for Department
20IET321	Fundamentals of Fuzzy Logic	All
20IET322	Geographical Information System	ECE/EEE/MECH/CSE/IT/CSM/CSD
20IET323	Renewable energy sources	ECE/MECH/CIVIL/CSE/IT/CSM/CSD
20IET324	Fundamentals of ROBOTICS	ECE/EEE/CIVIL/CSE/IT/CSM/CSD
20IET325	Principles of communications	EEE/MECH/CIVIL/CSE/IT/CSM/CSD
20IET326	JAVA Programming	ECE/EEE/MECH/CIVIL
20IET327	Introduction to DBMS	ECE/EEE/MECH/CIVIL
20IET328	Advanced Coding – II	CSE/IT/CSM/CSD
20IET329	Competitive Programming – II	ECE/EEE/MECH/CIVIL

III YEAR II SEMESTER

Category	Code	Theory/Lab	L	T	P	C
PC	**20CDI308**	Design Analysis of Algorithms	3	0	3	4.5
PC	20CDT309	Big Data Analytics	3	0	0	3
HSSC	20HST303	MEMS	3	0	0	3
PE	20CDE32X	Professional Elective – II	3	0	0	3
PE	20CDE33X	Professional Elective – III	3	0	0	3
HSSC	20HSL302	Professional Communication Skills Lab	0	0	3	1.5
PC	20CDL306	Big Data Analytics Lab	0	0	3	1.5
SC	20SSS301	Soft Skills	1	0	2	2
		Total	**16**	**0**	**11**	**21.5**
Industrial Internship (4 Weeks) (Mandatory) during summer vacation						

Professional Elective – II

CODE	COURSE
20CDE321	IOT
20CDE322	Software Project Management
20CDE323	Distributed Systems
20CDE324	Data Wrangling in Data Science

Professional Elective – III

CODE	COURSE
20CDE331	ETL Principles
20CDE332	Business Intelligence
20CDE333	Predictive Analytics and IOT

IV YEAR I SEMESTER

Category	Code	Theory/Lab	L	T	P	C
PC	20CDT410	Deep Learning	3	0	0	3
PC	20CDT411	Snowflake Cloud Analytics	3	0	0	3
PE	20CDE44X	Professional Elective – IV	3	0	0	3
PE	20CDE45X	Professional Elective – V	3	0	0	3
OE	20OET41X	Open Elective	3	0	0	3
PC	20CDL407	Deep Learning with Tensorflow Lab	0	0	3	1.5
PC	20CDL408	Snowflake Cloud Analytics Lab	0	0	3	1.5
SC	20CDS404	Skill Advanced Course - II	1	0	2	2
I/P	20CDP402	Industrial Internship	0	0	0	3
		Total	**16**	**0**	**8**	**23**

Professional Elective – IV

CODE	COURSE
20CDE441	Social Media Analytics
20CDE442	Nature Inspired Computing Technique
20CDE443	Reinforcement Learning

Professional Elective – V

CODE	COURSE
20CDE451	Cloud Computing
20CDE452	Information Retrieval Systems
20CDE453	NoSQL Databases
20CDE454	Recommender Systems

Subject Code	Offered by Dept.	Open Elective	Offered for Dept.
20OET411	MBA	HRD & Organizational behavior	All
20OET412	MBA	Project Management	All
20OET413	MBA	Entrepreneurial Development	All
20OET414	MBA	Digital Marketing	All
20OET415	CIVIL	Environmental impact assessment	All
20OET416	EEE	Energy Audit Conservation and Management	All
20OET417	MECH	Optimization Techniques	All
20OET418	CSE	Block chain Technologies	All
20OET419	IT	IT systems Management	All
20OET41A	CSM	API and Micro Services	All

IV YEAR II SEMESTER

Category	Code	Theory/Lab	L	T	P	C
I/P	20CDP403	Project work	0	0	0	12
Total						12

English
(Common to all Branches)

Subject Code: 20HST101

L	T	P	C
3	0	0	3

Course Objectives

- To enable students build vocabulary appropriate to their levels and to make students understand printed texts of different genres
- To enhance basic writing skills of the students in different forms of written communication
- To assist students implicitly synthesize the rules of grammar for the production of accurate sentences
- To help students learn rules of using punctuation marks and prepositions appropriately in writing
- To aid students acquire appropriate and adequate letter writing skills
- To get students develop reading skills and enhance their essay writing skills

Course Outcomes

1. Students will be able to comprehend printed texts of different genres more easily and they will be able to make appropriate word choice.
2. Students will be able to write short texts masterly.
3. Students will be able to construct grammatically correct sentences.
4. Students will be able to use punctuation marks and prepositions correctly in speech and writing.
5. Students will be able to communicate through letters and emails effectively.
6. Students will be able to comprehend unfamiliar passages, and will be able to write essays.

Unit – I *Father's Help* by R K Narayan
Synonyms and Antonyms — One-word substitutes

Unit – II *My Early Days* by A P J Abdul Kalam
Tense— Voice — *If* clauses

Unit – III *The Road Not Taken* by Robert Frost
Reported Speech—Degrees of Comparison — Simple, Compound, Complex Sentences

Unit – IV *Politics and the English Language* by George Orwell
Punctuation —Prepositions

Unit–V *Mother's Day* by J. B. Priestly
Letter Writing — E-mail Writing

Unit – VI *Chipko Movement*
Reading Comprehension—Essay Writing

Text Books

1. *On Writing Well.* William Zinsser. Harper Resource Book. 2001
2. *Practical English Usage*. Michael Swan. Oxford University Press. 1995.
3. *Study Writing.* Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
4. *Hugging the Trees: The Story of the Chipko Movement*. Thomas Weber. Viking Publishers, New Delhi, 1988.

Linear Algebra and Calculus
(Common to all Branches)

Subject Code : 20BST101

L	T	P	C
2	1	0	3

Course Objectives:

- Understand the process of calculation of rank, solution of System of Linear Homogeneous and Non Homogeneous equations by Gauss Elimination method.
- Learn the process of calculating the Eigen values, Eigenvectors and Quadratic Forms.
- Understand the concepts of multiple integrals and their usage.
- Learn the properties of Gamma and Beta Functions, their relation and evaluation of improper integrals.
- Understand the concepts of gradient, divergence, curl of scalar and vector point functions.
- Understand and calculate Line Integral, Surface Integral, Volume Integral, concepts of Green's, Stokes and Gauss Divergence theorems in converting one integral form to another

Course Outcomes:

The student will be able to:

1. Calculate the rank and solve linear homogeneous and non homogeneous equations by Gauss Elimination method.
2. Calculate eigen values, eigen vectors and estimate the nature of the matrix..
3. Evaluate multiple integral in both Cartesian and polar coordinates.
4. Apply Beta and Gamma functions to solve improper integrals.
5. Calculate gradient, divergence, curl of a scalar and vector point functions and derive vector identities.
6. Solve a Line Integral, Surface Integral, Volume Integral, apply Green's, Stokes and Gauss Divergence theorems in converting one integral form to another.

Unit – I

Linear System of Equations: *Matrices – Rank- echelon form – Normal form – System of Linear Homogeneous and Non Homogeneous equations – Gauss Elimination method- Applications- Matrix representation for a Graph- Current in an electrical circuit.* (8 hrs)

Unit – II

Eigen Values, Eigen Vectors, Quadratic Forms: *Eigen values – Eigenvectors – Properties (an over view)- Diagonalization- Quadratic Forms- Reduction of Quadratic Forms to Canonical Form- Rank-Nature-Index-Signature.* (8 hrs)

Unit – III

Multiple Integrals: *Double integral (Cartesian and polar form) -Change of order of integration - Change of variables (Cartesian to polar)- Triple integrals – Change of variables (Cartesian to spherical/cylindrical).* (8 hrs)

Unit – IV

Special functions: *Gamma and Beta Functions – Properties - Relation between Beta and Gamma functions-Evaluation of improper integrals.* (8 hrs)

Unit – V

Vector Differential Calculus: Scalar and Vector point functions- Vector differentiation - Directional derivatives – Gradient, Curl and Divergence- Vector identities. (8 hrs)

Unit – VI

Vector Integral Calculus: Vector Integration –Line Integral, Surface Integral, Volume Integral – Green Theorem, Stokes Theorem and Gauss Divergence theorem (without proofs with simple illustrations only). (8 hrs)

Text Books

1. B.V. Ramana, Higher Engineering Mathematics, 44th Edition, Tata McGraw Hill New Delhi, 2014.
2. Dr.B.S.Grewal, Higher Engineering Mathematics, 43nd Edition, Khanna Publishers, 2015.

Reference Books

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. **G.B. Thomas and R.L. Finney**, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
3. **Veerarajan T**., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. **D. Poole**, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
5. **N.P. Bali and Manish Goyal**, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

Chemistry
(Common to all Branches)

Subject Code : 20BST107

L	T	P	C
3	0	0	3

Course Objectives:

The students will become familiar and understand about:

- Rationalise the importance of water for society and industrial needs.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.
- To become familiar in moulding methods of preparation of different types of plastic materials
- Rationalise organic reactions such as addition, substitution, elimination, rearrangement reactions.
- Rationalise reference electrodes and science of corrosion.
- Distinguish Renewable & Non-Renewable energy resources and rationalise about green chemistry, batteries.

Course Outcomes:

The course will enable the student to:

1. Rationalise the importance of water for society and industrial needs.
2. Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
3. Differentiate different moulding techniques of plastic materials
4. Rationalise organic reactions such as addition, substitution, elimination, rearrangement reactions.
5. Rationalise the science of corrosion.
6. Distinguish Renewable & Non-Renewable energy resources and rationalise about green chemistry, batteries.

Unit – I

Water Technology Hardness of Water – Temporary and Permanent Hardness - Units of Hardness - Estimation of Hardness by EDTA Method - Problems on Temporary and Permanent Hardness - Disadvantages of Hard Water – Softening Methods of Hard Water- Zeolite or Permutit Process - Ion Exchange Process - Methods of Treatment of Water for Domestic Purposes – Sedimentation, Coagulation, Filtration, Disinfection - Sterilization, Chlorination, Break Point chlorination, Ozonisation. ***(9 lectures)***

Unit – II

Spectroscopy Spectroscopy - Electronic Spectroscopy - Types of Electronic Transitions - Definition of Chromophore – Definition of Auxochrome – Absorption and Intensity Shifts - Introduction to I.R. Spectroscopy – Fingerprint Region – Introduction to NMR – Principle - Equivalent and Non-Equivalent Protons - Chemical Shift- Splitting – Coupling Constant. ***(8 lectures)***

Unit – III

Polymers and Plastics Definitions of Polymer, Polymerization – Functionality – Degree of polymerization - Types of Polymerization (Addition and Condensation Polymerizations) - Plastics – Definition, Thermoplastics, Thermosetting Plastics – Compounding of Plastics – Moulding of Plastics into Articles (Compression, Injection, Transfer and Extrusion Moulding Methods) - Preparation, Properties and Engineering Uses of PVC and Bakelite. ***(7 lectures)***

Unit – IV

Organic Reactions Types of Organic reactions: Addition - Electrophilic, Nucleophilic and Free radical - Substitution - Electrophilic, Nucleophilic (SN^1 and SN^2) and Free radical – Elimination (E_1 and E_2) – Rearrangement Reactions (Claisen, Pinacol Pinacolone Rearrangement). ***(7 lectures)***

Unit – V

Corrosion and Its Control Definition of Corrosion – Theories of Corrosion (Chemical & Electrochemical) – Mechanism of Electrochemical Corrosion (Oxygen Absorption Type and Hydrogen Evolution Type) - Galvanic Series - Factors Influencing Corrosion – Corrosion Control Methods - Proper Designing, Modifying the Environment, Cathodic Protections – Sacrificial Anodic Protection and Impressed Current Cathodic Protection. Metallic (Anodic and Cathodic) Coatings – Methods of application on metals (Galvanizing and Tinning). ***(9 lectures)***

Unit – VI

Green Chemistry & Energy Introduction to green chemistry – Definition and 12 principles of green chemistry. Types of energy sources – Renewable & Non-Renewable - Introduction to solar energy – harnessing of solar energy – photo voltaic cells – Concentrated Solar power plants.
Introduction of Energy storage devices: Principle& mechanism of Batteries & Supercapacitors, Types of Batteries (Alkaline & Lead-Acid) - Difference between Batteries and Supercapacitors. ***(8 lectures)***

Text Books

1. University chemistry, by B. H. Mahan
2. Elementary organic spectroscopy: principles and applications, by Y. R. Sharma
3. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
4. "Engineering Chemistry", P. C. Jain and Monica Jain, Dhanpat Rai Publications, Co., New Delhi, 2004, 16th Edition

Reference books:

1. Fundamentals of Molecular Spectroscopy, by C. N. Banwell
2. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
3. Physical Chemistry, by P. W. Atkins
4. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition.
5. Concise Inorganic Chemistry: Fifth Edition by J.D. Lee

Programming for Problem Solving
(Common to all Branches)

Subject Code : 20ESI102

L	T	P	C
3	0	3	4.5

Course Objective

The course is designed to provide complete knowledge of C language. Students will be able to develop logics which will help them to create programs, applications in C. Also by learning the basic programming constructs they can easily switch over to any other language in future.

Course Outcomes

1. Understand the fundamentals of C programming
2. Choose the loops and decision making statements to solve the problem
3. Make use of pointers to access arrays, strings and implements different operations on arrays, and work with textual information, characters and strings.
4. Apply programming to write modular programs, user defined functions to solve real time problems and allocate memory using dynamic memory management functions.
5. Create user defined data types including structures and unions to solve problems.
6. Implement files operations in C programming for a given application and able to handle errors during program execution.

Unit – I

Introduction to Programming: Introduction to components of Computer system, Algorithm, Flow chart, Program development steps, C Tokens, Operator precedence, Structure of C program, Basic I/O statements.

Exercise Questions: 1

Ex 1: Write the C programs to calculate the following

a) Area of triangle when sides are given.
b) Program for Type Casting.
c) Interchanging values of two variables.

Ex 2: Write the C programs to perform the following

a) Read lower case character and convert into upper case.
b) Find maximum of 3 values using conditional operator.
c) Calculate area and perimeter of circle.

Unit – II

Control Structures: Decision statements: if, if-else, nested if and switch, **Iterative statements:** for, while, do while and nested loops **Branching:** Break, continue, goto.

Exercise Questions: 2

Ex 3: Write C programs for the following using decision making statements

a) Program to find roots of quadratic equation.
b) Find the Largest among 3 values.
c) Calculate the grades of a student.

Ex 4: Write C programs for the following using Iterative Statements

a) Arithmetical operations using switch-case.
b) Read a number and display in reverse.
c) Check for Armstrong number property

Ex 5:

a) Generate Fibonacci series.
b) Generate Prime numbers between two numbers.
c) Write a program in C to display the pattern like right angle triangle using an asterisk

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Unit – III

Arrays: Definition, Types: 1D, Multi Dimensional arrays, declaration, initialization, accessing elements, Matrix operations and String Handling.

Pointers: Definition, Declaration, Initialization, Pointer arithmetic, Pointer to pointer, arrays and pointers, Dynamic memory allocation

Exercise Questions: 3

Ex 6: Implement the following using arrays

a) Largest and smallest from a list of elements.
b) Program for Linear Search.
c) Program for Bubble Sort.

Ex 7: Implement the following using arrays

a) Matrix addition.
b) Matrix Multiplication.
c) Program using string handling functions

Ex 8: Implement the following using DMA Functions

a) Find the sum and average of list of elements using DMA Functions
b) Implementation of call by reference and call by valve.

Ex 9:

a) Implement C Program using any numerical methods

Unit – IV

Functions: Definitions, Declaration, Types of Functions, Parameter passing, Passing Arrays to functions, Recursion, library functions, functions and pointers, and Storage classes,

Exercise Questions: 4

Ex 10:

a) Factorial using recursion and non recursion.
b) GCD using recursion and non recursion.
c) To count the digits of a given number using recursion

Unit – V

Structures: Definition, Declaration, Accessing the structure elements, Array of structures, Arrays with in structures, pointer to structure, passing structure to function, nested structures, and unions.

Exercise Questions: 5

Ex: 11

a) Implementation of array of structure
b) Demonstration of Union

Unit – VI

Files: Definition, Types of files, Opening modes, File IO Functions, Random access functions, Preprocessor directives.

Exercise Questions: 6

Ex 12:

a) Copy the contents of one file into another.
b) Count the number of characters, words and lines in a file.

Text Books

1. B. W Kernighan, Dennis M. Ritchie. The C – Programming Language. 2nd Edition, PHI.
2. Behrouz A. Forouzan, "A Structured Approach Using C" Richard F. Gilberg 3rd Edition
3.G.S.N Murty, S Vishnu Murty, "Problem solving Through 'C'- User Friendly Approach", First Edition, MANTECH Publication Pvt.Ltd., 2021

References

1. Yashwant Kantikar. 2012. Let Us C, 8th Ed. PBP Publications.
2. E. Balagurusamy. 2011. C Programming. Tata Mc Graw Hills, New Delhi, India.

Web Links:

1. https://www.tutorialspoint.com › Cprogramming › C – Home
2. https://www.programiz.com/c-programming

Engineering Graphics & Design
(Common to all Branches)

Subject Code : 20ESL103

L	T	P	C
1	0	4	3

Course Objectives:

- Able to develop drawing skills.
- To draw orthographic views from the given isometric view and vice verse
- To understand the fundamentals of computer aided design and drafting

Course Outcomes:

1. Draw projection of points and straight lines in first angle projection.
2. Project plane surfaces and simple solids inclined to one reference plane.
3. Convert orthographic views into isometric projections and vice-versa.
4. Draw basic lines and profiles with commonly used operations in drafting software.
5. Generate 2D drawings along with dimensioning in drafting software.

List Of Exercises

PART-A: Conventional Engineering drawing

1 Projections of points
2 Projections of straight lines inclined to one reference plane only.
3 Projections of planes inclined to one reference plane only.
4 Projections of simple solids inclined to one reference plane only.
5 Conversion of isometric views into orthographic views
6 Conversion of orthographic views into isometric views.

PART-B: Basic Computer aided engineering drawing (2-D drawings)

1. Commands – Axes, Coordinate points, Creation of lines, Polylines, Square, Rectangle, Polygons, Spines, Circles, Ellipse, Text.
2. Move, Copy, Offset, Mirror, Rotate, Trim, Extend, Break, Chamfer, Fillet, Curves.

Note: Six Exercises are to be completed by using AutoCAD software

Text Books:

1. Engineering Drawing, N. D. Bhatt, V. M. Panchal, Charotar Pub.
2. Engineering Drawing, K. L .Narayana, P.Kanniah, Scitech Pub.

Reference Books:

1. Engineering Drawing and Graphics, 2nd ed., K. Venugopal, New Age International Pub.
2. Fundamentals of Engineering Drawing, 11th ed., Luzadder, J. Warren, D.M. Jon, Prentice Hall India Pub.

Language Proficiency Lab
(Common to all Branches)

Subject Code : 20HSL101

L	T	P	C
0	0	3	1.5

Course Objectives

- To enable students develop neutralized accent
- To assist students utter words intelligibly
- To enhance the ability of students to speak spontaneously
- To help students converse aptly as the context demands
- To get students acquire perceptive abilities in professional conversations
- To aid students grasp and interpret information provided in graphs and tables

Course Outcomes

1. Students will be able to recognize differences among various accents and speak with neutralized accent.
2. Students will be able to pronounce words accurately with the knowledge of speech sounds and use appropriate rhythm and intonation patterns in speech.
3. Students will be able to speak extemporaneously about anything in general.
4. Students will be able to generate dialogues for various situations.
5. Students will be able to present posters perceptively and concisely.
6. Students will be able to comprehend and interpret data provided in graphs and tables.

Course Syllabus

Unit – I

Listening Comprehension of Audio and Video clips of different accents Pronunciation—

Unit – II

Intonation—Stress—Rhythm

Unit – III

JAM — Narration of an Event

Unit – IV

Situational Dialogues

Unit – V

Poster Presentation

Unit – VI

Interpretation of Data in Graphs and Tables

Text Books

1. *Communication Skills*. Sanjay Kumar and Pushpa Lata. OUP. 2011.
2. *Practical English Usage.* Michael Swan. OUP. 1995.
3. *Speak Well*. K. Nirupa Rani. Orient Blackswan, Hyderabad. 2012.
4. *Strengthen Your Communication Skills*. M. Hari Prasad. Maruthi Publications, Hyd. 2014.
5. *Strengthen Your Steps*. M. Hari Prasad. Maruthi Publications, Hyderabad. 2012.
6. *Technical Communication*. Meenakshi and Sangeetha. OUP. New Delhi. 2013.

Chemistry Lab
(Common to all Branches)

Subject Code : 20BSL102

L	T	P	C
0	0	3	1.5

Course Objectives

The students will become familiar and understand about:

- Measure molecular/system properties such as kinematic viscosity, acid number of lubricating oil, etc
- Measure molecular/system properties such as surface tension and viscosity.
- Measure molecular/system properties such as pH, conductance of solutions, redox potentials, etc
- Measure molecular/system properties such as chloride content, hardness of water, dissolved oxygen, etc.
- Synthesize a small polymer molecule and analyze a salt sample.
- Estimate iron (by colorimeter), partition coefficient, and adsorption of acetic acid by Charcoal etc.

Course Outcomes:

The students will learn to:

1. Measure molecular/system properties such as kinematic viscosity, acid number of lubricating oil, etc.
2. Measure molecular/system properties such as surface tension and viscosity.
3. Measure molecular/system properties such as pH, conductance of solutions, redox potentials, etc
4. Measure molecular/system properties such as chloride content, hardness of water, dissolved oxygen, etc.
5. Synthesize a small polymer molecule and analyze a salt sample.
6. Estimate iron (by colorimeter), partition coefficient, and adsorption of acetic acid by charcoal, etc.

List of Experiments
(Choice of 10-12 experiments from the following)

1. Determination of surface tension and viscosity
2. Determination of Hardness of water sample by EDTA Method.
3. Conductometric estimation of Acid by Base.
4. Conductometric estimation of mixture of acids by base.
5. Potentiometric Titrations.
6. Synthesis of a polymer/drug.
7. Determination of acid value of an oil
8. Chemical analysis of a salt
9. Determination of Dissolved Oxygen present in the given water sample by Modern Winkler's Method
10. Colorimetric estimation of iron
11. pH metric titrations
12. Determination of the partition coefficient of a substance between two immiscible liquids
13. Adsorption of acetic acid by charcoal Use of the capillary viscosimeters to the demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg
14. Potentiometric Titration of a Chloride-Iodide Mixture.
15. Determination of Chloride content present in given water sample.
16. Determination of kinematic viscosity of given lubricating oil.

Text Books

1. "Practical Engineering Chemistry" by K.Mukkanti, etal. B.S.Publications, Hyderabad (2011).
2. "Lab Manual on Engineering Chemistry" by Sudharani, Dhanpat Rai Publications, Co., New Delhi., (2009).

Reference Books

1. "Engineering Chemistry Lab Manual" by Shuchi Tiwari (2010), SCITECH Publications.
2. "Vogel's Text Book of Quantitative Chemical Analysis", 6th Edition by G. J. Jeffery, J. Bassett, J. Mendham, R.C. Denney, Longman Scientific & Technical Publications, New York.
3. "A Text Book of Engineering Chemistry" by R. N. Goyal and H. Goel, Ane Books (P) Ltd.(2009).
4. "A Text Book on experiments and calculations Engineering" by S.S. Dara, S.Chand & Company Ltd. (2003).
5. "Instrumental methods of Chemical Analysis", Gurudeep R, Chatwal Sham, K. Anand, Latest Edition (2015), Himalaya Publications.

Constitution of India
(Common to all Branches)

Subject Code: 20MCT103

L	T	P	C
2	0	0	0

Course Objectives

1. To help Students regulate their behavior in a social environment as Engineering Professionals.
2. To make students aware of the impact of taking social, legal and Administrative decisions about their profession.
3. To understand the political and constitutional parameters in work environment.
4. To understand the need and strengths of our nation and adopt their knowledge for future career.

Course Outcomes

By the end of this course the student will be able to

1. Realize the rigidness of our Indian Politics and Administrative aspects.
2. A Student can understand our nation federalism.
3. Can assess different types of risks involved in misadministration.
4. Can create competitive advantage.
5. Summarizes the legal and administrative establishments
6. A student can infer financial aspects for betterment of the National building.

Unit – I

Introduction Historical perspective of the constitution of India - Salient features of The Indian Constitution - Amendment Procedure of The Indian Constitution.42nd amendment (Mini Constitution) - 44th amendment (1978 – Janatha Govt.)

Unit – II

Important Features Of Constitution Fundamental Rights(Article 12 to 35), Duties (51 A – 1976 emergency) and Directive principles (Article 36 to 51) of State Policy - Articles 14 to 18 - Articles 19 - Article 21

Unit – III

Parliamentary form of Govt. In India President of India - Emergency provisions -National Emergency – Article 352 - President Rules – Article 356 - Financial Emergency – Article 360 Prime Minister and Cabinet - Supreme Court of India (Indian Judiciary)

Unit – IV

Indian Federalism Union – State relations; - Legislative , Administrative and Financial relations. Local self Govt. – Constitutional Schemes in India (73 & 74 Constitutional amendments)

Unit – V

Parliamentary Committees: Public Accounts Committee - Estimates Committee - Committee on Public Undertakings. - Election commission of India (Article -324) - Comptroller and Auditor General (CAG) of India (Article – 148 to 150)

Unit-VI

Finance Commission (Article – 280) - Neethi Aayog (Planning Commission) and - Political Parties.

Text Books:

1) Introduction to Indian Constitution by D.D Basu,Lexis Nexis Butterworth wadhwa Nagapur, 2008.
2) Poicits in India by Rajini Kothari, Orient LongMan, 2005.
3) The Indian Constitution by Madhav Khosla by Oxford University Press India, 2012.

Differential Equations
(Common to all Branches)

Subject Code : 20BST102

L	T	P	C
2	1	0	3

Course Objectives:

- To solve the first order Ordinary Differential equations and apply to Orthogonal trajectories, Newton's Law of Cooling and Law of Growth (Decay).
- To solve second and higher order ordinary differential equations.
- Derive the Fourier series expansion of one variable functions.
- Understand Taylor's, Maclaurin's series expansion and rules of calculating extreme value of two or more variable functions.
- Learn the methods of solving first order quasi-linear (Lagrange) partial differential equations and first order non-linear partial differential equations.
- Understand the method of solving a linear Partial differential equation with constant coefficients by method of Separation of Variables, solve a one dimensional Wave and a one dimensional Heat equation.

Course Outcomes

The student will be able to:

1. Apply the mathematical tool for the solution of Ordinary Differential equations, orthogonal trajectories, Newton's Law of Cooling and Law of Growth (Decay).
2. Evaluate higher order homogenous and non-homogenous linear differential equations with constant coefficients.
3. Estimate the Fourier series expansion of one variable functions.
4. Estimate the Taylor's, Maclaurin's series expansion of two variable functions and extreme values of two or more variable functions.
5. Evaluate a first order quasi-linear (Lagrange) partial differential equations and first order non-linear partial differential equations.
6. Evaluate a one dimensional Wave and Heat equation.

Unit – I

Ordinary differential equations of first order: *Linear type - Bernoulli type–Exact type - Equations reducible to exact type- Orthogonal Trajectories-Newton's law of cooling - Law of Growth and Decay.* (8 hrs)

Unit – II

Ordinary differential equations of higher order: *Higher order homogenous and non-homogenous linear differential equations with constant coefficients- Complimentary Functions-Particular integrals for the functions of type sin(ax+b)/cos(ax+b), x^m, e^{ax} , $e^{ax}V(x)$ - Method of variation of parameters, Applications-LCR circuits.* (8 hrs)

Unit – III

Fourier series: Fourier Series -Even and odd functions– Fourier series of functions defined in the interval (0, 2π), (-π, π), (0, 2c),(-c,c) - Half range Fourier sine and cosine series**(8 hrs)**

Unit – IV

Partial Differentiation: *Functions of two or more variables-Partial differentiation-Total Derivative- Taylor's and Maclaurin's Series (without proof) - Maxima, minima of functions without constraints and functions with constraints (Lagrange method of undetermined multipliers).* (8 hrs)

Unit- V

Partial Differential Equations of first order: Partial differential Equations - Formation of partial differential equations– solutions of first order quasi-linear (Lagrange) partial differential equations and first order non-linear (standard type) partial differential equations. (8 hrs)

Unit – VI

Applications of Partial Differential Equations *Solution of linear Partial differential equations with constant coefficients – Method of Separation of Variables- One dimensional Wave and Heat equations.* (8 hrs)

Text Books

1. B.V.Ramana, Higher Engineering Mathematics, 44th Edition, Tata McGraw Hill New Delhi,2014.
2. Dr.B.S.Grewal, Higher Engineering Mathematics, 43nd Edition, Khanna Publishers,2015.
Reference Books
3. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
4. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.

Applied Physics
(Common to all Branches)

Subject Code : 20BST105

L	T	P	C
3	0	0	3

Course Description

This course encompass Fundamental Concepts of Physics that include

- Wave Optics
- Lasers
- Fiber Optics
- Modern Physics
- Electro Magnetic Theory
- Semiconductor Physics

that are inevitable for any Engineering student so that these prerequisites aid the student to readily understand Day to Day Engineering Problems with Pragmatic Approach.

Course Objectives

- To realize the principles of optics in designing optical devices
- To comprehend the Principles of Lasers
- To Infer the Principles of Fiber Optics
- To Recognize the shortcoming of classical physics and describe the need for modifications to classical theory
- To Identify the interaction of electromagnetic fields
- To Summarize the characteristics of semiconductor materials.

Course Outcome

Students will be able to

1. Apply the principles of optics in designing optical devices
2. Illustrate the Principles of Lasers
3. Outline the Principles of Fiber Optics
4. Resolve the discrepancies in classical estimates through quantum principles
5. Analyze the interaction of electromagnetic fields.
6. Interpret the characteristics of semiconductor materials.

Unit – I

Wave Optics – Interference - Introduction, Principle of Superposition of Waves, Interference in Plane Parallel Film due to Reflected Light, Newton's Rings under Reflected Light - Determination of Wavelength of Monochromatic Source of Light.

Diffraction - Introduction, Differences between Interference and Diffraction, Fraunhofer Diffraction due to Single Slit – Intensity Distribution.

Unit – II

Lasers - Introduction, Characteristics of Lasers- Coherence, Directionality, Monochromacity and High Intensity, Principle of Laser – Absorption, Spontaneous and Stimulated Emission, Einstein Coefficients (Qualitative), Population Inversion, Optical Resonator and Lasing Action, Ruby Laser [Three Level System], Helium-Neon Laser [Four Level System], Applications of Lasers in Industry, Scientific and Medical Fields.

Unit – III

Fiber Optics - Introduction, Optical Fiber Construction, Principle of Optical Fiber – Total Internal Reflection, Conditions for Light to Propagate - Numerical Aperture and Acceptance Angle, Differences between Step Index Fibers and Graded Index Fibers, Differences between Single Mode Fibers and Multimode Fibers, Applications of Optical Fibers in Communication

Unit – IV (Modern Physics)

Quantum Mechanics - Wave Particle Duality, de-Broglie's Hypothesis of Matter Waves, Heisenberg's Uncertainty Principle, Physical Significance of Wave Function. Time independent wave equation and Particle in One Dimensional Potential Box.

Unit – V

Electromagnetic Theory Concept of Electric Field, Point Charge in Electric Field, Gauss Law and it's Applications, Magnetic Field - Magnetic Force on Current Carrying Coil. Ampere's Law, Biot-Savart Law, Faraday's Law of Induction, Lenz's Law, Maxwell's Equations and Applications

Unit – VI

Semiconductors Physics: Introduction- Intrinsic and Extrinsic Semiconductors, Dependence of Fermi Level on Carrier Concentration and Temperature, Diffusion and Drift Currents. Hall Effect – Mobility, Sign of Charge Carriers, Conductivity, Resistivity.

Text Books

1. A Textbook of Engineering Physics, M N Avadhanulu & P G Kshirsagar, S.Chand Publishers
2. Fundamentals of Physics by Resnick, Halliday and Walker
3. Modern Physics by Arthur Beiser

Reference books

1. University Physics by Young and Freedman
2. Solid State Physics by S. O. Pillai, New Age International Pubishers
3. Engineering Physics, Volume-I&II, P.K.PalaniSwamy, Scitech Publications Hyderabad
4. Engineering Physics Volume I&II Dr.K.Vijaykumar, S.Chand Publishing Company, New Delhi
5. Engineering Physics Dr. S. Mani Naidu, Pearson Publications Chennai

Data Structures and Algorithms

Subject Code: 20CST101

L	T	P	C
3	0	0	3

Course Outcomes:

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

1. Compute the time and space complexities and calibrate the performance of a given algorithm.
2. Compare the performances of various Searching and Sorting techniques.
3. Demonstrate the advantages of dynamic memory allocation via linked lists.
4. Illustrate the applications of Stacks and Queues.
5. Implement the basic operations and Traversals on binary Trees.
6. Understand traversals and shortest path algorithms on a Graph.

Unit – I

Introduction: Basic Concepts of Data Structures; Notations of Time & Space Complexity: Performance Analysis of algorithms: Iterative & Recursive Algorithms; Asymptotic Notations (O, Ω, θ, o, ω)

Unit – II

Searching: Linear Search, Binary Search: Algorithm & Analysis; **Hashing:** Hash functions, Collision Resolution techniques; **Sorting:** Methodology & Performance Analysis of Sorting Algorithms: Selection, Bubble, Insertion, Quick, Merge, Heap Sort.

Unit – III

Linked Lists: Comparison with Arrays; Operations on Singly linked list: Creation, Insertion, Deletion, Traversing, Searching; Operations on Doubly linked list; Operations on Circular Linked Lists;

Unit – IV

Stacks: Definition & Efficient operations: Push & Pop; Applications of Stacks: Conversion & Evaluation of expressions;

Queues: Types of Queues: Simple Queue; Circular Queue: Efficient Operations on Queues; Implementation of Stack and Queue using Linked Lists.

Unit – V

Trees: Basic Terminology of Trees; Binary Tree: Traversals; Binary Search Tree Operations: Insert, Delete; Introduction to Balanced Trees: AVL, B-Tree

Unit – VI

Graph: Basic Terminologies and Representations of Graphs; Graph traversal algorithms: Breadth-FS & Depth-FS; Single-Source Shortest Path Algorithm: Dijkstra's Algorithm.

Text Books:

1. Mark Allen Weiss , **"Data Structures and Algorithm Analysis",** Fourth Edition , Pearson.
2. Ellis Horowitz, Sartaj Sahni, "**Fundamentals of Data Structures**", Illustrated Edition,Computer- Science Press.

Reference Books

1. Michel T. Goodrich, Roberto Tamassia, David Mount, **"Data Structures and Algorithm Analysis",** 2nd Edition, John Wiley & Sons, Inc.
2. Adam. Drozdek , **"Data Structure And Algorithms In C++",** 4th edition, Cengage.

Basic Electrical Engineering
(Common to all Branches)

Subject Code: 20EST101

L	T	P	C
3	0	0	3

Course objectives

- To introduce the basic knowledge of electric circuits
- To illustrate knowledge with network reduction techniques.
- To analyze AC circuits.
- To provide knowledge on Magnetic circuits.
- To become familiar with DC Generator.
- To understand the concept of DC Motor.

Course outcomes

1. Able to summarize different electrical circuits.
2. Able to construct network reduction techniques
3. Able to outline the basics of AC circuits.
4. Able to state magnetic circuits.
5. Able to examine DC Generator.
6. Able to explain DC Motor.

Unit – I

Introduction to Electric Circuits: Basic definitions, Electrical circuit elements (R, L and C), Voltage and current sources Independent and dependent sources, Ohm's Law, Series & Parallel circuits, Source transformation, Kirchhoff's Laws, , simple problems.

Unit – II

Network Reduction Techniques: Star-Delta transformation, Nodal Analysis, Super node, Mesh analysis, super mesh-Problems.

Unit – III

AC Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series only), real power, reactive power, apparent power, power factor, simple problems.

Unit – IV

Magnetic circuits: Basic definitions of magnetic flux, flux density, Reluctance, Magneto motive force (m.m.f), magnetic field intensity, magnetic permeability and susceptibility. Comparison between magnetic and electrical circuits, inductively coupled circuits, coefficient of coupling, dot convention, simple problems on magnetic circuits.

Unit – V

DC Generator: Generator-Principle of Operation, Construction, EMF equation, Classification, O.C.C, internal and external characteristics of shunt generator, Applications.

Unit – VI

DC Motor: Motor-principle of operation, Torque equation, Classification Speed Control Methods, Operation of 3 point starter, Applications.

Text Books

1. Principles of Electrical and Electronics Engineering by V.K.Mehta, S.Chand& Co.
2. Introduction to Electrical Engineering – M.S Naidu and S. Kamakshaiah, TMH Publ.

Reference Books .

1. Basic Electrical Engineering Dr.K.B.MadhuSahu scitech publications (india) pvt.ltd.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
3. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill,2010.

IT Workshop
(Common to all Branches)

Subject Code : 20ESL104

L	T	P	C
1	0	4	3

Course Objectives:

- PC Hardware introduces the students to a personal computer and its basic peripherals, the process of assembling a personal computer, installation of system software like MS Windows, Linux and the required device drivers.
- All the DOS commands would be covered for maintains of the Operating system.
- Internet & World Wide Web module introduces the different ways of hooking the PC on to the internet from home and workplace and effectively usage of the internet. Usage of web browsers, email, newsgroups and discussion forums would be covered.
- Productivity tools module would enable the students in crafting professional word documents, excel spread sheets, power point presentations and personal web sites using the Microsoft suite of office tools.

Course Outcomes:

1. Students gain knowledge on computer system such as system Unit, input devices, and output devices connected to the computer.
2. Students gain knowledge to understand the booting process that includes switching on the system, and familiar with all the commands of an operating system.
3. Students gain knowledge to understand the working of the internet that include the use of protocols, domains, IP addresses, URLs, web browsers and search engines etc.
4. Students get familiarize with parts of Word window, To create and save a document, To set page settings, create headers and footers, To use various formatting features such as bold face, italicize, underline, subscript, superscript, line spacing, etc.
5. Students get familiarize with parts of Excel window, to create and save a workbook with single and/or multiple worksheets, to apply operations on range of cells using built-in formulae, etc.
6. Students get familiarize with parts of PowerPoint win, to create and save a new presentation, apply design templates to a presentation, to insert, edit and delete a slide , etc.

PC Hardware

Task 1: Identification of the peripherals of a computer.
To prepare a report containing the block diagram of the CPU along with the configuration of each peripheral and its functions.

Task 2: (Optional) : A practice on disassemble the components of a PC and assembling them to working condition.

Task 3 : Installation of WINDOW XP operating system in PC.

Task 4: Introduction to all internal and external DOS commands

Task 5 : Installation of LINUX operating system in PC.

Internet & World Wide Web

Task 6: S**urfing the Web using Web Browsers and Search engine:** How to access the websites and email. Students customize their web browsers using bookmarks, search toolbars and pop up blockers. And Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google.

MS – Word

Word Orientation : Describe Importance of MS- Word

Task 7 :Using word to create project certificate. Features to be covered:-Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in Word.

Task 8: Creating project abstract for using MS-WORD: Abstract Features to be covered:- Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check , Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes and Paragraphs.

Task 9 : Creating a Newsletter : Features to be covered:- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes and Paragraphs

Task 10 : Creating a Feedback form - Features to be covered- Forms, Text Fields, Inserting objects, Mail Merge in Word.

MS-Excel

Excel Orientation : The mentor needs to tell the importance of MS/ equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel –Accessing, overview of toolbars, saving excel files, Using help and resources

Task 11 : Creating a Scheduler - Features to be covered:- Gridlines, Format Cells, Summation, auto fill, Formatting Text

Task 12 : Creating Performance Analysis - Features to be covered:- Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting.

Task 13: Calculating GPA - Features to be covered:- Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function,

Task 14: Creating Cricket Score Card - Features to be covered:-Pivot Tables, Interactive Buttons, Importing Data, Data Protection, Data Validation

MS-Power Point

Task 15 : Students will be working on basic power point utilities and tools which help them create basic power point presentation.
Topic covered during this week includes :- PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows, Hyperlinks, Inserting –Images, Clip Art, Tables and Charts in Powerpoint.

Task 16 : Concentrating on the in and out of Microsoft power point, Helps them learn best practices in designing and preparing power point presentation. Topic covered during this week includes: - Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), Inserting – Background, textures, Design Templates, Hidden slides.

Text Books:

1. Vikas Gupta ,"Comdex Information Technology course tool kit" , WILEY Dreamtech
2. Cheryl A Schmidt ,"The Complete Computer upgrade and repair book", 3rd edition, WILEY Dreamtech
3."Introduction to Information Technology", ITL Education Solutions limited, Pearson Education.
4. Kate J. Chase ,"PC Hardware and A+ Handbook" –PHI (Microsoft)

Reference Books:

1 Scott. Mueller, 2008, Upgrading and Repairing PCs, 22/e, QUE,
2 Cheryl A Schmidt ,The Complete Computer upgrade and repair book,3/e , Dreamtech

Physics Lab
(Common to all Branches)

Subject Code: 20BSL101

L	T	P	C
0	0	3	1.5

Course Description

This Laboratory course is intended to apply the scientific method to expedite experiments that include

- Error analysis
- Waves Fundamentals
- Mechanics
- Physical Optics
- Lasers and Fiber Optics
- Semiconductor devices

So that student can verify theoretical ideas and concepts covered in lecture through host of analytical techniques, statistical analysis and graphical analysis.

Course Objectives

- To Operate Sensitive Instruments for precision measurements
- To Identify Error for targeted accuracy
- To Interpret the results of mechanical parameters such as modulus of elasticity and acceleration due to gravity through simple oscillatory experiments using torsional pendulum or physical pendulum
- To Determine relevant parameters associated with Interference and Diffraction phenomena using Travelling Microscope and Spectrometer.
- To Exhibit Techniques and Skills associated with Modern Engineering Tools such as Lasers and Fiber Optics
- To Characterize semiconducting material devices.

Course Outcomes: Will be able to

1. Demonstrate the ability for precision measurements to design instrumentation
2. Estimate the Error for targeted accuracy
3. Infer the results of mechanical parameters such as modulus of elasticity and acceleration due to gravity through simple oscillatory experiments using torsional pendulum or physical pendulum
4. Apply the knowledge of Optics to calculate geometrical parameters of thickness of thin object and radius of curvature of a lens
5. Illustrate techniques and skills associated with Modern Engineering Tools such as Lasers and Fiber Optics
6. Evaluate characteristics of semiconducting material devices

List of Experiments

1. Precision Measurements and Instruments
2. Error Analysis and Graph Drawing
3. Determination of Rigidity Modulus of the Material of Wire using Tensional Pendulum
4. Determination of Acceleration due to Gravity (g) using Compound Pendulum

5. Newton's Rings – Determination of the Radius of Curvature of a given Plano Convex Lens
6. Determination of Thickness of Thin Object using Wedge Method
7. Verify the characteristic curve of NTC Thermistor.
8. Determination of width of a single slit using LASER
9. Determination of Numerical Aperture and Bending Loss of an Optical Fiber
10. Determination of Energy Band Gap using the given Semiconductor

Manual / Record Book

1. Manual cum Record for Engineering Physics Lab, by Prof. M. Rama Rao, Acme Learning.
2. Lab Manual of Engineering Physics by Dr.Y. Aparnaand Dr. K. VenkateswaraRao (VGS books links, Vijayawada)

Basic Electrical Engineering Lab
(Common to all Branches)

Subject Code: 20ESL101

L	T	P	C
0	0	3	1.5

Course Objective

To introduce the student to study different electrical components and to verify the basic laws related to electrical engineering, Speed control of D.C. motor, testing of transformer, electrical wiring system through study, practice, and experiments.

Course Outcomes

Students will be able to

1. Label various types of electrical components.
2. Demonstrate various basic electrical laws.
3. Demonstrate speed control DC motor & Characteristics of generator.
4. Experiment with lamps.
5. Examine electrical wiring system

List of Experiments:

1. Study of electrical components.
2. To verify Ohm's law.
3. To verify (a) Kirchhoff's current law (b) Kirchhoff's voltage law.
4. To verify the total resistance of the series and parallel connected circuits.
5. Find armature resistance, field resistance and filament Lamp Resistance using V-I method.
6. Magnetization characteristics of DC shunt generator.
7. Speed control of D.C. Shunt motor by a) Armature Voltage control b) Field flux control method
8. Fluorescent tube connection.
9. (a) One way control of lamp
   (b) Two way control of lamp
10. Fan wiring.

Additional Experiments:

11. Soldering and bread board precautions.
12. To find voltage current relationship for series RL circuit and determine power factor

Data Structures and Algorithms Lab

Subject Code : 20CSL101

L	T	P	C
0	0	3	1.5

Course Outcomes:

1. Develop Programs as recursive solutions for problems.
2. Demonstrate different strategies to solve the common searching and sorting algorithms.
3. Illustrate the use of dynamic memory allocation through linked list operations.
4. Design programs for linear data structures such as Stacks, and Queues.
5. Develop Programs for implementing various operations on Binary Trees and Binary Search Trees.
6. Apply the fundamental graph algorithms to solve problems using Depth-First and Breadth- First Search.

List of Experiments:

1] a) Write a C program to generate a Fibonacci series using recursive function.
b) Write a C program to find the GCD of given numbers using recursive function.
c) Write a C program to solve the Towers of Hanoi problem using recursive function.

2] a) Design, Develop and Implement a C program to perform linear search for a key value in a given list.
b) Design, Develop and Implement a C program to perform Binary search for a key value in a given list.

3] Given a File of **N** employee records with a set **K** of Keys(4-digit) which uniquely determine the records in file **F**. Assume that file **F** is maintained in memory by a Hash Table(HT) of **m** memory locations with **L** as the set of memory addresses (2-digit) of locations in HT. Let the keys in **K** and addresses in **L** are Integers. Design and develop a Program in C that uses Hash function **H: K→L** as H(**K**)=**K** mod **m (remainder** method), and implement hashing technique to map a given key **K** to the address space **L.** Resolve the collision (if any) using **linear probing**.

4] a) Design, Develop and Implement a C program that implement Selection Sort to sort a given list of integers.
b) Design, Develop and Implement a C program that implement Bubble Sort to sort a given list of integers.

5] a) Design, Develop and Implement C program that implement Quick Sort to sort a given list of integers.
b) Design, Develop and Implement C program that implement Merge Sort to sort a given list of integers.

6] Design, Develop and Implement a menu driven Program in C for the following operations on **Singly Linked List (SLL)** of Student Data with the fields: ***USN, Name, Branch, Sem, PhNo***
a. Create a SLL of N Students Data by using front insertion.
b. Display the status of SLL and count the number of nodes in it
c. Perform Insertion / Deletion at End of SLL
d. Perform Insertion / Deletion at Front of SLL (Demonstration of stack)
e. Exit

7] Design, Develop and Implement a menu driven Program in C for the following operations on **STACK** of Integers (Array Implementation of Stack with maximum size **MAX**)
a. ***Push*** an Element on to Stack
b. ***Pop*** an Element from Stack

c. Demonstrate how Stack can be used to check ***Palindrome***
d. Demonstrate ***Overflow*** and ***Underflow*** situations on Stack
e. Display the status of Stack
f. Exit
Support the program with appropriate functions for each of the above operations

8] Design, Develop and Implement a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: **+, -, *, /, %(Remainder), ^(Power)** and **alphanumeric** operands**.**

9] Design, Develop and Implement a menu driven Program in C for the following operations on **QUEUE** of Characters (Array Implementation of Queue with maximum size **MAX**)
a. Insert an Element into QUEUE
b. Delete an Element from QUEUE
c. Demonstrate ***Overflow*** and ***Underflow*** situations on QUEUE
d. Display the status of QUEUE
e. Exit
Support the program with appropriate functions for each of the above operations

10]a) Design, Develop and Implement a C program to implement Binary tree traversals using iterative functions.
b)Design, Develop and Implement a C program to implement Binary tree traversals using recursive functions.

11] Design, Develop and Implement a menu driven Program in C for the following operations on **Binary Search Tree (BST)** of Integers
a. Create a BST of **N** Integers: 6, 9, 15, 22, 8, 45, 24, 18, 71, 8, 5, 2
b. Traverse the BST in Inorder, Preorder and Post Order
c. Search the BST for a given element (**KEY**) and report the appropriate message
e. Exit

12] Design, Develop and Implement a Program in C for the following operations on **Graph(G)** of Cities
a. Create a Graph of **N** cities using Adjacency Matrix.
b. Print all the nodes **reachable** from a given starting node in a digraph using DFS/**BFS** method.

Text Books:

1. Mark Allen Weiss , **"Data Structures and Algorithm Analysis",** Fourth Edition , Pearson.
2. Ellis Horowitz, Sartaj Sahni, "**Fundamentals of Data Structures**", Computer Science Press.

References Books

1. Michel T. Goodrich, Roberto Tamassia, David Mount, "Data Structures and Algorithm Analysis", 2nd Edition, John Wiley & Sons, Inc.
2. Debasis Samanta, "Classic Data Structures", Second Edition, PHI, 2012, New Delhi, India.
3. B.A. Forouzan and R.F. Gilberg, ,"Computer science, A structured programming approach using C", Third edition, 2011, Thomson, New Delhi, India.

Reference Link

1. https://www.geeksforgeeks.org/data-structures

AR-20 : B.Tech - CSE (DATA SCIENCE)

II Year I Semester

Environmental Science
(Common to all Branches)

L	T	P	C
2	0	0	0

Subject Code: 20MCT202

Course Objectives

- Memorize the knowledge of environment and status of different resources on earth.
- Identify the significance, arrangement, causes of annihilation and conservation of ecosystems andbiodiversity.
- Identify the significance, types and conservation of biodiversity
- Discriminate causes, effects of a variety of pollutions and suitable control methods.
- Identify the hurdles of sustainable development; evaluate the different environmental managementand legal issues.
- Describe the population growths, health problems and evaluate the environmental assets.

Course Outcomes

After Completion of the Course, the students will be able to:

1. Recognize and speaks well again on the general issues of environment and know how to conserve resources for better usage.
2. Explain and demonstrate the ecosystems setup, assess
3. Recognize and conserving of diversity to upkeep.
4. Examine a range of pollution problems along with control and their eco-friendly disposalmethods.
5. Translate the sustainable development practice through clean development mechanisms.
6. Evaluate the changing trends of world population and compile the information in order to document the environmental assets.

Unit I:

Importance of Environmental Studies and Natural Resources: Definition of Environment – Importance-Need for Public Awareness

Forest Resources - Use and over exploitation - deforestation – consequences – case study

Water Resources - Use and over utilization - dams - benefits and problems on Tribes and Environment

Food Resources – Food security concept - changes caused by agriculture and overgrazing -effects of modern agriculture – fertilizer - pesticide problems - water logging - salinity – concept of sustainable agricultural methods - case study

Energy Resources - Non-renewable energy resources – coal – crude oil - natural gas - use of renewable and alternate energy sources.

Unit II:

Ecosystems: Definition – Structure of ecosystem: producers - consumers – decomposers.

Functions of ecosystem: Food chains - food webs - ecological pyramids - Energy flow – Nutrient cycles (Carbon cycle and Nitrogen cycle). Ecological succession.

Unit III:

Biodiversity and its conservation: Definition of Biodiversity - Values of biodiversity – Biogeographical classification of India - Hot Spots of India - Endangered and endemic species of India –Threats to biodiversity - Conservation of biodiversity.

Unit IV:

Environmental Pollution: Definition – causes - effects - control measures of Air pollution - Water pollution - Noise pollution – Marine Pollution - Nuclear hazards.

Solid waste Management: Causes - effects - disposal methods of urban waste – biomedical wastes - case studies

Disaster management: floods – earthquakes – cyclones

Unit V:

Social Issues and the Environment: Concept of Unsustainable and Sustainable development – Water conservation: Rain water harvesting- Watershed management – Global environmental challenges: climate change - global warming – acid rains - ozone layer depletion -World summits on environment: Stockholm conference – Rio-earth summit – Kyoto protocol – Environment (Protection) Act - Air (Prevention and Control of Pollution) Act – Water (Prevention and control of Pollution) Act - Wildlife (Protection) Act - Forest (Conservation) Act

Unit VI:

Human Population and the Environment: Population growth patterns - variation among nations - Population problems - control -Environment and human health - Role of information Technology in Environment and human health.

Text Books:

1. Shashi Chawla. 2015, A Text book of Environmental Studies, Revised edition, TMH, New Delhi
2. Bharucha, E. 2005, Text book of Environmental Studies, First edition, Universities Press (India) Pvt. Ltd., Hyderabad
3. Suresh K. Dhameja. 2006-07, Environmental Studies, Third revised edition, S.K. Kataria & Sons (P) Ltd., New Delhi
4. Benny Joseph. 2015, Environmental Studies, Revised edition, TMH, New Delhi

Reference Books:

1. Odum, E.P, Fundamentals of Ecology, Third edition, W.B. Saunders & Co (P) Ltd., Philadelphia.
2. P. D. Sharma, Ecology and Environment, Revised edition, Rastogi Publications (P) Ltd.
3. Cunningham, W.P., Cunningham, M.A., Principles of Environmental Science, TMH, New Delhi.
4. Peavy, Rowe and Tchobanoglous, Environmental Engineering, Mc Graw – Hill International edition.
5. Graedel, T.E., Allenby, B.R., Industrial Ecology and Sustainable Engineering, Pearson Publications.

AR-20 : B.Tech - CSE (DATA SCIENCE) **II Year I Semester**

Python Programming

L	T	P	C
3	0	3	4.5

Subject Code: 20ESI204

Course Objectives:

This course will enable students to

- Learn Syntax and Semantics and create Functions in Python
- Handle Strings and Files in Python
- Understand Lists, Dictionaries and Regular expressions in Python
- Understand use of functions and file handling in python
- Implement Object Oriented Programming concepts in Python
- Introduction to Regular Expressions and matching in Python

Course Outcomes:

By the end of this course the student will be able to

- Examine Python syntax and semantics and be fluent in the use of Python flow control and functions
- Demonstrate proficiency in handling Strings and File Systems
- Create, run and manipulate Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions
- Implement file handling functions and user defined functions in python
- Interpret the concepts of Object-Oriented Programming as used in Python
- Implement Regular Expressions and matching in Python

Unit I:

Introduction to Python: History, Features, Installing Python, Running Python, Operators, Statements and Expressions.

Control Structures: Conditional Statements, Loops

Exercise Questions: 1

Ex 1: Write the python programs to calculate the following

a) Find the factorial of given number

b) To print all the prime numbers below n. n value should be taken from the user at the time of execution

Ex 2: Write the python programs to perform the following

a) To check given number Armstrong or not.

b) To check Strong number.

c) To print Fibonacci series.

Unit II:

Data Types: Mutable vs immutable data type, Numbers - Introduction to Numbers, Integers, Floating Point Real Numbers, Complex Numbers, Operators, Built-in Functions, Related Modules

Sequences - Strings, Lists, and Tuples, Dictionaries and Set Types

Exercise Questions: 2

Ex 3: Write the python programs to calculate the following

a) Write a Python program to get a string from a given string where all occurrences of its first char have been changed to '$', except the first char itself.

b) Write a Python program to remove the characters which have odd index values of a given string.
c) To remove punctuations from the string
d) Write a Python program to count repeated characters in a string
e) Write a Python program to count Uppercase, Lowercase, special character and numeric values in a given string

Ex 4: Write the python programs to perform the following
a) Implement a STACK program by using PYTHON.
b) Implement a QUEUE program by using PYTHON.
c) Implement a Python Program for creating a dictionary and display its keys alphabetically.
d) Write a Python program to convert a list into a nested dictionary of keys.
e) Write a python program to remove duplicates from the list

Unit III:
Functions: Definitions, Declaration, Parameter passing, calling functions
File Handling: creating a file, opening a file, I/O with file (read, write, append), closing a file

Exercise Questions: 3
Ex 5: Write the python programs to calculate the following
a) To find HCF or GCD of two numbers
b) To find sum of natural numbers using recursive function

Ex 6: Write the python programs to perform the following
a) Read a file line by line into a list
b) Get filename, line count, file extension, file creation and modification date .
c) Reads and displays the content of the file
d) Write a program that inputs a text file. The program should print all of the unique words in the file in alphabetical order.

Unit IV:
Modules: Modules and Files, Namespaces, Importing Modules, Importing Module Attributes, Module Built-in Functions, Packages, Other Features of Modules.

Exercise Questions: 4
Ex 7: Write the python programs to calculate the following
a) Write a python program to define a module to find Fibonacci Numbers and import the module to another program.
b) Write a python program to define a module and import a specific function in that module to another program.

Unit V:
Classes in Python: Principles of Object Orientation , Creating Classes , Instance Methods , Special Methods ,class Variables and Inheritance, Data base connectivity.

Exercise Questions: 5
Ex 8: Write the python programs to calculate the following
a) Define a class, which have a class parameter and have a same instance parameter.
b) Define a class named 'Shape' and its subclass 'Square'. The Square class has an 'init' function which takes a given length as an argument. Both classes have an area function which can print the area of the shape, where Shape's area is 0 by default.

Unit VI:
Regular Expressions: Introduction, Special Symbols and Characters, Res and Python

Exercise Questions: 6
Ex 9: Write the python programs to calculate the following

a) implement Re.findall, re.split, re.sub, re.subn, re.search and Match.group.

b) Write a Python program to check the validity of a password (input from users).

Validation :

- At least 1 letter between [a-z] and 1 letter between [A-Z].
- At least 1 number between [0-9].
- At least 1 character from [$#@].
- Minimum length 6 characters.
- Maximum length 12 characters.

Text Books:

1. Wesley J .C hun "Core Python Applications Programming", 3rd Edition, 2012, Prentice Hall.
2. Brian jones, David Beazley “Python Cookbook ”, 3rd Edition.

References Books:

1. Mark Lutz "Programming Python, 4th Edition" O'Reilly Media. 2. Think Python, Allen Downey, Green Tea Press

Reference Links:

https://docs.python.org/3/tutorial/index.html
https://pythonprogramminglanguage.com

AR-20 : B.Tech - CSE (DATA SCIENCE)

II Year I Semester

Digital Logic Design

L	T	P	C
3	0	0	3

Subject Code: 20EST205

Course Objectives
The course is designed with the objective to:

•To solve a typical number base conversions
•To optimize logic gates for digital circuits using various techniques
•To apply knowledge of adders for higher order digital circuits
•To develop advanced combinational circuits
•To design various circuits using PLDs
•To identify new areas for applying the knowledge of flip-flops

Course Outcomes
After the successful completion of this course, students will be able to

1.Distinguish different number systems and digital codes
2.Design different arithmetic logic gates
3.Design various types of adder circuits using combinational circuits
4.Distinguish different combinational logic circuits and design logic circuits using Combinational circuits
5.Design logic circuits using PLDs
6.Distinguish different sequential logic circuits and design logic circuits using sequential circuits

Unit I:
Number Systems: Binary, Octal, Decimal, Hexadecimal Number Systems. Conversion Of Numbers from One Radix to another Radix, r's Complement and (r-1)'s Complement Subtraction, Weighted and Non-weighted codes.

Unit II:
Logic Gates and Boolean Algebra: Basic Gates: NOT, AND, OR, Boolean Theorems, Universal Gates, Ex-OR and Ex-NOR Gates, Compliment and dual of logic functions. Minimizations of Logic Functions, Multilevel Realization Of Logic Functions.
Gate-Level Minimization: Karnaugh Map Method (K-Map): Minimization Of Boolean Functions upto four variables, POS and SOP Simplifications with don't care conditions using K map, Quine mccluskey Method

Unit III:
Combinational logic circuits-I: Design of half adder, full adder, half subtractor, full subtractor, applications of full adders, 4-bit binary adder, 4-bit binary subtractor, BCD adder, excess – 3 adder, carry look ahead adder

Unit IV:
Combinational logic circuits-II: Design of decoder, encoder, multiplexer, de-multiplexer, and comparators and LED seven segment display

Unit V:
Programmable Logic Devices: PLA, PAL, PROM. Realization of Switching Functions Using PROM, PAL and PLA. Comparison of PLA, PAL and PROM. Programming Tables of PLA, PAL and PROM

Unit VI:

Itnroduction to Sequential Logic Circuits: Classification, Basic Sequential Logic Circuits:. RS, JK, T and D Flip flops, truth tables & excitation tables. Conversion of Flip Flops,Flip Flops with Asynchronous Inputs (Preset and Clear).

Registers and Counters: Design of Registers, Buffer Register, Control Buffer Registers, Bidirectional Shift Registers, Universal Shift Register, Design of Ripple Counters, Synchronous Counters and Variable Modulus Counters, Ring Counter, Johnson Counter

Text Books:

1. M.Morris Mano, Michael D Ciletti, Digital Design ,4/e, PEA
2. Roth, Cengage Fundamentals of Logic Design, 5/e.

Reference Books:

1. Kohavi, Jha, Switching and Finite Automata Theory,3/e, Cambridge.
2. Leach, Malvino, Saha,Digital Logic Design, TMH 3. Jaya Bhaskar, Verilog HDL primer,PEA

Reference Links

1. https://nptel.ac.in/courses/108/105/108105132/

AR-20 : B.Tech - CSE (DATA SCIENCE) **II Year I Semester**

Discrete Mathematics

L	T	P	C
2	1	0	3

Subject Code: 20CST202

Course Objectives

Students are expected to learn:

- Understand the theory and techniques of logic, graphs and trees, and algebraic systems
- Apply the knowledge and skills obtained to investigate and solve a variety of discrete mathematical problems
- Communicate mathematical ideas

Course Outcomes

After Completion of the Course, the students will be able to:

1. Apply equivalence formulas, tautological implications in finding normal forms, and theory of inference in Statement Calculus and predicates, and explain Mathematical Induction principle and apply the same
2. Apply equivalences and inference theory in Predicate Calculus
3. Explain the basic properties of relations, POSETS, LATTICES, functions and apply the same in solving the problems
4. Identify the basic properties of graphs and related structures and solve the related problems
5. Identify the basic properties of Trees and solve minimum cost spanning tree problems
6. Solve and formulate, generating functions and recurrence relations

Unit – I

Logic & Mathematical Reasoning Propositional calculus: statements and notations, connectives, Truth tables, Tautologies, Equivalence of formulas, Tautological implications, Normal forms, Theory of inference for statement calculus.

Unit – II

Predicate Calculus Predicate logic, statement functions, variables and quantifiers, free and bound variables. Inference Theory of the Predicate Calculus: Logical implication involving quantifiers, Statements with more than one variable.

Unit – III

Relations Properties of Relations, Equivalence relations, partial orders, Lattices, properties of Lattices, Special types of Lattices (Proofs not required).

Unit – IV

Graph Theory Basic Concepts of Graphs, Matrix representation of graphs: Adjacency Matrices, Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerain & Hamiltonian graphs, Planar Graphs, Graph coloring.

Unit – V

Trees: Introduction and applications of trees, Tree traversals, Spanning Trees, Minimum cost spanning trees (Prim's & Kruskal's)

Unit-VI

Combinatorics: Generating Function of Sequences, calculating coefficient of Generating function, Partial Fractions. Recurrence relations: First order and second order Linear Homogeneous and Non-Homogeneous recurrence relations, method of generating functions.

Text Books:

1. J.P.Tremblay & R. Manohar, "Discrete Mathematical Structure with Applications to Computer Science" Mc.Graw Hill, 2004.
2. Kolman, Busby Ross , "Discrete Mathematical Structures", PHI,5th Edition,2003.
3. D.S.Chandrasekharaiah, "Mathematical Foundation of Computer Science" Prism Publications 2009.

Reference Books:

1. Trembly J.P. and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw–Hill Pub. Co. Ltd, New Delhi, 30th Re-print (2007).
2. Discrete Mathematics for Computer Scientists & Mathematicians, 2/e Mott, Kandel, Baker, PHI
3. Kenneth H.Rosen, "Discrete Mathematics and its Applications", 6th Edition, Special Indian edition , Tata McGraw – Hill Pub. Co. Ltd., New Delhi, (2007).
4. V. Krishnamurthy, "Combinatories:Theory and Applications", East-West Press.
5. Seymour Lipschutz, M.Lipson, "Discrete Mathemataics" Tata Mc Graw Hill, 2005.

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II Year I Semester

Computer Organization & Architecture

L	T	P	C
3	0	0	3

Subject Code: 20CST203

Course Objectives

Students are expected to learn

- To provide students with basic concepts in computer system as its logic operations.
- To make the students understand the basic operations involved in execution of an instruction.
- Explain the basic concept of interrupts and their usage to implement I/O control and data transfers.
- Identify the different architectural design issues that can affect the performance of a computer such as, RISC architecture, instruction set design, and addressing modes

Course Outcomes

After Completion of the Course, the students will be able to:

1. Draw the functional block diagram of a computer and describe the function of the instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set
2. Recognize and manipulate representations of numbers stored in digital computers
3. Evaluate cost performance and design trade-offs in designing and constructing a computer processor including memory.
4. Understand input output device and their interconnection to CPU along mode of data transfer from I/O device to memory
5. Understand multiprocessor concepts
6. Design a pipeline for consistent execution of instructions with minimum hazards.

Unit – I

Functional blocks of a computer CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU – registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set.

Unit – II

Data representation Signed number representation, fixed and floating-point representations, Computer arithmetic – integer addition and subtraction, ripple carry adder, carry look-ahead adder. Multiplication – shift-and add, Booth multiplier, array multiplier. Division restoring and non-restoring techniques, floating point arithmetic.

Unit – III

Memory organization Memory Hierarchy, Main Memory-RAM, ROM Chips, Associative Memory-Hardware Organization and Match Logic, Cache Memory-Associative Mapping, Direct Mapping and Set Associative Mapping, Virtual Memory.

Unit – IV

Peripheral devices and their characteristics: Peripheral device, Input-output interface I/O Bus and Interface Modules, I/O versus memory bus, Isolated versus memory-mapped I/O, Asynchronous data transfer, modes of transfer, priority interrupt and direct memory access.

Unit – V

Pipelining: Introduction to parallel processing, Basic concepts of pipelining, Arithmetic pipeline, Instruction pipeline throughput and speedup, pipeline hazards. Vector processing and Array Processor.

Unit-VI

Multiprocessors: Characteristics of Multiprocessors, Interconnection Structures, Interprocessor arbitration, Interprocessor communication and synchronization, Cache Coherence.

Text Books:

1. "Computer Organization and Design: The Hardware/Software Interface", 5th Edition by David Patterson and John L. Hennessy, Elsevier.
2. "Computer System Architecture", Revised 3rd Edition by M. Morris Mano and Rajiv Mall, Pearson Education.

Reference Books:

1. "Computer Architecture and Organization", 3rd Edition by John P. Hayes, WCB/McGraw-Hill
2. "Computer Organization and Architecture: Designing for Performance", 10th Edition by William Stallings, Pearson Education.
3. "Computer System Design and Architecture", 2nd Edition by Vincent P. Heuring and Harry F. Jordan, Pearson Education.
4. "Computer Organization and Embedded Systems", 6th Edition by Carl Hamacher, McGraw Hill Higher Education.

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II Year I Semester

Database Management Systems

L	T	P	C
3	0	0	3

Subject Code: 20CDT201

Course Objectives:

- To introduce basic RDBMS concepts, SQL, Database Design and Query processing. And also to introduce transaction processing, issues and techniques relating to concurrency and recovery in multi-user database environments, and various Data structures for External Data storage and efficient retrieval.

Course Outcomes:

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

1. Differentiate Database Systems from File Systems and Define the Terminology, Features, Classifications, Characteristics embodied in Database Systems
2. Interpret, Design and Implement an E-R Model
3. Create/Modify the structure and write optimized SQL queries to extract and modify information from Tables or Views
4. Apply proper Techniques such as Normalization and analyze the applicability of a specific Normal Form in designing a Database
5. Explain broad range of Database Management issues including Data integrity, Concurrency and Recovery
6. Compare various Indexing, Hashing and File Organization Techniques.

Unit – I

Database System Applications: Database Systems versus file Systems; View of Data: Data Abstraction, Instances and Schemas; Data Models: The ER Model, Relational Model, Other Data Models; Database Languages: DDL, DML, Database Access from Application Programs; Database Users and Administrators; Transaction Management; Database System Structure: Storage Manager, the Query Processor.

Unit – II

Database Design and ER Diagrams: Beyond ER Design; Entities, Attributes and Entity sets; Relationships and Relationship sets; Additional features of ER Model; Conceptual Design with the ER Model; Introduction to the Relational Model; Integrity Constraints over relations; Enforcing Integrity constraints; Querying relational data; Logical database Design: ER to Relational; Introduction to Views: Destroying/Altering tables and Views; Relational Algebra: Selection and projection, set operations, renaming , Joins, Division.

Unit – III

SQL: Queries, Constraints, Triggers: Overview; The Form of a Basic SQL Query; Nested Queries: Introduction to Nested Queries, Correlated Nested Queries, Set-Comparison Operators; Aggregative Operators ; NULL values : Comparison using Null values; Logical connectives AND, OR, and NOT, Impact on SQL Constructs, Outer Joins, Disallowing NULL values; Triggers and Active Data bases.

Unit – IV

Schema Refinement and Normal Forms: Problems Caused by Redundancy, Problems related to Decomposition; Functional Dependencies; Normal Forms: FIRST, SECOND, THIRD Normal Forms, BCNF; Properties of Decompositions: Lossless-Join Decomposition, Dependency-Preserving Decomposition.

Unit – V

Transaction Concept: Transaction State; Implementation of Atomicity and Durability; Concurrent Executions; Serializability; Recoverability; Lock–Based Protocols: Locks, Granting of locks, The Two-Phase Locking Protocol (2PL), Implementation of locking ; Timestamp-Based Protocols.

Recovery System: Failure classification; Log–Based Recovery; Shadow Paging; Buffer Management; Failure with loss of Nonvolatile storage.

Unit-VI

File Organization and Indexes: Comparison of File Organizations; Properties of Indexes: Clustered versus Unclustered Indexes, Dense versus Sparse Indexes, Primary and Secondary Indexes; Index Data Structures: Hash Based Indexing, Tree based Indexing: ISAM; B+ Trees: A Dynamic Index Structure.

Text Books:

1. Raghu Ramakrishnan, Johannes Gehrke: Database Management Systems, TATA McGraw Hill, Fourth Edition, 2010.
2. Abraham Silberschatz, Henry F. Korth : Database System Concepts, McGraw Hill, SixthEdition, 2011.

Reference Books

1. Peter Rob, Carlos Coronel: Database Systems: Design, Implementation, and Management, Cengage Learning, Seventh Edition, 2006.
2. Elmasri, Navathe: Fundamentals of Database Systems. Pearson Education, Sixth Edition, 2010.
3. C.J. Date: Introduction to Database Systems, Pearson Education, Fourth Edition, 2005.

Reference Links

1. https://www.coursera.org/course/db

AR-20 : B.Tech - CSE (DATA SCIENCE)

II Year I Semester

Digital Logic Design Lab

L	T	P	C
0	0	3	1.5

Subject Code: 20ESL205

Course Objectives

- Verify the truth tables of logic gates
- Design and verify the operation of combinational circuits.
- Design and verify the operation of code converters.
- Design and verify the operation of sequential circuits
- Verify the operation of Johnson/ring counter
- Verify the operation of memory element

Course Outcomes

After Completion of the Course, the students will be able to:

1. Distinguish logic gates for design of digital circuits
2. Design different types of Combinational logic circuits
3. Design different types of Code converters
4. Analyze the operation of flip-flops
5. Apply knowledge of flip-flops in designing of Registers and Counters
6. Analyze the Read/write operations of memory element

List of Experiments (At least ten experiments are to be done) :

1. Verification of logic Gates
2. Half/Full Adder
3. Half/Full/Subtractor
4. Binary-Gray & Gray-Binary Converter using Ex-or gates
5. BCD –Excess3 & Excess 3 –BCD converter using Full adder
6. MUX/DEMUX
7. Comparators
8. Encoder/Decoder
9. Flip-Flops
10. 4 Bit - Counter
11. Shift Registers
12. RAM

AR-20 : B.Tech - CSE (DATA SCIENCE)

II Year I Semester

Data Base Management Systems Lab

L	T	P	C
0	0	3	1.5

Subject Code: 20CDL201

Course Outcomes

After completion of this course, the Students will be able to:

1. Create relational database
2. Manipulate data using SQL
3. Compose Queries to retrieve required information from Database
4. Use Aggregate functions
5. Develop programs using Triggers and Cursors
6. Design Procedures, Functions and Packages for required Database tasks

List of Experiments

1. Execute DDL and DML commands
   Execute single line and group functions on a table.

2. Create tables for various relations in SQL with necessary integrity constraints, keys, data types. Verify messages by violating the constraints.
   Perform various join operations like Equi and non-equi, outer join, self join on two tables and show the results.

3. Execute DCL and TCL Commands.
   Write a PL/SQL program for accepting a number and indicate whether it is odd or even.

4. Write a PL/SQL program to find the largest of three integers.
   Write a PL/SQL program to find the factorial of a given integer and store the integer with it's factorial in a table.

5. Write a PL/SQL program to display the sum of digits of given number.
   Write a PL/SQL program to display the reverse of given number.

6. Write a PL/SQL program to accept two numbers N1 and N2 and perform division operation. And also handle the exception "Divide by zero "when N2 is zero.
   Write a PL/SQL program to accept the customer id from the user and display the corresponding customer name and address from customer table. Raise user defined exception "invalid- id" when customer id is <=0 and catch built in exceptions "no data found " and display suitable messages for each exception.

7. Write a PL/SQL program using Cursors to update the salaries of Employees as follows. And also count and display the no. of records have been updated.*/
   if sal<1000 then update the salary to 1500.
   if sal>=1000 and <2000 then update the salary to 2500. if
   sal>=2000 and <=3000 then update the salary to 4000.

8. Write a PL/SQL program using triggers to automatically store all the deleted records from employee table in a separate table called “employees history “ along with date of deletion,user-id of the person who deleted.

9. Write a PL/SQL program to which computes and returns the maximum of two values using a function.
   Write a PL/SQL procedure to display all the records of employee table in a neat format.

10. Write a PL/SQL program to create a Package to group logically related variables, types and sub programs and use the package elements later.

Text Books:

1. SQL, PL/SQL the Programming Language of Oracle by Ivan Bayross, BPB Publications, 4th Edition

AR-20 : B.Tech - CSE (DATA SCIENCE) **II Year II Semester**

Human Values
(Common to all Branches)

L	T	P	C
2	0	0	0

Subject Code: 20MCT204

Course Objectives

- To educate the students how to governance the professional behavior in their carrier as employee.
- To make aware of culture when they are working in different organizations.
- Understand value of education and self- development.
- Imbibe good values in students.
- Let the student know about the importance of character.
- Let the student to discriminate the personality and behaviour development.

Course Outcomes

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

1. Upon completion of this course students can aware of ethical behavior in the work place
2. To shapes the students by the end of this curriculum with appropriate behavior in the society
3. To understand the challenging environment in work place
4. To understand the Global culture in engineering problems
5. Learn the importance of Human values
6. Knowledge of self-development, Developing the overall personality

Unit – I

Introduction To Values And Morals: Theory of Evolution – Ethics as a necessity for spiritual evolution--Description of Human Values & Morals ---- Values --- Integrity, Honesty, Courage, Empathy, Personality, Character, Self-Confidence, Respect for Others, 7 Ways of Misusing Truth – Work Culture, Social Responsibility, Responsibilities as a Citizen, Cooperation and Commitment, Caring and Sharing--- Religion vs. Spirituality, Philosophy, Customs and Practices --- Impediments to Responsibility – Self-Interest, Fear, Self-Deception, Ignorance, Ego, Narrow Vision, Uncritical Acceptance of Authority, Group Thinking

Unit – II

Mind And Its Mysteries: What is Mind? Mind and Body, Mind and Food--- Mental faculties, Theory of perception, Memory, Tendencies, Thought Creates the World -- Power of Thought, Thought Culture, Desires, Pleasure and Pain -- Cultivation of Virtues, Control of Senses and Mind -- Discrimination, Dispassion, Sacrifice – Concentration, Meditation and Enlightenment

Unit – III

Risk, Safety And Environment: Difficulties in Estimating Risk -- Approach to Acceptable Risk, Regulator's Approach to Risk – Engineer's Liability, Changing Legal Rights of the Employees -- Organizational Disobedience by Contrary Action, by Non-Participation, by Protest – Environmental Laws and Judicial Intervention in Related Matters -- Environmental Movements

Unit – IV

Non-Ethical Practices In Vogue: Engineer's Responsibility for Rights - Respect for Authority – Conflict of Interests - Occupational crime -- Global Issues – How Multinational Corporations Influence Government Decisions, Risk and Public Policy- Engineers as Managers, Advisors and Experts, Engineers as Moral Leaders Problem of Bribery, Extortion, Grease Payments, Nepotism ----Nexus between Politicians and Industrialists. Case Study – Chinese Minister Sentenced to Death for Corruption

Unit – V

Values And Self-Development: Social values and individual attitudes. Work ethics, Indian vision of humanism Moral and non- moral valuation Standards and principles Value judgments

Unit - VI

Personality And Behavior 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

Text Books:

1. Charles E Harris, Micheal J Rabins, "Engineering Ethics, Cengage Learning
2. Mike Martin and Roland Schinzinger, "Ethics in Engineering" McGraw Hill
3. Mind, Its Mysteries and Control, Swami Sivananda, Divine Life Society Pub.
4. Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi

AR-20 : B.Tech - CSE (DATA SCIENCE) **II Year II Semester**

Probability & Statistics with R

L	T	P	C
3	0	0	3

Subject Code: 20BST204

Course Objectives

- To introduce the concept of discrete random variable and describe Binomial, Poisson distributions.
- To introduce the concept of a continuous random variable and describe Normal distribution.
- To analyze sampling distribution of means and estimation.
- To perform large sample tests – test of means and proportion.
- To perform the small sample tests - t-test, F-test and Chi-square test and ANOVA for the give data.
- To determine correlation and regression coefficients for given data.

Course Outcomes

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

1. Calculate the probability of a random variable following Binomial, Poisson distributions.
2. Obtain the probability of a random variable Normal distribution.
3. Determine the sampling distribution of means for the given data and estimate the parameters using point estimation and interval estimation.
4. Perform the large sample tests – test of means and proportion.
5. Perform the small sample tests - t- test, F-test, Chi-Square and analyze ANOVA for the given data.
6. Determine correlation and regression coefficients for given data.

Unit – I

Discrete Random variables and Distributions: Introduction- Random variables- Discrete Random variable- Distribution function-Expectation- Discrete distributions: Binomial, Poisson distributions.

Unit – II

Continuous Random variable and distributions: Introduction-Continuous Random variable- Distribution function- Expectation- Continuous distribution: Normal distributions.

Unit – III

Sampling Theory: Introduction - Population and sample- Sampling distribution of means (with □ known and □ unknown) - Central limit theorem- sampling distribution of sums and differences - Point estimation- Maximum error of estimate - Interval estimation.

Unit – IV

Tests of Hypothesis (Large samples): Introduction –Hypothesis-Null and Alternative Hypothesis- Type I and Type II errors –Level of significance - One tail and two tail tests- Tests concerning single mean and single proportion- Tests concerning difference of means and difference of proportions.

Unit – V

Test of Hypothesis (Small Samples): Introduction - student's - t -test, F-test, Chi-square Test (Test of independence of attributes and goodness of fit) -ANOVA for one-way and two-way classified data.

Unit-VI

Correlation and Regression: Introduction - Concept of correlation–types of correlation-Karl-Pearson correlation coefficient method and its properties-Rank Correlation Coefficient. Regression-Linear regression and its properties.

Text Books:

1. Probability and Statistics for Engineering, Richards A Johnson, Irvin Miller and Johnson E Freund, 9th Edition, PHI.
2. Introduction to Probability and Statistics Using R, G. Jay Kerns, First Edition, ISBN: 978-0-557-24979-4. (Free e-book from R software website)
3. Probability and Statistics, Dr.T.K.V.Iyengar, Dr.B.Krishna Gandhi, S.Ranganatham and Dr.M.V.S.S.N.Prasad, S.Chand Publications.

Reference Books:

1. Probability and Statistics Engineers and the Scientists, Shron L. Myers, Keying Ye, Ronald E Walpole, 8th Edition, Pearson 2007.
2. Introduction to probability and statistics, William Menden Hall, Robert J. Bever and Barbara Bever, Cengage learning, 2009.
3. Introduction to probability and statistics Engineers and the Scientists, Sheldon, M. Rosss, Academic Foundation,2011.
4. Applied statistics for Engineers and Physical Scientists, Johannes Ledolter and Robert V.Hogg, 3rd Edition, Pearson,2010.
5. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley-India, 10th Edition.

AR-20 : B.Tech - CSE (DATA SCIENCE) **II Year II Semester**

Data Warehousing and Mining

L	T	P	C
2	1	0	3

Subject Code: 20CDT202

Course Objectives:

- To understand and implement classical models and algorithms in data warehousing and data mining.
- To analyze the data, identify the problems, and choose the relevant models and algorithms to apply.
- To assess the strengths and weaknesses of various methods and algorithms and to analyze their behavior.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

- Summarize the architecture of data warehouse
- Apply different preprocessing methods, Similarity, Dissimilarity measures for any given raw data.
- Construct a decision tree and resolve the problem of model over fitting
- Compare Apriori and FP-growth association rule mining algorithms for frequent item set generation
- Apply suitable clustering algorithm for the given data set

Unit I:

Data Warehouse and OLAP Technology: An Overview: What Is a Data Warehouse? A Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, From Data Warehousing to Data Mining.

Unit II:

Data Mining: Introduction, What is Data Mining?, Motivating challenges, The origins of Data Mining, Data Mining Tasks, Types of Data, Data Quality.

Data Preprocessing: Aggregation, Sampling, Dimensionality Reduction, Feature Subset Selection, Feature creation, Discretization and Binarization, Variable Transformation, Measures of Similarity and Dissimilarity.

Unit III:

Classification: Basic Concepts, General Approach to solving a classification problem, Decision Tree Induction: Working of Decision Tree, building a decision tree, methods for expressing an attribute test conditions, measures for selecting the best split, Algorithm for decision tree induction.

Unit IV:

Model Overfitting: Due to presence of noise, due to lack of representation samples, evaluating the performance of classifier: holdout method, random sub sampling, cross-validation, bootstrap. Bayes Theorem, Naïve Bayes Classifier.

Unit V:

Association Analysis: Basic Concepts and Algorithms: Problem Definition, Frequent Item Set Generation, Apriori Principle, Apriori Algorithm, Rule Generation, Compact Representation of Frequent Itemsets, FP-Growth Algorithm.

Unit VI:

Cluster Analysis: Basic Concepts and Algorithms: Overview, What Is Cluster Analysis? Different Types of Clustering, Different Types of Clusters; K-means: The Basic K-means Algorithm, K- means Additional Issues, Bisecting K-means, Strengths and Weaknesses; Agglomerative Hierarchical Clustering: Basic Agglomerative Hierarchical Clustering Algorithm DBSCAN: Traditional Density Center-Based Approach, DBSCAN Algorithm, Strengths and Weaknesses.

Text Books:

1. Introduction to Data Mining : Pang-Ning Tan & Michael Steinbach, Vipin Kumar, Fifth Impression, Pearson, 2015.
2. Data Mining concepts and Techniques, 3rd Edition, Jiawei Han, Michel Kamber, Elsevier, 2011

Reference Books:

1. Data Mining Techniques and Applications: An Introduction, Hongbo Du, Cengage Learning, 2010
2. Data Mining : Introductory and Advanced topics : Dunham, First Edition, Pearson, 2020
3. Data Warehousing Data Mining & OLAP, Alex Berson, Stephen Smith, TMH, 2008
4. Data Mining Techniques, Arun K Pujari, Universities Press, 2001

Web Resources:

1. NPTEL Online Course on Data Mining : https://onlinecourses.nptel.ac.in/noc18_cs14/preview

AR-20 : B.Tech - CSE (DATA SCIENCE) **II Year II Semester**

Object Oriented Programming

L	T	P	C
3	0	0	3

Subject Code: 20CDT203

Course Objectives:

- The objective of the course is to teach the basic concepts and techniques which form the object oriented programming paradigm
- Well equipped with Java SDK environment to create, debug and run simple Java programs

Course Outcomes:

After Completion of the Course, the students will be able to:

1. Knowledge of the structure and model of the Java programming language
2. Explain the concept of class and objects with access control to represent real world entities
3. Demonstrate the implementation of inheritance by using extends and implements keywords
4. Illustrate different techniques on creating and accessing packages (fully qualified name and import statements)
5. Understand the impact of exception handling to avoid abnormal termination of program using checked and unchecked exceptions
6. Use multithreading concepts to develop inter process communication and also design applet Programs.

Unit I:

Introduction To Java: Evolution of Java, Java Buzzwords, The Java Virtual Machine, An overview of Java- Simple Java Program, Naming Conventions in Java, Data types, Variables, Expressions, Automatic type Conversion, Operators, Control Statements , Arrays, Strings

Unit II:

Classes & Objects: Class fundamentals, Declaring Objects, Initializing the instance variables, Access Control, Constructors, Methods in Java, Overloading Methods and constructors, Static Methods, Recursion, final keyword, this keyword, garbage collection, finalize() method

Unit III:

Inheritance: Inheritance Basics, Types of Inheritance, The Keyword ‘super’, Final with inheritance. Polymorphism: Method Overriding, Dynamic Method Dispatch, Abstract Classes. INTERFACES: Interface, Multiple Inheritance using Interface, Abstract Classes vs. Interfaces

Unit IV:

Packages: Packages, Different Types of Packages, Access Protection, Importing Packages.
Exception Handling: Exception-handling fundamentals, throw Clause,throws Clause.
Types of Exceptions: Built-in Exception, User Defined Exception.

Unit V:

Threads: Java Thread Model, Main Thread, Creating a Thread and Running it, terminating the Thread, Creating Multiple Threads, Thread Synchronization, and Thread Priorities.

Unit VI:

Applets: Applet Basics, Applet Life Cycle, A Simple Applet, HTML applet tag, Applet Parameters.

Text Books:

1. Herbert Schildt, "Java The complete reference", 9thEdition, McGrawHill, 2017.
2. Timothy budd, "An introduction to object-oriented programming", 3rdEdition, Pearson Education,
2009.

Reference Books

1 E.Balaguruswamy, "Programming with Java A Primer", 5th Edition, TataMcGraw-Hill, 2017.
2. Y. Daniel Liang, "Introduction to Java programming", 9thEdition, Pearson education, 2012

Reference Link

1. http://en.wikibooks.org/wiki/Java_Programming - Java Learning WikiBook
2. http://www.javabeginner.com - Java Beginner Tutorial

AR-20 : B.Tech - CSE (DATA SCIENCE) **II Year II Semester**

Fundamentals of Data Science

L	T	P	C
3	0	0	3

Subject Code: 20CDT204

Course Objectives:
- To provide a comprehensive knowledge of data science using Python.
- To learn the essential concepts of data analytics and data visualization.

Course Outcomes:
Upon successful completion of the course, the student will be able to:
- Apply principles of NumPy and Pandas to the analysis of data.
- Make use of various file formats in loading and storage of data.
- Identify and apply the need and importance of pre-processing techniques.
- Show the results and present them in a pictorial format.

Unit I:
Data science: definition, Datafication, Exploratory Data Analysis, The Data science process, A data scientist role in this process.
NumPy Basics: The NumPy ndarray: A Multidimensional Array Object, Creating ndarrays ,Data Types for ndarrays, Operations between Arrays and Scalars, Basic Indexing and Slicing, Boolean Indexing, Fancy Indexing, Data Processing Using Arrays, Expressing Conditional Logic as Array Operations, Methods for Boolean Arrays , Sorting , Unique.

Unit II:
Getting Started with pandas: Introduction to pandas, Library Architecture, Features, Applications, Data Structures, Series, DataFrame, Index Objects, Essential Functionality Reindexing, Dropping entries from an axis, Indexing, selection, and filtering),Sorting and ranking, Summarizing and Computing Descriptive Statistics, Unique Values, Value Counts, Handling Missing Data, filtering out missing data.

Unit III:
Data Loading, Storage, and File Formats: Reading and Writing Data in Text Format, Reading Text Files in Pieces, Writing Data Out to Text Format, Manually Working with Delimited Formats, JSON Data.

Unit IV:
XML and HTML: Web Scraping, Binary Data Formats, Using HDF5 Format, Reading Microsoft Excel Files, Interacting with Databases, Storing and Loading Data in MongoDB.

Unit V:
Data Wrangling: Combining and Merging Data Sets, Database style DataFrame Merges, Merging on Index, Concatenating Along an Axis, Combining Data with Overlap , Reshaping and Pivoting, Reshaping with Hierarchical Indexing, Data Transformation, Removing Duplicates, Replacing Values.

Unit VI:
Plotting and Visualization: A Brief matplotlib API Primer, Figures and Subplots, Colors, Markers, and Line Styles, Ticks, Labels, and Legends, Annotations and Drawing on a Subplot, Saving Plots to File, Plotting Functions in pandas, Line Plots, Bar Plots, Histograms and Density Plots, Scatter Plots.

Text Books:

1. Wes McKinney, “Python for Data Analysis”, O’REILLY, ISBN:978-1-449-31979-3, 1st edition, October 2012.
2. Rachel Schutt & O’neil, “Doing Data Science”, O’REILLY, ISBN:978-1-449-35865-5, 1st edition, October 2013.

Reference Books:

1. Joel Grus, “Data Science from Scratch: First Principles with Python”, O’Reilly Media, 2015
2. Matt Harrison, “Learning the Pandas Library: Python Tools for Data Munging, Analysis, and Visualization , O'Reilly, 2016.

AR-20 : B.Tech - CSE (DATA SCIENCE) **II Year II Semester**

Probability & Statistics with R Lab

L	T	P	C
0	0	3	1.5

Subject Code: 20BSL203

Course Objectives

- To introduce basic R operations and determine the probabilities of a random variable using Binomial, Poisson's, Normal distribution.
- To determine the probabilities of sample mean using central limit theorem and to estimate confidence interval using R programming.
- To perform z-test for sampling distribution using R - programming.
- To analyze t-test and F-test for sampling distribution using R - programming.
- To perform -test and Analysis of variance (ANOVA) using R - programming.
- To calculate correlation and regression for given data using R programming.

Course Outcomes

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

1. Obtain probabilities of random variable of a Binomial, Poisson's, Normal distribution using R programming.
2. Calculate probabilities of sample mean and confidence interval using R - programming.
3. Perform z – test for sampling distributions using R programming.
4. Perform t – test and F-test for sampling distributions using R programming.
5. Analyze tests of significance using -test and ANOVA using R programming.
6. Determine the coefficient of correlation and regression equations for given data using R programming.

List of Experiments

1. Calculate the probability of random variable for Binomial distribution using R.
2. Calculate the probability of random variable for Poisson distribution using R.
3. Calculate the probability of random variable for Normal distribution using R.
4. Calculate probability of mean of random variable using central limit theorem using R.
5. Calculate the confidence interval for mean and proportions C.
6. Perform z-test for testing single mean and difference of means at α level of significance using R.
7. Perform z-test for testing single proportion and difference of proportions at α level of significance using R.
8. Perform t-test for testing the single mean and difference of means at α level of significance using R.
9. Perform F-test for testing the equality of population variances at α level of significance using R.
10. Perform -test for testing the goodness of fit and independence of attributes using R.
11. 7. Perform ANOVA of one way and two way classifications to test on the basis of sample observations whether the means of 3 or more populations are equal or not, using R.
12. Perform Correlation and regression for given data, using R.

AR-20 : B.Tech - CSE (DATA SCIENCE) **II Year II Semester**

Object Oriented Programming through Java Lab

L	T	P	C
0	0	3	1.5

Subject Code: 20CDL202

Course Objectives

- To develop skills to design and analyze the applications with respect to java programming
- To strengthen the ability to identify and apply the suitable object oriented concept for the given Real world problem

Course Outcomes

After Completion of the Course, the students will be able to:

- Able to write, compile and execute simple java programs
- Explain the concept of class and objects with access control to represent real world entities
- Use overloading methodology on methods and constructors to develop application programs
- Describe the concept of interface and abstract classes to define generic classes
- Able to create user defined packages and handle exceptions at run time
- Apply Threading concept based on application requirement and design Applet programming

List of Experiments

1. A) Write a java program that displays welcome to follow by user name. Accept user name from the user.
   B) Write a java program that prompts the user for an integer and then prints out all the prime numbers up to that integer.
2. A) Write a java program to create a class Rectangle. The class has attributes Length and Width.
   It should have methods that calculate Area and Perimeter of the Rectangle. It should have read Attributes () method to read Length and Width from the user.
   B) The Fibonacci sequence is defined by the following rule: The first two values in the sequence are1 and 1. Every subsequent value is the sum of the two values preceding it.
3. A) Write a java program that uses both Recursive and Non-Recursive functions to find the factorial of a given number.
   B) Write a java program that checks whether the given string is Palindrome or not. Ex: MALAYALAM is a Palindrome.
4. A) Write a java program to illustrate method overloading and method overriding.
   B) Writ a java program that illustrates how java achieved Run Time Polymorphism.
5. A) Write a java program to demonstrate the use of subclass.
   B) Write a java program for abstract class to find areas of different shapes.

6. Write a Java program to implement the concept of importing classes from user defined package and creating packages.
7. Write a java program to implement the concept of Exception Handling by using predefined and user defined exceptions.
8. Write a java program to implement the concept of Threading by Extending Thread class and by Implementing Runnable Interface.

9. Write a program using Applet to display a message in the Applet and for configuring Applets by passing parameters.
10 Write a java program to implement thread priorities

Text Books

1. Herbert Schildt: "Java The complete reference", 9th Edition, Tata McGraw Hill, 2017.
2. E.Balaguruswamy: "Programming with Java A Primer", 5th Edition, Tata McGraw Hill, 2017.

Reference Books

1. Timothy budd, "An introduction to object-oriented programming", 3rdEdition, Pearson Education, 2009.
2. Y. Daniel Liang, "Introduction to Java programming", 9thEdition, Pearson education, 2012

AR-20 : B.Tech - CSE (DATA SCIENCE) **II Year II Semester**

Fundamentals of Data Science Lab

L	T	P	C
0	0	3	1.5

Subject Code: 20CDL203

Course Objectives:

The main objective of the course is to inculcate the basic understanding of Data Science and it's practical implementation using Python.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

- Perform various operations on numpy arrays
- Importing data from different file formats using pandas
- Draw different types of charts using matplotlib

List of Experiments

1. Creating a NumPy Array
a) Basic ndarray
b) Array of zeros
c) Array of ones
d) Random numbers in ndarray
e) An array of your choice
f) Imatrix in NumPy
g) Evenly spaced ndarray

2. The Shape and Reshaping of NumPy Array
a) Dimensions of NumPy array
b) Shape of NumPy array
c) Size of NumPy array
d) Reshaping a NumPy array
e) Flattening a NumPy array
f) Transpose of a NumPy array

3. Expanding and Squeezing a NumPy Array
a) Expanding a NumPy array
b) Squeezing a NumPy array
c) Sorting in NumPy Arrays

4. Indexing and Slicing of NumPy Array
a) Slicing 1-D NumPy arrays
b) Slicing 2-D NumPy arrays
c) Slicing 3-D NumPy arrays
d) Negative slicing of NumPy arrays

5. Stacking and Concatenating Numpy Arrays
a) Stacking ndarrays
b) Concatenating ndarrays
c) Broadcasting in Numpy Arrays
6. Perform following operations using pandas
a) Creating dataframe

b) concat()
c) Setting conditions
d) Adding a new column

7. Perform following operations using pandas
a) Filling NaN with string
b) Sorting based on column values
c) groupby()

8. Read the following file formats using pandas
a) Text files
b) CSV files
c) Excel files
d) JSON files

9. Read the following file formats
a) Pickle files
b) Image files using PIL
c) Multiple files using Glob
d) Importing data from database

10. Demonstrate web scraping using python

11. Perform following preprocessing techniques on loan prediction dataset
a) Feature Scaling
b) Feature Standardization
c) Label Encoding
d) One Hot Encoding

12. Perform following visualizations using matplotlib
a) Bar Graph
b) Pie Chart
c) Box Plot
d) Histogram
e) Line Chart and Subplots
f) Scatter Plot

Web References:

1. https://www.analyticsvidhya.com/blog/2020/04/the-ultimate-numpy-tutorial-for-data-science- beginners/
2. https://www.analyticsvidhya.com/blog/2021/07/data-science-with-pandas-2-minutes-guide-to-key- concepts/
3. https://www.analyticsvidhya.com/blog/2020/04/how-to-read-common-file-formats-python/
4. https://www.analyticsvidhya.com/blog/2016/07/practical-guide-data-preprocessing-python-scikit- learn/
5. https://www.analyticsvidhya.com/blog/2020/02/beginner-guide-matplotlib-data-visualization- exploration-python/

AR-20 : B.Tech - CSE (DATA SCIENCE) **II Year II Semester**

Transform Theory
(Interdisciplinary Elective I)
(Common to Mechanical, Civil)

L	T	P	C
3	0	0	3

Subject Code: 20IET211

Course Objectives

- To study the Laplace transform of different basic functions and its properties.
- To study Inverse Laplace Transforms and apply Laplace transforms to solve differential equations.
- To Study the mathematical tool of Fourier transforms their properties and applications.
- To study Inverse Fourier transforms their properties.
- To study the mathematical tool of Z- transform, their properties and implementation.
- To study Inverse Z Transforms and apply Z- transform to solve Difference Equations.

Course Outcomes

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

1. Evaluate Laplace Transform of different functions utilizing its properties.
2. Evaluate Inverse Laplace Transform of different functions and solve Differential Equations.
3. Estimate Fourier transform/ Fourier sine(cosine) Transform of functions.
4. Estimate inverse Fourier transform/ inverse Fourier sine(cosine) transform of different functions.
5. Evaluate Z-transform of different functions utilizing different properties.
6. Evaluate inverse Z- transform of different functions and solve Difference Equations utilizing different properties.

Unit I:

Laplace Transforms: Laplace Transform for elementary functions Properties- 1^{st} shift and 2^{nd} shifting theorems - Laplace transform of derivative, integrals, multiplication by t^n and division by t- unit step and unit impulse function.

Unit II:

Inverse Laplace Transforms: Inverse Laplace Transform Evaluation by partial fractions, convolution theorem(without proof), application of Laplace transforms to solve ordinary differential equations.

Unit III:

Fourier Transforms : Fourier Integral Theorem (without proof)- Fourier sine and cosine integrals complex form of Fourier Integral - Fourier transform - Fourier sine and cosine transforms - properties.

Unit IV:

Inverse Fourier Transforms: Inverse Fourier Transforms, Inverse sine and cosine transforms – properties Convolution Theorem.

Unit V:

Z - Transforms: Z-transform - Linear property - Damping rule - Shifting rule - Initial and final value theorems- Z transforms of functions multiplied and divided by n.

Unit VI:

Inverse Z- Transforms: Inverse Z-Transforms of basic functions, Partial fractions, Convolution theorem. Application of Z transforms to solve Difference Equations.

Text books:

1) B.V.Ramana, Higher Engineering Mathematics, 44th Edition, Tata McGraw Hill New Delhi,2014.
2) Dr.B.S.Grewal, Higher Engineering Mathematics, 43nd Edition, Khanna Publishers, 2015.

References

1. Advanced Engineering Mathematics , Erwin Kreyszig, 9th Edition, John Wiley & Sons.
2. Engineering Mathematics for first year, Veerarajan T., Tata McGraw-Hill, New Delhi.
3.A text book of Engineering Mathematics, N.P. Bali and Manish Goyal, Laxmi Publications.

AR-20 : B.Tech - CSE (DATA SCIENCE) **II Year II Semester**

Numerical Methods
(Interdisciplinary Elective I)
(Common to ECE, EEE)

L	T	P	C
3	0	0	3

Subject Code: 20IET212

Course Objectives

- To Solve the algebraic and transcendental equations, using different numerical method.
- Calculate the value of dependent variable for a particular x by deducing the unknown function y=f(x) for an evenly or unevenly spaced points.
- To estimate the value of derivatives using different numerical methods.
- To evaluate the definite integrals using different numerical methods.
- To calculate the numerical solution of an ordinary differential equation i.e IVP .
- Estimate an equation of curve which fits a given data.

Course Outcomes

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

1. Solve the algebraic and transcendental equations by identifying suitable numerical methods.
2. Estimate a linear and non-linear curve to the given data by the method of least squares.
3. Calculate the value of dependent variable for a particular x by deducing the unknown function y = f(x) for an evenly or unevenly spaced points.
4. Estimate the value of derivatives and evaluate the definite integrals using different numerical methods and evaluate an IVP.
5. Calculate the numerical solution of an ordinary differential equation i.e IVP .
6. Enables to fit a equation of curve to the given data.

Unit I:

Algebraic and Transcendental Equations: Solution of Algebraic and Transcendental Equations: Introduction The Bisection Method The Method of False Position The Iteration Method Newton- Raphson Method.

Unit II:

Interpolation: Interpolation: Introduction Finite differences- Forward Differences Backward differences Central differences-Relation between different operators- Newton's Interpolation formulae-Gauss Interpolation Formulae- Interpolation with unevenly spaced points-Lagrange's Interpolation formula.

Unit III:

Numerical Differentiation: Numerical Differentiation using finite differences- Newton's Forward - Backward- Lagrange's- Stirling's formula's interpolation formula.

Unit IV:

Numerical Integration: Numerical Integration - Trapezoidal rule - Simpson's 1/3 rule - Simpson's 3/8 Rule. Numerical double integration - Trapezoidal rule -Simpson's 1/3 rule.

Unit V:
Numerical solution of Ordinary Differential equations: Solution by Taylor's series - picard's Method of successive Approximations - Euler's Method - Runge Kutta Method(4th order).

Unit VI:
Curve Fitting: Curve fitting: Fitting a straight line-Second degree curve-Exponential curve-Power curve by method of least squares.

Text Books:
1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, New Delhi, 42nd edition, 2012.
2. A Text Book on Mathematical Methods, Ravindranath, V. and Vijayalaxmi, A.,Himalaya Publishing House, Bombay, 2nd edition, 2012.

Reference Books:
1. Engineering Mathematics Vol.2.-Mathematical Methods(JNTU Kakinada), Dr.T. K.V.Iyengar, Dr.M.V.S.S.N.Prasad, S.Ranganatham, Dr.B.Krishna Gandhi, , S. Chand Publications.
2. Engineering Mathematics, B. V. Ramana, Tata McGraw Hill, New Delhi.

AR-20 : B.Tech - CSE (DATA SCIENCE) **II Year II Semester**

Introduction to Number Theory
(Interdisciplinary Elective I)
(Common to CSE, IT, CSM, CSD)

L	T	P	C
3	0	0	3

Subject Code: 20IET213

Course Objectives

- Identify importance of divisibility, prime and composite numbers in engineering field.
- Understand the process of congruence and solve linear congruence using their properties.
- Gain knowledge and importance of Euler-Fermat Theorem, Wilson Theorem, Chinese Remainder Theorem.
- Know the application of Mobious function and Euler totient function in their relevant problems.
- Calculate Quadratic Residues and use Quadratic reciprocity law in engineering subjects.
- Encrypt and decrypt the messages using Cryptography.

Course Outcomes

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

1. Solve the divisibility problems, GCD, LCM, Bracket function.
2. Solve congruence problems, solutions of linear congruence equations.
3. Apply Euler-Fermat Theorem, Wilson and Chinese Remainder Theorems in engineering problems
4. Apply Euler-totient function and solve engineering relevant problems.
5. Estimate the reciprocity of a number.
6. Applying the process of encryption and decryption in converting the messages using Cryptography.

Unit I:

Divisibility Divisibility, Statement of Division Algorithm, GCD, Prime, Composite numbers, Statement of Fundamental Theorem of Arithmetic, LCM, Bracket function, The "O" and "o" Symbols, Properties.

Unit II:

Congruence's Introduction to Congruence's, Residue systems, Euler's Φ function, linear congruence's, properties and their solutions.

Unit III:

Euler-Fermat Theorem, Wilson Theorem, The Chinese Remainder Theorem Statement of Euler's Theorem, Fermat Theorem, Wilson Theorem, the Chinese Remainder Theorem, properties and problem.

Unit IV:

Multiplicative Number theoretic Functions Definitions and properties, Euler's totient function $\Phi(n)$,the sum of divisors function, the number of divisors function, product formula, Mobius function $\mu(n)$ and Mobious Inverse formula, perfect, Mersenne and Fermat Number.

Unit V:
Primitive Roots and Quadratic Residues Order of Integers and Primitive roots, primitive roots for primes, the existence of primitive roots, Quadratic residues, Legendre's symbol and its properties, Evolution of (-1/p) and (2/p), Gauss lemma, the Quadratic reciprocity law, application of the reciprocity law, the Jacobi symbol.

Unit VI:
Cryptography Introduction to Cryptography, Ciphers, Block and Stream Ciphers, Exponential Ciphers, Public Key Cryptography, Cryptographic protocol and applications.

Text books

1. Introduction to Analytic Number theory, Tom M, Apostol,(Springer International Student Edition). Naroda Publishing House, Springer Publisher -8th reprint. ISBN: 81-85015-12-0.

2. Elementary Number Theory and its Applications, Kenneth H. Rosen, Pearson Publications (Sixth edition-Online, ISBN 10:0-321-50031-8, ISBN 13: 978-0-321-50031-1.)

3. An Introduction to the theory of Numbers, Ivan Niven- Herbert S, Zuckermam-Hugh L. Montgomery John Wiley & Sons Publisher (Online- Fifth Edition , ISBN 0-471-62546-9)

Reference Books:

1. Theory of Numbers, Prakash Om, Laxmi Publications (p) LTD, New Delhi.

AR-20 : B.Tech - CSE (DATA SCIENCE) **II Year II Semester**

Elements of Building Planning
(Interdisciplinary Elective I)
(Only to Mechanical Engineering)

L	T	P	C
3	0	0	3

Subject Code: 20IET214

Course Objectives

- To interpret the conventional building materials.
- To summarize the objectives of building byelaws, principles and regulations
- To apply the minimum standards for various parts of buildings.
- To draw the line plan of a school and hospital for given site plan
- To describe the orientation of buildings based on earth's motion around the sun and significance of bond for brick walls
- To draw plan, elevation and sectional elevation of single room buildings from the given line diagram.

Course Outcomes

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

1. 1.Interpret the conventional building materials.
2. 2.Summarize the objectives of building byelaws, principles and regulations
3. 3.Apply the minimum standards for various parts of buildings.
4. 4.Draw the line plan of a school and hospital for given site plan
5. 5.Describe the orientation of buildings based on earth's motion around the sum and significance of bond for brick walls
6. Draw plan, elevation and sectional elevation of single room buildings from the given line diagram.

Unit I:

Building Materials: Conventional Building Materials such as Brick, Cement, Steel, Wood - Modern Building Materials Plumbing Fixtures Sanitary fittings Materials for Building Electrification Ready to use building materials currently available in the market.

Unit II:

Building Byelaws and Regulations: Introduction- terminology- objectives of building byelaws floor area ratio floor space index- principles under laying building bye laws- classification of buildings- open space requirements built up area limitations- height of buildings- wall thickness lightening and ventilation requirements.

Unit III:

Residential buildings: Minimum standards for various parts of buildings, requirements of different rooms and their grouping, characteristics of various types of residential buildings - Study of structural elements of Building Minimum standards for Septic tank, balcony, corridor and staircase.

Unit IV:

Public Buildings: Planning of educational institutions, hospitals and dispensaries. Requirements and minimum standards for various public buildings. Draw the line plan of a school and hospital for given site plan.

Unit V:
Principles of Planning and Orientation of the Residential Building: Orientation of Buildings based on Earths motion round the Sun Significance of Bond for Brick walls Study of specifications of doors, Windows, ventilators and roofs Prefabricated Buildings and Toilets.

Unit VI:
Drawing practice: Single room building, given line diagram with specifications to draw, plan, elevation and sectional elevation.

Text Books:
1. Planning and Design of buildings by Y.S. Sane, 2015
2. Planning, designing and Scheduling by Gurucharan Singh and Jagadish Singh, 2012
3. Building planning and drawing by M. Chakravarthi, 2016

Reference Books:
1. Building drawing by Shah and Kale
2. 'A' Series & 'B' Series of JNTU college of Engineering, Anantapur.

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Remote Sensing
(Interdisciplinary Elective I)
(Common to CSE, IT, ECE, EEE, CSM, CSD)
Subject Code: 20IET215

L	T	P	C
3	0	0	3

Course Objectives
The objective of the course is to

- To demonstrate the working principle of remote sensing
- To differentiate the types platforms and orbits
- To describe the various types of sensors and resolutions
- To utilize different digital image processing and visual interpretation techniques to extract meaningful information from spatial data
- To illustrate the image classification procedure
- To explain the use of remote sensing in different applications.

Course Outcomes
After the completion of this course, the student will be able to:

1. Demonstrate the working principle of remote sensing
2. Differentiate the types of platforms and orbits
3. Describe the types of sensors & resolutions
4. Utilize different digital image processing and visual interpretation techniques to extract meaningful information from spatial data
5. Illustrate the image classification procedure
6. Explain the use of remote sensing in different applications.

Unit I:
Introduction: Definition, Basic components of remote sensing, Electromagnetic radiation, Electromagnetic spectrum, EMR interaction with atmosphere - EMR interaction with Earth Surface Materials.

Unit II:
Platforms: Introduction, Platforms- Ground borne, Airborne remote sensing, Space borne remote sensing; Orbital Characteristics, Type of Orbits

Unit III:
Sensors & Resolution: Introduction, Sensors- Passive sensors, Active sensors; Spatial Resolution, Spectral Resolution, Temporal Resolution, Radiometric Resolution.

Unit IV:
Image Analysis: Introduction, Digital Image processing, elements of visual interpretations, image enhancement techniques.

Unit V:
Image classification: Introduction, Principles of Image classification, Process of image classification supervised classification, unsupervised classification.

Unit VI:
Applications: Land use/Land cover, Agriculture, Forest, Water Resources and Urban Planning

Text books
1. LRA Narayana,"Remote Sensing and its Applications" University Press, 1999.
2. M. Anji Reddy,"Remote Sensing and Geographical Information Systems". BS Publications, 4th edition,2014.
3. Basudeb Batta,"Remote Sensing and GIS", Oxford University Press, New Delhi, 2nd Edition, 2011

Reference Books
1. S.Kumar,"basics of Remote Sensing and GIS", Laxmi Publications, 1st Edition, 2016.
2. Lillesand, Kiefer, Chipman, "Remote Sensing and Image Interpretatyion", Willy Publishers, 7th Edition, 2015
3. James B. Cambell, Rondolph H. Wynne, , Guilford Press, London and Newyork, 5th Edition, 2011

AR-20 : B.Tech - CSE (DATA SCIENCE) **II Year II Semester**

Mathematical Simulation and Modeling
(Interdisciplinary Elective I)
(Common to CSE, IT, ECE, Mechanical, Civil, CSM, CSD)
Subject Code: 20IET216

L	T	P	C
3	0	0	3

Course Objectives

By the end of this course, students in this class will understand the basic principles of programming and implementing mathematical concepts in MATLAB. Specifically, they will be able to write numerical algorithms and evaluate the computational results using graphical representations. The ultimate goal is to motivate the students for their profession and for future courses in curriculum.

Course Outcomes

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

1. Translate mathematical methods to MATLAB code.
2. Generalize results and represent data visually.
3. Apply computer methods for solving a wide range of engineering problems.
4. Utilize computer skills to enhance learning and performance in other engineering and science courses.
5. Demonstrate professionalism in interactions with industry.
6. Understands about Scilab.

Unit I:

Introduction to Matlab Historical Background, Applications, Scope of MATLAB, Importance of MATLAB for Engineers, Features, MATLAB Windows (Editor, Work Space, Command History, Command Window). Operations with Variables, Clearing Operations, Commands, Data types, Operators.

Unit II:

Data and Data Flow in Matlab Vectors, Matrix Operations & Operators, Reshaping Matrices, Arrays, Colon Notations, Functions

Unit III:

Matlab Programming Conditional Statements, Loops, Writing Script Files, Error Correction, Saving Files, Worked out Examples.

Unit IV:

Matlab Advanced Plotting graphs, Creating Plot & Editing Plot, MATLAB-Algebra, Calculus, Differential, Integration, Polynomials, solving a system of linear equations.

Unit V:

Simulink-I Introduction, Importance, Model Based Design, Tools, Mathematical Modeling,

Unit VI:

Simulink-II Converting Mathematical Model into Simulink Model, Running Simulink Models, Introduction to scilab.

Text books

1. Getting Started With Matlab: A Quick Introduction for Scientists and Engineers (English) by RudraPratap, OXFORD University Press.
2. Matlab Programming by Y. Kirani Singh, B.B. Chaudhuri, PHI Publication

Reference Books

1. MATLAB® Programming For Engineers Fourth edition by Stephen J. Chapman
2. Applied Numerical Methods Using MATLAB 1st Edition by Won Y. Yang ,WenwuCao,Tae- SangChung,JohnMorris.
3. https://in.mathworks.com/products/simulink.html

AR-20 : B.Tech - CSE (DATA SCIENCE) **II Year II Semester**

Fundamentals of Material Science
(Interdisciplinary Elective I)
(Common to CSE, IT, ECE, EEE, Civil, CSM, CSD)
Subject Code: 20IET217

L	T	P	C
3	0	0	3

Course Objectives

- To understand different engineering materials and their structures.

Course Outcomes

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

1. On completion of this course, students should be able: To gain thorough knowledge in engineering materials and their structures.
2. To gain thorough knowledge in deformation in different engineering materials.
3. Understand necessity of hot and cold working methods.
4. Understand thoroughly mechanical properties.
5. To acquire knowledge on material testing methods and its process
6. Understand necessity of making components using powder metallurgy route

Unit I:

Introduction: Introduction, classification of materials, crystal defects.

Unit II:

Plastic deformation of single crystals: Plastic deformation of single crystals. Deformation by slip, Deformation of single crystal. Deformation by twinning.

Unit III:

hot working, cold working. Recovery, recrystallization and grain growth. Solidification mechanism.

Unit IV:

Mechanical properties: Mechanical properties. Tensile stress-strain diagrams, proof stress, yield stress diagrams, modules of elasticity. Hardness Testing: -Rockwell, Brinell and Vickers.

Unit V:

Impact toughness, Charpy V-Notch, fracture, ductile, brittle, creep, creep mechanisms, fatigue- mechanism-factors to improve fatigue resistance

Unit VI:

Powder Metallurgy: Definition, Methods of production of metal powders, Stages in powder metallurgical components preparation, Design considerations.

Text books

1.An introduction to material Science --V Raghavan
2.Mechanical Metallurgy -- GE Dieter.
3.Material Science -- Callister.

Reference Books

1.Material Science for Engineers -- Vanvlack.
2.Material Science for Engineers -- Schakleford.

AR-20 : B.Tech - CSE (DATA SCIENCE) **II Year II Semester**

Introduction to Electronic Measurements
(Interdisciplinary Elective I)
(Common to CSE, IT, Mechanical, EEE, Civil, CSM, CSD)
Subject Code: 20IET218

L	T	P	C
3	0	0	3

Course Objectives

- To provide knowledge of performance characteristics and classify static errors of different measuring instruments.
- To construct DC Ammeter, DC Voltmeter, Ohmmeters for measurement of unknown current, voltage and resistance.
- To introduce various Signal generators and Harmonic Distortion analyzers.
- To become familiar with the working of CRO and special Oscilloscopes for measurement of electronic parameters.
- To construct AC and DC bridges for measurement of unknown Resistance, Inductance and Capacitance.
- To understand working principles of transducers for the measurement of non-electrical quantities.

Course Outcomes

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

1. Define various performance characteristics and classify static errors of Instruments.
2. Calculate the resistance values for construction of DC voltmeter, Ammeter and Ohmmeters.
3. Explain the working of various signal generators and analyzers for distortion measurements.
4. Describe the working and use of CRO and special oscilloscopes.
5. Determine the value of unknown resistance, inductance, capacitance and frequency of excitation.
6. Classify transducers and identify suitable transducer for measuring various non-electrical quantities.

Unit I:

Performance characteristics of instruments: Static characteristics - accuracy, resolution, precision, expected value, error and sensitivity, Error in measurement, Types of Static error, Dynamic characteristics - speed of response, fidelity, lag and dynamic error.

Unit II:

DC Meters: DC Ammeter Construction, Multirange ammeter, Universal Shunt and Extending Range. RF ammeter. DC Voltmeter Construction, Multirange voltmeter, Extending Range. Ohmmeters - Series type and shunt type.

Unit III:

Signal Generators and Harmonic Distortion Analyzers:
Signal Generators - Standard signal generator, AF sine and square wave generator, Function Generator. Harmonic Distortion Analyzers:Fundamental Suppression Type - Resonance bridge, Wien's Bridge, Bridged T-Network.

Unit IV:
CRO and Special Oscilloscopes: CRT features, Block Diagram of oscilloscope, Dual Beam CRO, Dual trace oscilloscope, Storage oscilloscope.

Unit V:
DC and AC Bridges: DC Bridge - Measurement of Resistance - Wheatstone's bridge. AC Bridges - measurement of inductance - Maxwell's Bridge, Anderson's bridge, Measuremenent of capacitance - Schering's Bridge and Wien's Bridge.

Unit VI:
Transducers: Classification, Resistive Transducer Potentiometer type Pressure Transducer and Position Transducer, unbonded and bonded strain gauges, Thermistor, Inductive Transducer- LVDT, Capacitive Transducer Pressure Transducer, Temperature Transducer-Thermocouple.

Text books
1.Electronic instrumentation H.S.Kalsi, Tata McGraw Hill, 2004, 2/e.
2.Modern Electronic Instrumentation and Measurement Techniques - A.D. Helfrick and W.D. Cooper, PHI, 2002, 5/e.

Reference Books
1.Electronic Instrumentation & Measurements - David A. Bell, PHI, 2003, 2/e.
2.Electronic Test Instruments, Analog and Digital Measurements - Robert A.Witte, Pearson Education, 2004, 2/e.

Reference Links
1.https://nptel.ac.in/courses/108/105/108105153/
2.http://nitttrc.edu.in/nptel/courses/video/108105153/108105153.html

AR-20 : B.Tech - CSE (DATA SCIENCE) **II Year II Semester**

UNIX Utilities
(Interdisciplinary Elective I)
(Common to ECE, EEE, Mechanical, Civil)

L	T	P	C
3	0	0	3

Subject Code: 20IET219

Course Objectives

Know about UNIX operating system
Understand important commands which are used in UNIX Learn shell programming
Study UNIX file system Understand the process mechanism

Course Outcomes

After the completion of this course, the student will be able to:
1.Describe UNIX Architecture and Functions of OS
2.Demonstrate the basic set of commands and utilities in UNIX system
3.Design and Implement of UNIX file system
4.Familiar with various shell commands
5.Develop shell scripts to automate various tasks
6.Analyze the different types of processes in UNIX environment

Unit I:

Introduction to Unix-Brief History,What is Unix-Unix Components, Operating system services, Assumptions about hardware. Introduction to the Kernel: Architecture of the UNIX operating system, Introduction to system concepts Kernel data structures System administration.

Unit II:

Using Unix-Commands, Unix-Some Basic Commands-. Unix Command - man, echo, printf, script, passwd, uname, who, date, stty, pwd, cd, mkdir, rmdir, ls, cp, mv, rm, cat, more, wc, lp, od, tar, gzip. Unix Utilities:- Introduction to unix file system, vi editor, file handling utilities, security by file permissions, process utilities, disk utilities, networking commands, unlink, du, df, mount, umount, find, unmask, ulimit, ps, w, Text processing utilities and backup utilities , detailed commands to be covered are tail, head , sort, nl, uniq, grep, egrep, fgrep, cut, paste, join, comm, cmp, diff, tr.

Unit III:

The File system The Basics of Files- What's in a File - Directories and File Names-Permissions-I Nodes- The Directory Hierarchy, File Attributes and Permissions-The File Command knowing the File Type-The Chmod Command Changing File Permissions-The Chown Command Changing the Owner of a File-The Chgrp Command Changing the Group of a File.

Unit IV:

Using the Shell-Command Line Structure-Met characters-Creating New Commands-Command Arguments and Parameters-Program Output as Arguments-Shell Variables- -More on I/O Redirection-Looping in Shell Programs.

Unit V:

Shell Programming-Shell Variables-The Export Command-The Profile File a Script Run

During Starting- The First Shell Script-The read Command-Positional parameters-The $? Variable knowing the exit Status- More about the Set Command-The Exit Command-Branching Control Structures-Loop Control Structures-The Continue and Break Statement-The Expr Command: Performing Integer Arithmetic-Real Arithmetic in Shell Programs-The here Document(<<)-The Sleep Command-Debugging Scripts-The Script Command-The Eval Command-The Exec Command.

Unit VI:

The Process-The Meaning-Parent and Child Processes-Types of Processes-More about Foreground and Background processes-Internal and External Commands-Process Creation-The Trap Command-The Stty Command-The Kill Command-Job Control.

Text books

1. Introduction to Unix Shell Programming by M.G.Venkateshmurthy, Parson.
2. Your Unix the ultimate guide, Sumitabha Das, TMH. 2nd Edition.

Reference Books

1. Unix and shell programming by B.M. Harwani, OXFORD university press.
2. Unix programming environment, Kernighan and Pike, PHI. / Pearson Education
3. Beginning shell scripting, E. Foster - Johnson & other, Wile Y- India

AR-20 : B.Tech - CSE (DATA SCIENCE) **II Year II Semester**

Fundamentals of Data Structures
(Interdisciplinary Elective I)
(Common to ECE, EEE, Mechanical, Civil)

L	T	P	C
3	0	0	3

Subject Code: 20IET21A

Course Outcomes:

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

1. Compute the time and space complexities and calibrate the performance of a given algorithm.
2. Compare the performances of various Searching and Sorting techniques.
3. Illustrate the applications of Stacks and Queues.
4. Demonstrate the advantages of dynamic memory allocation via linked lists.
5. Implement the basic operations and Traversals on binary Trees.
6. Understand traversals and shortest path algorithms on a Graph.

Unit I:

Introduction: Basic Concepts of Data Structures and types of Data Structures; Performance Analysis of algorithms: Asymptotic Notations (O, Ω, θ)

Unit II:

Searching: Linear Search, Binary Search: Algorithm & Analysis; Sorting: Methodology & Performance Analysis of Sorting Algorithms: Selection, Bubble, Insertion, Quick, Merge sort.

Unit III:

Stacks: Definition, operations, Applications of Stacks: Conversion of infix to postfix expression Queues: Definition, operations, Applications of Queues;

Unit IV:

Linked Lists: Comparison with Arrays; Operations on Singly linked list: Creation, Insertion, Deletion, Traversing; Operations on Doubly linked list; Operations on Implementation of Stack and Queue using Linked Lists.

Unit V:

Trees: Basic Terminology of Trees; Binary Tree: Traversals; Binary Search Tree Operations: Insert, Delete;

Unit VI:

Graph: Basic Terminologies and Representations of Graphs; Graph traversal algorithms: Breadth-FS & Depth-FS; Minimum spanning tree algorithms: Prim's and kruskal's algorithms.

Text Books:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis", Fourth Edition, Pearson.
2. Ellis Horowitz, Sartaj Sahni, "Fundamentals of Data Structures", Illustrated Edition, Computer-Science Press.

Reference Books

1. Michel T.goodrich, Roberto Tamassia, david mount, "Data Structures and Algorithm Analysis", 2nd Edition, John Wiely & Sons, Inc.
2. Adam.Drozdek. 'data Structure and Algorithms in C++". 4th edition, Cengage.

Reference Links

1. https://nptel.ac.in/courses/106/102/106102064/
2. https://nptel.ac.in/courses/106/106/106106127/

AR-20 : B.Tech - CSE (DATA SCIENCE) **II Year II Semester**

Advanced Coding - I
(Interdisciplinary Elective I)
(Common to CSE, IT, CSM, CSD)

L	T	P	C
3	0	0	3

Subject Code: 20IET21B

Course Objectives

- Understanding importance of Mathematics and Problem solving approaches for Programming
- Understanding importance of Optimized solution for problem solving

Course outcomes

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

1. Solve problems using programming
2. Design solution using OOP principles
3. Analyze time and space Complexity of Solution of a problem.
4. Select appropriate container to organize data for problem solving.
5. Develop solution for problems Using Recursion
6. Analyze the problem using Mathematics

Unit I:

CPP Essentials: Basics: Basic Syntax, Variables, Data types, Operators, Input and output, Conditional Statements and loops, pointers and Dynamic memory allocation, arrays ,vector , built in functions, user defined functions.

Problems to Practice: Missing Number ,Integer to English Words ,Integer to Roman, Roman to Integer, 2sum, 3sum,3sum closet,4sum,Remove duplicates in a list, Circular Array Loop, Fruit Into Baskets, K-diff Pairs in an Array, Move Zeroes, Rotate Array, Flipping an Image, Circular Array Loop

Unit II:

OOP Principles: Implementation of OOP principles (Encapsulation , Abstract, Inheritance, polymorphism) in cpp and Exception Handling.

Unit III:

Algorithm Analysis: Characteristics of algorithm, Algorithm Analysis-operation count , step counts,. asymptotic complexity, recurrence equations.

Unit IV:

Standard Template Library: Containers, Container Classes, Vectors, Lists, Iterators, Maps, Set structures, Bit set, Stack, Queue, De queue, Priority queue

Unit V:

Recursion: Recursion and its applications, Exhaustive search using Backtracking. Problems to Practice: Permutations, Palindrome Partitioning, Beautiful Arrangement, N-Queens , Path with Maximum Gold

Unit VI:

Number Theory: Modular arithmetic, exponentiation ,Modular exponentiation, Greatest Common Divisor, Extended Euclidean algorithm, Modular multiplicative inverse, Prime

Number, Sieve of Eratosthenes.
Problems to Practice: Factorial Trailing Zeroes, Happy Number, Ugly Number, Smallest Integer Divisible by K, Prime Arrangements, Poor Pigs, Check If It Is a Good Array, Rabbits in Forest

Text Books
1.The Complete Reference C++ by Herbert Schildt ,4th Edition
2.E. Horowitz. et.al., Fundamentals of computer Algorithms, Universities Press, 2008, 2nd Edition.

Reference Books
1.J.Kleinberg & E. Tardos - Algorithm Design, Pearson Education, New Delhi, 2006.
2.G.Brassard & P. Bratley - Fundamentals of Algorithms, PHI, New Delhi, 2005.
3.T.H. Cormen et.al. - Introduction to Algorithms, PHI, New Delhi, 2005.
4.S.Dasgupta et.al. - Algorithms, TMH, New Delhi, 2007.

Reference Links
1.https://leetcode.com/problems/
2.https://nptel.ac.in/courses/106106145/
3.https://www.spoj.com/problems

AR-20 : B.Tech - CSE (DATA SCIENCE) **II Year II Semester**

Competitive Programming - I
(Interdisciplinary Elective I)
(Common to ECE, EEE, Mechanical, Civil)

L	T	P	C
3	0	0	3

Subject Code: 20IET21C

Course Objectives

- Understanding importance of Mathematics and Problem solving approaches for Programming
- Understanding importance of optimized solution for problem solving

Course Outcomes

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

1. Solve problems using programming
2. Design solution using OOP principles
3. Analyze time and space Complexity of a Solution.
4. Select appropriate container to organize data for problem solving.
5. Design a Relational Database schema for a subject of interest
6. Identify Redundancy in the Database using Normal Forms

Unit I:

CPP Essentials: Basics: Basic Syntax, Variables, Data types, Operators, Input and output, Conditional Statements and loops, pointers and Dynamic memory allocation, arrays , vector , built in functions, user defined functions.

Problems to Practice: Missing Number ,Integer to English Words ,Integer to Roman, Roman to Integer, 2sum, 3sum,3sum closet,4sum,Remove duplicates in a list, Circular Array Loop, Fruit Into Baskets,, K-diff Pairs in an Array, Move Zeroes, Rotate Array, Flipping an Image, circular Array Loop

Unit II:

OOP Principles: Implementation of OOP principles (Encapsulation, Abstraction, Inheritance, Polymorphism) in cpp and Exception Handling.

Unit III:

Algorithm Analysis: Characteristics of algorithm, Algorithm Analysis-operation count , step counts,. asymptotic complexity, recurrence equations

Unit IV:

Standard Template Library: Containers, Container Classes,Vectors, Lists, Iterators, Maps, Set structures, Bit set, Stack, Queue, Deque, Priority queue.

Recursion: Recursion and its applications, Exhaustive search using Backtracking.

Problems to Practice: Permutations, Palindrome Partitioning, Beautiful Arrangement, N-Queens , Path with Maximum Gold

Unit V:

Introduction to DBMS, ER Model, ER to Relation Model Conversion

SQL Part1: SQL Command, Data Types, Operators and Expressions, DDL statements, DML statements, Functions, Sorting Data, Grouping Data

Unit VI:

SQL Part2: Cartesian Product and Inner Join, Self Join, Outer Join, Subquery, Independent Subquery, Correlated Subquery

Normalization: Functional Dependency and Normal Forms (1NF,2NF,3NF,BCNF)

Text Books

1.The Complete Reference C++ by Herbert Schildt ,4th Edition

2.Raghurama Krishnan, Johannes Gehrke: Database Management System, TATA McGrawHill 3rd Edition

Reference Books

1.J.Kleinberg & E. Tardos Algorithm Design, Pearson Education, New Delhi, 2006.

2.G.Brassard & P. Bratley Fundamentals of Algorithms, PHI, New Delhi, 2005.

3.T.H. Cormen et.al. Introduction to Algorithms PHI, New Delhi, 2005.

4.S.Dasgupta et.al. Algorithms, TMH, New Delhi 2007.

Reference Links

1.https://leetcode.com/problems/

2.https://nptel.ac.in/courses/106106131/

3.https://www.spoj.com/problems

AR-20 : B.Tech - CSE (DATA SCIENCE) **III Year I Semester**

Compiler Design

L	T	P	C
3	0	0	3

Subject Code: 20CDT305

Course Objectives:
Understand the basic concept of compiler design, and its different phases which will be helpful to construct new tools like LEX, YACC, etc.

Course Outcomes: At the end of the course, student will be able to
- Demonstrate phases in the design of compiler
- Organize Syntax Analysis, Top Down and LL(1) grammars
- Design Bottom Up Parsing and Construction of LR parsers
- Analyze synthesized, inherited attributes and syntax directed translation schemes
- Determine algorithms to generate code for a target machine

Unit I:
Finite Automata and Regular expressions: Introduction, Finite state machine, DFA and NFA, NFA with Epsilon transition. Equivalence between NFA with and without Epsilon transitions, NFA to DFA conversion, minimization of FSM, equivalence between two FSM's, Finite Automata with output- Moore and Mealy machines. Regular Expression: Constructing finite Automata for a given regular expressions, Conversion of Finite Automata to Regular expressions.

Lexical Analysis: Structure of a Compiler, The Role of the Lexical Analyzer, Bootstrapping, Specification and Recognition of Tokens, Lexical Analyzer Generator-LEX.

Unit II:
Syntax Analysis: The Role of the Parser, Context-Free Grammars, Derivations, Parse Trees, Ambiguity, Left Recursion, Left Factoring, Top Down Parsing: Pre Processing Steps of Top Down Parsing, Backtracking, Recursive Descent Parsing, LL (1) Grammars, Non-recursive Predictive Parsing, Error Recovery in Predictive Parsing.

Unit III:
Bottom Up Parsing: Introduction, Difference between LR and LL Parsers, Types of LR Parsers, Shift Reduce Parsing, SLR Parsers, Construction of SLR Parsing Tables, More Powerful LR Parses, Construction of CLR (1) and LALR Parsing Tables, Dangling Else Ambiguity, Error Recovery in LR Parsing, Handling Ambiguity Grammar with LR Parsers.

Unit IV:
Syntax Directed Translation: Syntax-Directed Definitions, Evaluation Orders for SDD's, Applications of Syntax Directed Translation, Syntax-Directed Translation Schemes, Implementing L-Attributed SDD's. Intermediate Code Generation: Variants of Syntax Trees, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking, Control Flow, Back patching, Intermediate Code for Procedures.

Unit V:
Run Time Environments: Storage Organization, Run Time Storage Allocation, Activation Records, Procedure Calls, Displays, Code Optimization: The Principle Sources of Optimization, Basic Blocks, Optimization of Basic Blocks, Structure Preserving Transformations, Flow Graphs, Loop Optimization, Data-Flow Analysis, Peephole Optimization.

Unit VI:
Code Generation: Issues in the Design of a Code Generator, Object Code Forms, Code Generation Algorithm, Register Allocation and Assignment.

Text Books:
1. Compilers: Principles, Techniques and Tools, Second Edition, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffry D. Ullman, Pearson Publishers, 2007.

Reference Books:
1. Compiler Construction, Principles and Practice, Kenneth C Louden, Cengage Learning, 2006
2. Modern compiler implementation in C, Andrew W Appel, Revised edition, Cambridge University Press.
3. Optimizing Compilers for Modern Architectures, Randy Allen, Ken Kennedy, Morgan Kauffmann, 2001.
4. Levine, J.R., T. Mason and D. Brown, Lex and Yacc, edition, O'Reilly & Associates, 1990

AR-20 : B.Tech - CSE (DATA SCIENCE) **III Year I Semester**

Operating Systems

L	T	P	C
3	0	0	3

Subject Code: 20CDT306

Course Objectives:
- Understand structures and functions of operating systems
- Learn about Processes, Threads and Scheduling algorithms
- Understand the principles of concurrency
- Understand Deadlock Management
- Learn various memory management schemes
- Study File systems and Mass-storage devices

Course Outcomes

After the completion of this course, the student will be able to:
1. Explain different types of operating systems and implement various process management concepts for maximization of CPU throughput
2. Analyze the mechanisms used for process synchronization
3. Implement deadlock handling methods
4. Compare and contrast various memory management schemes
5. Design and Implement file systems
6. Familiarize with disk organization and device drivers

Unit I:

Operating System structures: Overview of Operating System, Operating systems services, types of operating systems, system calls, types of system calls

Process Management: Process concept, process scheduling, operations on processes, scheduling criteria, scheduling algorithms, and their evaluation.

Unit II:

Concurrency: Process synchronization, the critical-section problem, Peterson's Solution, synchronization Hardware, semaphores, classic problems of synchronization, monitors

Unit III:

Principles of deadlock: System model, deadlock characterization, deadlock prevention, deadlock detection, deadlock avoidance, recovery form deadlock

Unit IV:

Main Memory Management: Swapping, Contiguous memory allocation, paging, structure of the page table, segmentation, segmentation with paging.

Virtual Memory Management: Virtual memory, demand paging, page replacement algorithms: FIFO, optimal page replacement and LRU, Allocation of frames, Thrashing.

Unit V:

File System Interface: The concept of a file, file attributes, file types, access methods: sequential access, direct access and indexed access, directory structure, files sharing, protection.

File System Implementation: File system structure, file system implementation, directory implementation, allocation methods: contiguous allocation, linked allocation and indexed allocation, free-space management.

Unit VI:

Mass-storage structure: Overview of Mass-storage structure, Disk structure, disk attachment, disk scheduling, block and character devices.

Text Books:

1. Abraham Silberchatz, Peter B. Galvin and Greg Gagne, Operating System Concepts, 9th Edition, John Wiley & Sons(Asia) Pvt Ltd.
2. William Stallings, Operating Systems-Internal and Design Principles,7th Edition, Pearson

Reference Books:

1. D.M. Dhamdhere, Operating systems-A concept based approach, 3rd Edition, TMH
2. Crowley, Operating Systems-A Design-Oriented Approach,7th Edition, Pearson
3. Andrew S Tanenbaum, Modern Operating Systems, 3rd Edition, Pearson

Reference links:

1. http://www.cs.kent.edu/~farrell/osf03/oldnotes/index.html : Lecture Notes
2. http://www.computerhope.com/os.htm : Different Types of Operating Systems
3. http://nptel.iitm.ac.in/courses/Webcourse-contents/IISc-BANG/
4. http://www.personal.kent.edu/~rmuhamma/OpSystems/os.html : OS Lecture Notes

AR-20 : B.Tech - CSE (DATA SCIENCE) **III Year I Semester**

Machine Learning

L	T	P	C
3	0	0	3

Subject Code: 20CDT307

Course Objectives:

- Identify problems that are amenable to solution by ANN methods, and which ML methods may be suited to solving a given problem.
- Formalize a given problem in the language/framework of different ANN methods (e.g., as a search problem, as a constraint satisfaction problem, as a planning problem, as a Markov decision process, etc).

Course Outcomes: After the completion of the course, student will be able to

- Explain the fundamental usage of the concept Machine Learning system
- Demonstrate on various regression Technique
- Analyze the Ensemble Learning Methods
- Illustrate the Clustering Techniques and Dimensionality Reduction Models in Machine Learning.
- Discuss the Neural Network Models and Fundamentals concepts of Deep Learning

Unit I:

Introduction: Artificial Intelligence, Machine Learning, Deep learning, Types of Machine Learning Systems, Main Challenges of Machine Learning.

Statistical Learning: Introduction, Supervised and Unsupervised Learning, Training and Test Loss, Tradeoffs in Statistical Learning, Estimating Risk Statistics, Sampling distribution of an estimator, Empirical Risk Minimization.

Unit II:

Supervised Learning(Regression/Classification):Basic Methods: Distance based Methods, Nearest Neighbours, Decision Trees, Naive Bayes, Linear Models: Linear Regression, Logistic Regression, Generalized Linear Models, Support Vector Machines, Binary Classification: Multiclass/Structured outputs, MNIST, Ranking.

Unit III:

Unsupervised Learning Techniques: Clustering, K-Means, Limits of K-Means, Using Clustering for Image Segmentation, Using Clustering for Preprocessing, Using Clustering for Semi-Supervised Learning, DBSCAN, Gaussian Mixtures.

Unit IV:

Ensemble Learning and Random Forests: Introduction, Voting Classifiers, Bagging and Pasting, Random Forests, Boosting, Stacking.

Support Vector Machine: Linear SVM Classification, Nonlinear SVM Classification SVM Regression, Naïve Bayes Classifiers.

Unit V:

Dimensionality Reduction: The Curse of Dimensionality, Main Approaches for Dimensionality Reduction, PCA, Using Scikit-Learn, Randomized PCA, Kernel PCA.

Unit VI:
Neural Networks and Deep Learning: Introduction to Artificial Neural Networks with Keras, Implementing MLPs with Keras, Installing TensorFlow 2, Loading and Preprocessing Data with TensorFlow.

Text Books:
1.Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition, O'Reilly Publications, 2019
2.Data Science and Machine Learning Mathematical and Statistical Methods,Dirk P. Kroese, ZdravkoI. Botev, Thomas Taimre, Radislav Vaisman,25th November 2020

Reference Book(s):
1. Machine Learning Probabilistic Approach, Kevin P. Murphy, MIT Press, 2012.

AR-20 : B.Tech - CSE (DATA SCIENCE) **III Year I Semester**

Software Engineering and Agile Approach (Professional Elective-I)

L	T	P	C
3	0	0	3

Subject Code: 20CDE311

Course Objectives:

This course is designed to:

- Give exposure to phases of Software Development, common process models including Waterfall, and the Unified Process, and hands-on experience with elements of the agile process
- Give exposure to a variety of Software Engineering practices such as requirements analysis and specification, code analysis, code debugging, testing, traceability, and version control
- Give exposure to Software Design techniques

Course Outcomes:

Students taking this subject will gain software engineering skills in the following areas:

- Ability to transform an Object-Oriented Design into high quality, executable code
- Skills to design, implement, and execute test cases at the Unit and Integration level
- Compare conventional and agile software methods

Unit I:

The Nature of Software, The Unique Nature of WebApps, Software Engineering, The Software Process, Software Engineering Practice, Software Myths. A Generic Process Model, Process Assessment and Improvement, Prescriptive Process Models, Specialized Process Models, The Unified Process, Personal and Team Process Models, Process Technology.

Unit II:

Agility, Agility and the Cost of Change, Agile Process, Extreme Programming (XP), Other Agile Process Models, A Tool Set for the Agile Process, Software Engineering Knowledge, Core Principles, Principles That Guide Each Framework Activity, Requirements Engineering, Establishing the Groundwork, Eliciting Requirements, Developing Use Cases, Building the Requirements Model, Negotiating Requirements, Validating Requirements.

Unit III:

Requirements Analysis, Scenario-Based Modeling, UML Models That Supplement the Use Case, Data Modeling Concepts, Class-Based Modeling, Requirements Modeling Strategies, Flow-Oriented Modeling, Creating a Behavioral Model, Patterns for Requirements Modeling, Requirements Modeling for WebApps.

Unit IV:

Design within the Context of Software Engineering, The Design Process, Design Concepts, The Design Model, Software Architecture, Architectural Genres, Architectural Styles Assessing Alternative Architectural Designs, Architectural Mapping Using Data Flow, Components, Designing Class-Based Components, Conducting Component-Level Design, Component-Level Design for WebApps, Designing Traditional Components, Component-Based Development.

Unit V:
The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, WebApp Interface Design, Design Evaluation, Elements of Software Quality Assurance, SQA Tasks, Goals & Metrics, Statistical SQA, Software Reliability,

Unit VI:
A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for Conventional Software, Test Strategies for Object-Oriented Software, Test Strategies for WebApps, Validation Testing, System Testing, The Art of Debugging, Software Testing Fundamentals, Internal and External Views of Testing, White-Box Testing, Basis Path Testing.

Text Books:
1. Software Engineering a practitioner's approach, Roger S. Pressman, Seventh Edition, McGraw Hill Higher Education.
2. Software Engineering, Ian Sommerville, Ninth Edition, Pearson.

Reference Books:
1. Software Engineering, A Precise Approach, PankajJalote, Wiley India, 2010.
2. Software Engineering, Ugrasen Suman, Cengage.

e-Resources:
1) https://nptel.ac.in/courses/106/105/106105182/

AR-20 : B.Tech - CSE (DATA SCIENCE) **III Year I Semester**

Object Oriented Analysis and Design
(Professional Elective-I)

L	T	P	C
3	0	0	3

Subject Code: 20CDE312

Course Objectives:

- Develop different UML diagrams for a software system based on the given requirements.
- Apply forward engineering to convert diagram to code and reverse engineering to convert code to diagram.
- Analyze & design a software system in object oriented approach using unified modeling language.
- Understand different types of Design patterns.
- Learn advanced design techniques, principles, practices, and approaches in solving problems

Course Outcomes:

At the end of the course students are able to:

- Identify the building blocks for structural and behavioral modeling of object oriented systems.
- Model structural and behavioral aspects of object oriented systems.
- Construct models to build reactive and concurrent software systems.
- Understand selection and usage of various design patterns.
- Implement selected creational, structural and behavioral design patterns.

Unit I

Introduction to UML: Importance of modeling, principles of modeling, object oriented modeling, conceptual model of the UML, Architecture, and Software Development Life Cycle.

Unit II

Basic Structural Modeling: Classes, Relationships, common Mechanisms, and diagrams. Class & Object Diagrams: Terms, concepts, modeling techniques for Class & Object Diagrams.

Unit III

Basic Behavioral Modeling-I: Interactions, Interaction diagrams. Use cases, Use case Diagrams, Activity Diagrams.

Unit IV

Advanced Behavioral Modeling: Events and signals, state machines, processes and Threads, time and space, state chart diagrams. Architectural Modeling: Component, Deployment, Component diagrams and Deployment diagrams.

Unit V

Introduction: What Is a Design Pattern? Design Patterns in Smalltalk MVC, Describing Design Patterns, How to Select a Design Pattern, How to Use a Design Pattern.

Unit VI

Creational Patterns: , Singleton , Factory ,Abstract Factory, Structural Patterns: Adapter, Bridge, Composite. Behavioral Patterns: Chain of Responsibility, Command Pattern.

Text Books:

1. Grady Booch, James Rambaugh, Ivar Jacobson, "The unified Modeling language user guide" PEA.
2. Erich Gamma, "Design Patterns Pearson Education", 3 rd Edition.

Reference Books:

1. Satzinger: Object Oriented Analysis and Design, CENGAGE.
2. http://www.uml.ac.at/ex/lernen
3. https://www.developer.com/design/article.php/3309461/Using-Design-Patterns-inUML.ht

AR-20 : B.Tech - CSE (DATA SCIENCE) **III Year I Semester**

DevOps
(Professional Elective-I)

L	T	P	C
3	0	0	3

Subject Code: 20CDE313

Course Objectives:

- Introduces the basic concepts of Information System.
- To understand The Management Control Framework and The Application Control Framework.

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

- Enumerate the principles of continuous development and deployment, automation of configuration management, inter-team collaboration, and IT service agility.
- Describe DevOps & DevSecOps methodologies and their key concepts
- Illustrate the types of version control systems, continuous integration tools, continuous monitoring tools, and cloud models
- Set up complete private infrastructure using version control systems and CI/CD tools
- Acquire the knowledge of maturity model, Maturity Assessment

Unit I:
Phases of Software Development Life Cycle, Values and principles of agile software development.

Unit II:
Fundamentals of DevOps: Architecture, Deployments, Orchestration, Need, Instance of applications, DevOps delivery pipeline, DevOps eco system.

Unit III:
DevOps adoption in projects: Technology aspects, Agiling capabilities, Tool stack implementation, People aspect, processes

Unit IV:
CI/CD: Introduction to Continuous Integration, Continuous Delivery and Deployment,

Unit V:
Benefits of CI/CD, Metrics to track CICD practices.

Unit VI:
Devops Maturity Model: Key factors of DevOps maturity model, stages of Devops maturity model, DevOps maturity Assessment.

Text Books:

1. The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations, Gene Kim , John Willis , Patrick Debois , Jez Humb,1st Edition, O'Reilly publications, 2016.
2. What is Devops? Infrastructure as code, 1st Edition, Mike Loukides ,O'Reilly publications, 2012.

AR-20 : B.Tech - CSE (DATA SCIENCE) **III Year I Semester**

Computer Networks
(Open Elective - I)

L	T	P	C
3	0	0	3

Subject Code: 20CDE314

Course Objectives:

- Explain Data Communications System and its components, different types of network topologies and protocols.
- Demonstrate different layers of ISO and TCP/IP models and illuminate its function.
- Apply knowledge of different techniques of error detection and correction to detect and solve error bit during data transmission.
- Analyze main protocols such as HTTP, FTP, SMTP, TCP, UDP and IP.

Course Outcomes:

After completion of this course, the students will be able to:

- Identify and enumerate different types of network topologies, protocols and the layers of the OSI and TCP/IP models and explain the functions of each layer.
- Recognize the data link design issues and various data link protocols used for data transmission.
- MAC Sub layer and illustrate how a network can detect and correct transmission errors.
- Classify and compare the major routing and congestion control algorithms and understand how a packet is routed over the internet.
- Describe how TCP and UDP function, its uses and summarize the connection establishment and connection release.
- Analyze the features and operations of various Application layer protocols such as http, DNS, and HTTP.

Unit I:

Introduction: Network Hardware, Network Software; Reference Models: OSI Reference Model, TCP/IP Reference Model, Comparison between OSI and TCP/IP Models; Example Networks: The ARPANET, Internet.

Unit II:

Data Link Layer: Data Link Layer Design Issues: Services Provided to Network Layer, Framing, Error Control and Flow Control; Error Detection and Correction: Error Correcting Codes, Error Detecting Codes; Elementary Data Link Protocols, Sliding Window Protocols: One-Bit Sliding Window Protocol, Protocol Using Go Back N and Selective Repeat.

Unit III:

The Medium Access Control Sublayer: Channel Allocation Problem: Static Channel Allocation, Dynamic Channel Allocation; Multiple Access Protocol: ALOHA, Carrier Sense Multiple Access Protocols, Collision-Free Protocols, Limited Contention Protocol.

Unit IV:

The Network Layer: Network Layer Design Issues, Routing Algorithms: Shortest Path Routing, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing, Congestion Control Algorithms: General Principles of Congestion Control, Congestion Prevention Policies.

Unit V:
The Transport Layer: Services Provided to Upper Layer; Elements of Transport Protocols: Addressing, Connection Establishment, Connection Release; The Internet Transport Protocols: UDP and TCP Protocol, TCP Segment Header, TCP Connection Establishment, TCP Connection Release.

Unit VI:
The Application Layer: DNS- Domain Name System, Electronic Mail: Architecture and Services, The User Agent, Message Format, Message Transfer, The World Wide Web: Architectural Overview, Static Web Document, Dynamic Web Document; Hyper Text Transfer Protocol (HTTP).

Text Books:
1. Andrew S. Tanenbaum, Computer Networks, 5th Edition, Pearson Education, 2016.
2. Behrouz A Forouzan, Data Communications and Networking, 4th Edition, McGraw-Hill, 2006

Reference Books:
1. S Keshav, An Engineering approach to computer Networking, 2nd Edition, Pearson Education
2. J.F.Kurose, K.W.Ross, Computer Networking a Top-Down approach featuring the internet, 2nd Edition, Pearson Education

AR-20 : B.Tech - CSE (DATA SCIENCE) **III Year I Semester**

Operating Systems & Compiler Design Lab

L	T	P	C
0	0	3	1.5

Subject Code: 20CDL304

Course Objectives:

The man objective of this course is to implement operating systems and compiler design concept

Course Outcomes:

By the end of the course, student will be able to

- Implement various scheduling, page replacement algorithms and algorithms related to deadlocks
- Design programs for shared memory management and semaphores
- Determine predictive parsing table for a CFG
- Apply Lex and Yacc tools
- Examine LR parser and generating SLR Parsing table

List of Experiments:

1. Simulate the following CPU scheduling algorithms:
   (a) Round Robin (b) SJF (c) FCFS (d) Priority
2. Simulate the following:
   a) Multiprogramming with a fixed number of tasks (MFT)
   b) Multiprogramming with a variable number of tasks (MVT)
3. Simulate the following page replacement algorithms:
   a) FIFO b) LRU c) LFU
4. Write a C program that illustrates two processes communicating using shared memory
5. Write a C program to simulate producer and consumer problem using semaphores
6. Simulate Bankers Algorithm for Dead Lock Avoidance
7. Simulate Bankers Algorithm for Dead Lock Prevention.
8. Write a C program to identify different types of Tokens in a given Program.
9. Write a Lex Program to implement a Lexical Analyzer using Lex tool.
10. Write a C program to Simulate Lexical Analyzer to validating a given input String.
11. Write a C program to implement the Brute force technique of Top down Parsing.
12. Write a C program to implement a Recursive Descent Parser.
13. Write C program to compute the First and Follow Sets for the given Grammar.
14. Write a C program for eliminating the left recursion and left factoring of a given grammar
15. Write a C program to check the validity of input string using Predictive Parser.
16. Write a C program for implementation of LR parsing algorithm to accept a given input string.
17. Write a C program for implementation of a Shift Reduce Parser using Stack Data Structure to accept a given input string of a given grammar
18. Simulate the calculator using LEX and YACC tool.

AR-20 : B.Tech - CSE (DATA SCIENCE) **III Year I Semester**

Machine Learning Lab

L	T	P	C
0	0	3	1.5

Subject Code: 20CDL305

Course Objectives:
This course will enable students to learn and understand different Data sets in implementing the machine learning algorithms.

Course Outcomes: At the end of the course, student will be able to
- Implement procedures for the machine learning algorithms
- Design and Develop Python programs for various Learning algorithms
- Apply appropriate data sets to the Machine Learning algorithms
- Develop Machine Learning algorithms to solve real world problems

Requirements: Develop the following program using Anaconda/ Jupiter/ Spider and evaluate ML models.

Experiment-1:
Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.

Experiment-2:
For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate- Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.

Experiment-3:
Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

Experiment-4:
Exercises to solve the real-world problems using the following machine learning methods: a) Linear Regression b) Logistic Regression c) Binary Classifier

Experiment-5:
Develop a program for Bias, Variance, Remove duplicates , Cross Validation

Experiment-6:
Write a program to implement Categorical Encoding, One-hot Encoding

Experiment-7:
Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.

Experiment-8:
Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions.

Experiment-9:
Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Experiment-10:
Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.

Experiment-11:
Apply EM algorithm to cluster a Heart Disease Data Set. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

Experiment-12:
Exploratory Data Analysis for Classification using Pandas or Matplotlib.

Experiment-13:
Write a Python program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set

Experiment-14:
Write a program to Implement Support Vector Machines and Principle Component Analysis

Experiment-15:
Write a program to Implement Principle Component Analysis

AR-20 : B.Tech - CSE (DATA SCIENCE) **III Year I Semester**

Fundamentals of Fuzzy Logic
(Interdisciplinary Elective II)
(Common for all Branches)

L	T	P	C
3	0	0	3

Subject Code: 20IET321

Course Objectives

The student will be able to

- Understand the concepts of fuzzy sets, membership functions and their operations.
- Understand the concepts of fuzzy relations and their operations.
- Frame linguistic variables, analyze the fuzzy quantifiers and understand Fuzzy Inference.
- Understand the concept of constructing simple fuzzy sets.
- Understand the process of Fuzzification and Defuzzification by using different methods.
- Understand the concepts of Mamdani Approach & with simple examples.

Course Outcomes

After completion of this course, the students will be able to:

1. Perform different fuzzy operations on fuzzy sets.
2. Perform different fuzzy operations on fuzzy relations.
3. Construct linguistic variables, estimate the fuzzy quantifiers as per the Requirement, and perform Fuzzy Inference.
4. Construct the fuzzy set.
5. Perform the process of Fuzzification and Defuzzification by using different methods for simple Engineering problems.
6. Apply Mamdani Fuzzy Model & Takagi Sugeno Model for simple Engineering problems

Unit I:

Fuzzy set Theory : Crisp Sets- an overview, Fuzzy sets membership functions -types of membership functions: Triangular, Trapezoidal, Gaussian-examples. Basic Fuzzy set operations- union, intersection, complement. Properties of Fuzzy Sets. ,

Unit II:

Fuzzy Relations: Cardinality, operations, properties, fuzzy Cartesian product and composition, fuzzy tolerance and equivalence relations, forms of composition operation.

Unit III:

Fuzzy Logic: Classic and fuzzy logic, approximate reasoning, Natural language, linguistic hedges, Fuzzy propositions, Fuzzy connectives, Fuzzy quantifiers, Fuzzy Inference -fuzzy rule based systems, graphical technique of inference.

Unit IV:

Construction of Fuzzy sets: Methods of construction an overview, Direct methods with one expert, Direct methods with multiple experts, constructions from Sample data examples.

Unit V:

Fuzzy Expert System Fuzzification & De-fuzzification: Fuzzy Controllers, Fuzzy Logic

Control- Fuzzification- Fuzzy membership values, linguistic Hedges, Fuzzy Logical operators, Fuzzy Inference rules. Defuzzification-Centre of gravity method, centre of sums method, Mean of Maximum method.

Unit VI:
Fuzzy Expert System: Mamdani Approach & with simple examples.

Text books:

1. Fuzzy Sets and Fuzzy Logic-Theory and Applications, George. J. klir / Bo Yuan, Prentice- Hall of India Pvt Limited.
2. Neural Networks, Fuzzy Logic, and Genetic Algorithms, S.Rajasekharan, G.A.Vijayalakshmi Pai, Prentice-Hall of India Pvt Limited.

References Books

1. Fuzzy Logic with Engineering Applications, Timothy J.Ross, 3rd edition, John wiley & sons Ltd.

AR-20 : B.Tech - CSE (DATA SCIENCE) **III Year I Semester**

Geographical Information System
(Interdisciplinary Elective II)
(Offered for ECE/EEE/MECH/CSE/IT/CSM/CSD)
Subject Code: 20IET322

L	T	P	C
3	0	0	3

Course Objectives

- To interpret map projections
- To describe GIS components in GIS.
- To discuss data analysis operations in GIS To apply the concepts of DBMS in GIS
- To analyze spatial data and modeling in GIS To apply GIS in real time applications

Course Outcomes

After completion of this course, the students will be able to:

1. Interpret map projections
2. Describe GIS components.
3. Discuss data analysis operations in GIS
4. Apply the concepts of DBMS in GIS
5. Analyze spatial data and modeling in GIS
6. Apply GIS in real time applications

Unit I:

Fundamental Concepts of Map: Introduction; Classification of Maps; Scale of maps; Spatial referencing System; Map Projections- Classification; commonly used map projections and their comparisons- Grid systems.

Unit II:

Basic Concepts of Geographical Information System: Introduction to GIS; components of a GIS; Geo spatial Data: Spatial Data- Attribute data-Joining Spatial and attribute data.

Unit III:

GIS Operations: Spatial Data Input Attribute data Management -Data display Data Exploration Data Analysis.

Unit IV:

Data Base Management Systems: Introduction - Functions of DBMS; Components of DBMSGIS Data file Management- Simple List, Ordered Sequential Files; Data Base Models Hierarchical Database Models, Network Systems.

Unit V:

Spatial Data Modeling: Introduction; stages of GIS data modeling; Graphical representation of Raster data, Graphical representation of Vector data; Raster GIS Model, Vector GIS Model.

Unit VI:

Applications of GIS: Land use and Land cover, agriculture, forestry, geology, urban applications, flood zone delineation and mapping.

Text Books:

1. Peter A Burrough, Rachael A. Mc Donnell and Christopher D. Lloyd (2016), Principles of Geographical Information Systems, 3rd edition, Oxford University Press.
2. M.Anji Reddy(2012), Text Book of Remote Sensing and Geographical Information systems,4th edition, BS Publications/BSP Books

Reference Books:

1. Chor Pang Lo and Albert K.W. Yeung (2016), Concepts & Techniques of GIS, Pearson Education
2. Kangtsung Chang (2017), GIS, 4th edition, McGraw-Hill Education

AR-20 : B.Tech - CSE (DATA SCIENCE) **III Year I Semester**

Renewable energy sources
(Interdisciplinary Elective II)
(Offered for ECE/EEE/MECH/CSE/IT/CSM/CSD)
Subject Code: 20IET323

L	T	P	C
3	0	0	3

Course Objectives

- To outline the concept regarding solar radiation.
- To outline the concept regarding the collection of solar energy and storage of solar energy To outline the concept regarding different types of wind mills.
- To outline the concept regarding different types of biomass digesters and geothermal energy conversion.
- To Outline the concept regarding ocean energy conversion To Outline the concept regarding direct energy conversion

Course Outcomes:

After completion of this course, the students will be able to:

1. Define different kind of solar radiation.
2. Understand different methods of collection of solar energy and storage of solar energy.
3. Classify different types of wind mills.
4. Classify different types of biomass digesters and geothermal energy.
5. Classify different types of ocean energy extracting techniques.
6. Distinguish different kinds of direct energy conversion techniques.

Unit I:

Principles of solar radiation: Role and potential of new and renewable source, the solar energy option, the solar constant, extraterrestrial and terrestrial solar radiation, instruments for measuring solar radiation.

Unit II:

Solar energy collection, storage and applications: Flat plate and concentrating collectors, Different methods of storage -Sensible, latent heat. Solar Applications- solar heating/cooling technique, solar distillation and, photovoltaic energy conversion.

Unit III:

Wind energy: Sources and potentials, block diagram, Types: horizontal and vertical axis windmills. Types of generators and its parts.

Unit IV:

Biomass and Geothermal energy: Principles of Bio-Conversion, Anaerobic/aerobic digestion, gas yield. Resources, types of wells, Open loop and closed loop energy conversion.

Unit V:

Ocean energy: OTEC, Principles utilization, setting of OTEC plants, Tidal and wave energy: Potential and conversion techniques.

Unit VI:

Direct energy conversion (DEC): Need for DEC, principles of DEC. Thermoelectric generators, seebeck, peltier and joul Thomson effects, MHD generators, principles, hall effect, magnetic flux, principle of MHD, power generation with closed loop MHD systems.

Text Books

1. Non-Conventional Energy Sources /G.D. Rai
2. Renewable Energy Technologies /Ramesh & Kumar /Narosa

Reference Books

1. Renewable energy resources/ Tiwari and Ghosal/ Narosa.
2. Non-Conventional Energy / Ashok V Desai /Wiley Eastern.
3. Non-Conventional Energy Systems / K Mittal /Wheeler
4. Solar Energy /Sukhame

AR-20 : B.Tech - CSE (DATA SCIENCE) **III Year I Semester**

Fundamentals of ROBOTICS
(Interdisciplinary Elective II)
(Offered for ECE/EEE/MECH/CSE/IT/CSM/CSD)

L	T	P	C
3	0	0	3

Subject Code: 20IET324

Course Objectives:

- This subject gives the knowledge about the fundamentals of the robotics technology and its wide area of applications in various fields.
- This gives the knowledge about the kinematic and dynamic aspects of the robot construction and designing aspects of the robots.

Course Outcomes:

After completion of this course, the students will be able to:

1. Discuss basic fundamentals and Describe commonly used robot configurations.
2. Discuss end effectors, drives along with robotics applications.
3. Describe working principles of various sensors commonly used in a robot.
4. Solve basic transformation problems and rotation matrices.
5. Discuss methods of programming and programming languages.
6. Discuss robot manufacturing & non-manufacturing applications of robots.

Unit I:

Fundamentals of Robotics: Introduction to Robotics & Overview Robotics & Automation Robotics Classification of Robots based on Configuration & Control Terminology - Components of Industrial Robots DOF, Functions and Specifications of Robot System.

Unit II:

Robot Actuators: Robotic Actuators Classification of actuators Difference between Electric, Pneumatic and Hydraulic actuators, Servo & Stepper Motors, Servo Amplifiers, Control of Robotic Joints, Closed and Open Loop Control System.

Unit III:

Sensing Systems: Sensing systems Overview of sensing Functions of sensing Types Optical and Non Optical Sensors, position sensors: potentiometer, resolvers, and encoders, velocity, proximity, accelerometers, tactile, range sensors, touch and slip sensors, force and torque sensors.

Unit IV:

Homogeneous transformations: Mapping, mapping between rotated, translated and combined rotated and translated frames, description of objects in space, fundamental rotation matrices, homogeneous transformations, representations & properties problems and differential motions of a frame.

Unit V:

Programming: Introduction to robot programming methods of programming programming languages. generations of robot programming languages, robot control sequencing, AL, AML, RAIL, RPL, VAL Robot languages.

Unit VI:
Applications: Introduction Manufacturing & Non-manufacturing applications Selection and need of robot for a particular application (Case study), Future applications.

Text Books:

1. Industrial Robotics, M. P. Groover, Pearson Education Pub.
2. Robotics & Control, R. K. Mittal, I. J. Nagarath, Tata McGraw Hill Pub.

Reference Books:

1. Robotics, K. S. Fu, Lee, McGraw Hill Pub.
2. An Introduction to Robot Technology, P. Coiffet, M. Chaironze, Kogam Page Pub., London.
3. Robotic Engineering, Richard D. Klafter, Prentice Hall Pub.
4. Robot Analysis and Intelligence, Asada, Slow time, Wiley Inter-Science Pub.
5. Introduction to Robotics, John J Craig, Pearson Education Pub.
6. Robot Dynamics & Control, Mark W. Spong, M. Vidyasagar, John Wiley & Sons (ASIA) Pub.

AR-20 : B.Tech - CSE (DATA SCIENCE) **III Year I Semester**

Principles of communications
(Interdisciplinary Elective II)
(Offered for ECE/EEE/MECH/CSE/IT/CSM/CSD)
Subject Code: 20IET325

L	T	P	C
3	0	0	3

Course Objectives:

- Explain the fundamental concepts of modulation and demodulation of Amplitude modulation and Angle modulation schemes.
- Understand various pulse modulation schemes.
- Compare the different types of Digital communication systems
- Understand various Digital modulation schemes.
- Understand the concept of channel capacity, information theory and shannon's theorem

Course Outcomes:

After completion of this course, the students will be able to:

1. Determine Modulation Index, Bandwidth and power of AM,DSB- and SSB for the given specifications and also compare various Demodulation techniques of AM.
2. Compute Modulation parameters of FM and PM waves as per the given specifications and also compare FM and PM in terms of characteristics and applications.
3. Describe Sampling theorem and Compute Nyquist sampling rate for the given signal and also compute Modulation parameters of PAM,PWM and PPM for the given specifications.
4. Analyze the PCM,DM and ADM techniques with respect to baud rate bit error rate and also construct the above said signals as per given conditions.
5. Determine Modulation parameters of ASK,FSK,PSK, DPSK and QPSK for the given data and also construct the wave forms for the given specifications.
6. Differentiate noises in communications systems and compute noise figure as per given specifications.

Unit I:

Amplitude Modulation: Need for modulation, Types of Amplitude modulation, AM, DSB , SSB , Power and BW requirements, generation and Demodulation of AM.

Unit II:

Angle Modulation: Frequency & Phase modulations, advantages of FM over AM, Bandwidth consideration, Narrow band and Wide band FM, Comparison of FM & PM.

Unit III:

Pulse Modulations: Sampling, Nyquist rate of sampling, Sampling theorem for Band limited signals, PAM, regeneration of base band signal, PWM and PPM

Unit IV:

Digital Communication: Advantages, Block diagram of PCM, Quantization, effect of quantization, quantization error, Base band digital signal, DM, ADM.

Unit V:

Digital Modulation: ASK, FSK, PSK, DPSK, QPSK.

Unit VI:
Noise: External noise, Internal noise, noise calculations, noise figure and noise temperature.

Text books

1. Electronic Communication Systems Kennedy & Davis, TMH, 4th edition.
2. Digital Communications Dr. Sanjay Sharma, S.K.Kataria and sons, New delhi, 2015

Reference Books

1. Communication Systems Engineering John. G. Proakis, Masoud and Salehi, 2nd Ed. PHI/Pearson, 2004.
2. Digital and Analog Communication Systems Sam Shanmugam, John Wiley, 2005.

Reference Links

1. https://youtube.com/playlist?list=PLq-Gm0yRYwTgX2FkPVcY6io003-tZd8Ru
2. https://youtube.com/playlist?list=PLmA4L9UCzuEMcZv9QxlBoUJHcNFM2LIpf

AR-20 : B.Tech - CSE (DATA SCIENCE) **III Year I Semester**

Advanced Coding - II
(Interdisciplinary Elective II)
(Offered for ECE/EEE/MECH/CSE/IT/CSM/CSD)
Subject Code: 20IET328

L	T	P	C
3	0	0	3

Course Objectives

- Understanding importance of Mathematics and Problem solving approaches for programming.
- Understanding importance of optimized solution for problem solving

Course Outcomes

After completion of this course, the students will be able to:

1. Develop solution using Dynamic linear Data structures
2. Select appropriate Sorting /Hashing technique to solve the Problem
3. Develop solutions using Non-Linear Data Structures
4. Develop Solution to problems using Greedy approach
5. Develop solution to pattern matching problems
6. Develop Solution to problems using Dynamic Programming

Unit I:

Linked List: Singly Linked List, Doubly Linked List and Circular Linked List and Josephus Circle problem

Problems to practice: Add Two Numbers, Swap Nodes in Pairs, Rotate List, Palindrome Linked List, Linked List Cycle, Remove Duplicates from Sorted List,

Stacks and Queues: Implementation in Array and Linked List and classic problem on Stacks and Queues.

Problems to practice : Min Stack, Valid Parentheses, Trapping Rain Water, Largest Rectangle in Histogram, Asteroid Collision, Simplify Path, Next Greater Element I, Online Stock Span, Implement Stack using Queues

Unit II:

Sorting and Searching: Bubble Sort, Selection Sort, Insertion Sort, Merge Sort, Quick sort , Count Sort. Linear Search , Binary Search and Ternary Search.

Practice Problems: Find Peak Element, Guess Number Higher or Lower, Peak Index in a Mountain Array, Koko Eating Bananas, Find Minimum in Rotated Sorted Array.

Hashing: Introduction to Hashing, Open addressing and Separate chaining.

Problems to Practice: Sort Colors, Largest Number, H-Index, Car Fleet, Relative Sort Array, Maximum Gap, Merge Intervals, Pancake Sorting, Insertion Sort List, Valid Anagram.

Unit III:

Trees : Terminology of Tree concept, Types of Trees ,Tree traversal, Binary Search Tree and Heap sort.

Graphs: Terminology, Representation of Graph, Graph Traversal DFS and BFS, Disjoint Set Union (Union Find).

Problems to Practice: Word Ladder, Shortest Path in Binary Matrix, Rate In Maze, Same Tree, Path Sum, Loud and Rich, Matchsticks to Square.

Unit IV

Greedy Approach: General approach, Fractional Knapsack problem, Scheduling problem, Dijkstra's Algorithm

Problems to Practice: Jump Game, Gas Station, Candy, Assign Cookies, Lemonade Change, Walking Robot Simulation, Two City Scheduling, Car Pooling

Unit V:

String Matching algorithms: Naïve approach, KMP algorithm, Rabin-Karp Algorithm.

Problems to Practice: Repeated String Match, Count Binary Substrings, Most Common Word, Goat Latin, Minimum Time Difference, Longest Common Prefix, Number of Segments in a String, Validate IP Address.

Unit VI:

Dynamic Programming : Introduction, Bottom up DP, Top Down DP, Coin Change Problem, Road Cutting problem, Egg dropping problem, 0/1 Knapsack problem, Longest common Sub Sequence problem.

Text Books:

1. T.H. Cormen et.al. Introduction to Algorithms PHI, New Delhi, 2005.

Reference Books:

1. J.Kleinberg & E. Tardos Algorithm Design, Pearson Education, New Delhi, 2006.
2. G.Brassard & P. Bratley Fundamentals of Algorithms, PHI, New Delhi, 2005.
3. S.Dasgupta et.al. Algorithms, TMH, New Delhi 2007.
4. E. Horowitz. et.al., Fundamentals of computer Algorithms, Universities Press, 2008, 2nd Edition.

Reference Links:

1. https://leetcode.com/problems/
2. https://nptel.ac.in/courses/106106131/
3. https://www.spoj.com/problems

AR-20 : B.Tech - CSE (DATA SCIENCE) **III Year II Semester**

Design and Analysis of Algorithms

L	T	P	C
3	0	3	4.5

Subject Code: 20CDI308

Course Objectives:

The main objective of the course is, students have to build the following:

- Ability to understand, analyze and denote time complexities of algorithms
- To introduce the different algorithmic approaches for problem solving through numerous example problems
- Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize dynamic-programming algorithms, and analyze them.
- To provide some theoretical grounding in terms of finding the lower bounds of algorithms and the NP-completeness

Course Outcomes:

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

- Analyze the performance of a given algorithm, denote its time complexity using the asymptotic notation for recursive and non-recursive algorithms
- List and describe various algorithmic approaches and Solve problems using divide and conquer &greedy Method
- Synthesize efficient algorithms dynamic programming approaches to solve in common engineering design situations.
- Organize important algorithmic design paradigms and methods of analysis: backtracking, branch and bound algorithmic approaches
- Demonstrate NP- Completeness theory ,lower bound theory and String Matching

Unit I:

Introduction: Algorithm Definition, Algorithm Specification, performance Analysis, Performance measurement, asymptotic notation, Randomized Algorithms.

Unit II:

Divide and Conquer: General Method, Defective chessboard, Binary Search, finding the maximum and minimum, Merge sort, Quick sort.

Lab Experiments:

1. Develop a program and measure the running time for Binary Search with Divide and Conquer
2. Develop a program and measure the running time for Merge Sort with Divide and Conquer
3. Develop a program and measure the running time for Quick Sort with Divide and Conquer

Unit III:

The Greedy Method: The general Method, knapsack problem, minimum-cost spanning Trees, Optimal Merge Patterns, Single Source Shortest Paths.

Lab Experiments:

4. Develop a program and measure the running time for estimating minimum-cost spanning Trees with Greedy Method

5. Develop a program and measure the running time for estimating Single Source Shortest Paths with Greedy Method

Unit IV:

Dynamic Programming: The general method, multistage graphs, All pairs-shortest paths, optimal Binary search trees, 0/1 knapsack, The traveling salesperson problem.

Lab Experiments:

6. Develop a program and measure the running time for optimal Binary search trees with Dynamic Programming
7. Develop a program and measure the running time for identifying solution for traveling salesperson problem with Dynamic Programming

Unit V:

Backtracking: The General Method, The 8-Queens problem, sum of subsets, Graph coloring, Hamiltonian cycles, knapsack problem.

Lab Experiments:

8. Develop a program and measure the running time for identifying solution for 8-Queens problem with Backtracking
9. Develop a program and measure the running time for Graph Coloring with Backtracking
10. Develop a program and measure the running time to generate solution of Hamiltonian Cycle problem with Backtracking
11. Develop a program and measure the running time running time to generate solution of Knapsack problem with Backtracking.

Unit VI:

NP-Hard and NP-Complete problems: Basic concepts, non-deterministic algorithms,
NP - Hard and NP- Complete classes, Cook's theorem.

Text Books:

1. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", 2nd Edition, Universities Press.
2. Introduction to Algorithms Thomas H. Cormen, PHI Learning
3. Harsh Bhasin, "Algorithms Design & Analysis", Oxford University Press.

Reference Books:

1. Horowitz E. Sahani S: "Fundamentals of Computer Algorithms", 2nd Publications,2008.
2. S. Sridhar, "Design and Analysis of Algorithms", Oxford University Press.

AR-20 : B.Tech - CSE (DATA SCIENCE) **III Year II Semester**

Big Data Analytics

L	T	P	C
3	0	0	3

Subject Code: 20CDT309

Course Objectives:
- To optimize business decisions and create competitive advantage with Big Data analytics
- To learn to analyze the big data using intelligent techniques
- To introduce programming tools PIG&HIVE in Hadoop echo system

Course Outcomes:
At the end of the course, the students will be able to
- Illustrate big data challenges in different domains including social media, transportation, finance and medicine
- Use various techniques for mining data stream
- Design and develop Hadoop
- Identify the characteristics of datasets and compare the trivial data and big data for various applications
- Explore the various search methods and visualization techniques

Unit I:
Introduction: Introduction to big data: Introduction to Big Data Platform, Challenges of Conventional Systems, Intelligent data analysis, Nature of Data, Analytic Processes and Tools, Analysisvs Reporting.

Unit II:
Stream Processing: Mining data streams: Introduction to Streams Concepts, Stream Data Model and Architecture, Stream Computing, Sampling Data in a Stream, Filtering Streams, Counting Distinct Elements in a Stream, Estimating Moments, Counting Oneness in a Window, Decaying Window, Real time Analytics Platform (RTAP) Applications.

Unit III:
Introduction to Hadoop: History of Hadoop, the Hadoop Distributed File System, Components of Hadoop Analysing the Data with Hadoop, Scaling Out, Hadoop Streaming, Design of HDFS, Java interfaces to HDFS Basics.

Unit IV:
Implementation: Developing a Map Reduce Application, How Map Reduce Works, Anatomy of a Map Reduce Job run, Failures, Job Scheduling, Shuffle and Sort, Task execution, Map Reduce Types and Formats, Map Reduce Features Hadoop environment.

Unit V:
Frameworks and Applications: Frameworks: Applications on Big Data Using Pig and Hive, Data processing operators in Pig, Hive services, HiveQL, Querying Data in Hive, fundamentals of H Base and Zoo Keeper.

Unit VI:
Predictive Analytics and Visualizations: Predictive Analytics, Simple linear regression, Multiple linear regression, Interpretation of regression coefficients, Visualizations, Visual data analysis techniques, interaction techniques, Systems and application.

Text Books:

1. Tom White, “Hadoop: The Definitive Guide”, Third Edition, O’reilly Media, FourthEdition,2015.
2. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGraw Hill Publishing, 2012.
3. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, CUP,2012

Reference Books:

1. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with AdvancedAnalytics”,JohnWiley&sons,2012.
2. Paul Zikopoulos, DirkdeRoos, Krishnan Parasuraman, Thomas Deutsch, James Giles, David Corrigan, “Harness the Power of Big Data: The IBM Big Data Platform”, Tata McGraw HillPublications,2012.
3. Arshdeep Bahga and Vijay Madisetti, “Big Data Science & Analytics: A Hands OnApproach“, VPT, 2016.
4. Bart Baesens, “Analytics in a Big Data World: The Essential Guide to Data Science and its Applications (WILEY Big Data Series)”, John Wiley & Sons, 2014.

Software Links:

1. Hadoop:http://hadoop.apache.org/
2. Hive: https://cwiki.apache.org/confluence/display/Hive/Home
3. Piglatin: http://pig.apache.org/docs/r0.7.0/tutorial.html

AR-20 : B.Tech - CSE (DATA SCIENCE) **III Year II Semester**

Managerial Economics and Management Science

L	T	P	C
3	0	0	3

Subject Code: 20HST303

Course Objectives

- To introduce the economic concepts
- To familiarize with the students the importance of economic approaches in managerial decision making To understand the applications of economic theories in business decisions

Course Outcomes: After completion of this course, the students will be able to:

1. Recognize managerial Economics skills to the solution of engineering problems
2. Explain the cost and production theories in engineering problems
3. Explore and develop the management qualities
4. Enhance the problem solving skills in various business areas
5. Enhance the promotional skills in various Marketing situations
6. Evaluate the future threats and application theories.

Unit I:

Introduction to Managerial Economics: Definition, Nature and Scope of Managerial Economics, Demand Analysis: Demand Determinants, Law of Demand and its Exceptions, Elasticity of Demand, Demand Forecasting, Factors Governing Demand Forecasting, Methods of Demand Forecasting viz. Survey methods, Statistical methods, Expert opinion method, Test marketing, Controlled experiments, Judgmental approach to Demand Forecasting.

Unit II:

Theory of Production and Cost Analysis: Production Function in Isoquants and Isocosts, MRTS, Least cost Combination of Inputs, Production Function Laws of Returns, Internal and External Economies of Scale. Cost Analysis: Cost Concepts, Opportunity cost, Fixed &Variable costs explicit costs &Implicit costs, Out of pocket costs & Imputed costs, Break-Even Analysis (BEA), Determination of Break- Even Point (simple problems), Managerial Significance and Limitations of BEA.

Unit III:

Introduction to Markets and Pricing Strategies: Market Structure, Types of competition, Features of Perfect competition, Monopoly and Monopolistic Competition, Price-Output Determination in Case of Perfect Competition and Monopoly, Concept on different Pricing Strategies.

Unit IV:

Introduction to Management : Concept of Management and Organization : Nature, Importance and Functions of Management, Taylor‘s Scientific Management Theory, Fayal‘s Principles of Management, Mayo‘s Hawthorne Experiments , Maslow‘s Theory of Human Needs, Douglas McGregor‘s Theory X and Y, Hertzberg‘s Two-Factor Theory of Motivation, Systems Approach to Management, Leadership Styles, Social responsibilities of Management.

Unit V:
Introduction to Marketing: Function of Marketing, Marketing Mix, Marketing Strategies based on Product Lifecycle, Channels of Distribution, Digital Marketing.

Unit VI:
Human Resources Management (HRM): Concept of HRM, HRD and Personnel Management and Industrial Relations (PMIR), HRM vs. PMIR, Basic Functions of HR Manager; Manpower Planning, Recruitment, Selection, Training and Development, Placement, Wage and Salary Administration, Promotion, Transfer, Separation, Performance Appraisal, Grievance Handling and Welfare Administration, Job Evaluation and Merit Rating.

Text Books:
1. Managerial Economics – Varshney and Maheswari, Sultan and Chand, New Delhi, 2003
2. Principles of Management – Ramaswamy,T, Himalaya Publishing House, Mumbai, 2008.
3. Marketing Management – Phillip Kotler and Kevin Lane Keller, PHI Learning Private Limited, 2006, 12/e.
4. Personnel and Human Resource Management: Text and Cases – P.Subba Rao, Himalaya Publishing Houses, Mumbai.

Reference Books:
1. Managerial Economics, Dwivedi, Vikas Publications, 2009, 6/e.
2. Principles of Management – Koonz, Weihrich and Aryasri, Tata McGraw Hill, 2004.
3. Marketing Management: Texts and Cases – Tapan K. Panda, Excel Books, 2008, 2/e.
4. Marketing Management – Rajan Saxena, Tata Mc Graw Hill, 2009, 4/e.
5. Human Resource Management – Aswathappa, Mc Graw Hill, 2009.
6. Personnel Management – Edwin B.Flippo, Mc Graw Hill, 2000

AR-20 : B.Tech - CSE (DATA SCIENCE) **III Year II Semester**

Internet of Things
(Professional Elective-II)

L	T	P	C
3	0	0	3

Subject Code: 20CDE321

Course Objectives:

- From the course the student will learn
- the application areas of IOT
- the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
- building blocks of Internet of Things and characteristics

Course Outcomes:

- By the end of the course, student will be able to
- Review Internet of Things (IoT).
- Demonstrate various business models relevant to IoT.
- Construct designs for web connectivity
- Organize sources of data acquisition related to IoT, integrate to enterprise systems.
- Describe IoT with Cloud technologies.

Unit I:

The Internet of Things- An Overview of Internet of things, Internet of Things Technology, behind IoTs Sources of the IoTs, Examples of IoTs, Design Principles For Connected Devices, Internet connectivity, Application Layer Protocols- HTTP, HTTPS, FTP

Unit II:

Business Models for Business Processes in the Internet of Things, IoT/M2M systems LAYERS AND designs standardizations, Modified OSI Stack for the IoT/M2M Systems ,ETSI M2M domains and High-level capabilities, Communication Technologies, Data Enrichment and Consolidation and Device Management Gateway Ease of designing and affordability.

Unit III:

Design Principles for the Web Connectivity for connected-Devices, Web Communication protocols for Connected Devices, Message Communication protocols for Connected Devices, Web Connectivity for connected-Devices.

Unit IV:

Data Acquiring, Organizing and Analytics in IoT/M2M, Applications/Services/Business Processes, IOT/M2M Data Acquiring and Storage.

Unit V:

Business Models for Business Processes in the Internet Of Things, Organizing Data, Transactions, Business Processes, Integration and Enterprise Systems.

Unit VI:

Data Collection, Storage and Computing Using a Cloud Platform for IoT/M2M Applications/Services, Data Collection, Storage and Computing Using cloud platform Everything as a service and Cloud Service Models, IOT cloud-based services using the Xively (Pachube/COSM), Nimbits and other platforms Sensor, Participatory Sensing,

Actuator, Radio Frequency Identification, and Wireless, Sensor Network Technology, Sensors Technology, Sensing the World.

Text Books:

1. Internet of Things: Architecture, Design Principles And Applications, Rajkamal, McGraw Hill Higher Education
2. Internet of Things, A.Bahgya and V.Madisetti, Univesity Press, 2015

Reference Books:

1. Designing the Internet of Things, Adrian McEwen and Hakim Cassimally, Wiley
2. Getting Started with the Internet of Things, CunoPfister , Oreilly

AR-20 : B.Tech - CSE (DATA SCIENCE) **III Year II Semester**

Software Project Management
(Professional Elective-II)

L	T	P	C
3	0	0	3

Subject Code: 20CDE322

Course Objectives:

At the end of the course, the student shall be able to:

- To describe and determine the purpose and importance of project management from the perspectives of planning, tracking and completion of project
- To compare and differentiate organization structures and project structures
- To implement a project to manage project schedule, expenses and resources with the application of suitable project management tools

Course outcomes:

Upon the completion of the course students will be able to:-

- Apply the process to be followed in the software development life-cycle models
- Apply the concepts of project management & planning
- Implement the project plans through managing people, communications and change
- Conduct activities necessary to successfully complete and close the Software projects
- Implement communication, modeling, and construction & deployment practices in software development

Unit I:

Conventional Software Management: The waterfall model, conventional software Management performance. Evolution of Software Economics: Software Economics, pragmatic software cost estimation.

Unit II:

Improving Software Economics: Reducing Software product size, improving software processes, improving team effectiveness, improving automation, Achieving required quality, peer inspections.

The old way and the new: The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process.

Unit III:

Life cycle phases: Engineering and production stages, inception, Elaboration, construction, transition phases. Artifacts of the process: The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts.

Unit IV:

Model based software architectures: A Management perspective and technical perspective.

Work Flows of the process: Software process workflows, Iteration workflows.

Checkpoints of the process: Major mile stones, Minor Milestones, Periodic status assessments.

Iterative Process Planning: Work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning.

Unit V:
Project Organizations and Responsibilities: Line-of-Business Organizations, Project Organizations, evolution of Organizations.
Process Automation: Automation Building blocks, The Project Environment. Project Control and Process instrumentation: The seven core Metrics, Management indicators, quality indicators, life cycle expectations, pragmatic Software Metrics, Metrics automation.

Unit VI:
Agile Methodology, ADAPTing to Scrum, Patterns for Adopting Scrum, Iterating towards Agility. Fundamentals of DevOps: Architecture, Deployments, Orchestration, Need, Instance of applications, DevOps delivery pipeline, DevOps eco system. DevOps adoption in projects: Technology aspects, Agiling capabilities, Tool stack implementation, People aspect, processes

Text Books:
1. Software Project Management, Walker Royce, PEA, 2005.
2. Succeeding with Agile: Software Development Using Scrum, Mike Cohn, Addison Wesley.
3. The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations, Gene Kim , John Willis , Patrick Debois , Jez Humb,1st Edition, O'Reilly publications, 2016.

Reference Books:
1. Software Project Management, Bob Hughes,3/e, Mike Cotterell, TMH
2. Software Project Management, Joel Henry, PEA
3. Software Project Management in practice, Pankaj Jalote, PEA, 2005,
4. Effective Software Project Management, Robert K.Wysocki, Wiley,2006
5. Project Management in IT, Kathy Schwalbe, Cengage

AR-20 : B.Tech - CSE (DATA SCIENCE) **III Year II Semester**

Distributed Systems
(Professional Elective-II)

L	T	P	C
3	0	0	3

Subject Code: 20CDE323

Course Objectives:
- To understand the foundations of distributed systems.
- To learn issues related to clock Synchronization and the need for global state in distributed systems
- To learn distributed mutual exclusion and deadlock detection algorithms
- To understand the significance of agreement, fault tolerance and recovery protocols in Distributed Systems
- To learn the characteristics of peer-to-peer and distributed shared memory systems

Course Outcomes:
At the end of the course, the students will be able to:
- Elucidate the foundations and issues of distributed systems
- Illustrate the various synchronization issues and global state for distributed systems
- Illustrate the Mutual Exclusion and Deadlock detection algorithms in distributed systems
- Describe the agreement protocols and fault tolerance mechanisms in distributed systems
- Describe the features of peer-to-peer and distributed shared memory systems

Unit I:
Distributed Systems: Definition, Relation to computer system components, Motivation, Relation to parallel systems, Message-passing systems versus shared memory systems, Primitives for distributed communication, Synchronous versus asynchronous executions, Design issues and challenges.

Unit II:
A model of distributed computations: A distributed program, A model of distributed executions, Models of communication networks, Global state, Cuts, Past and future cones of an event, Models of process communications.
Logical Time: A framework for a system of logical clocks, Scalar time, Vector time, Physical clock synchronization: NTP.

Unit III:
Message Ordering & Snapshots: Message ordering and group communication: Message ordering paradigms, Asynchronous execution with synchronous communication, Synchronous program order on an asynchronous system, Group communication, Causal order (CO), Total order. Global state and snapshot recording algorithms: Introduction, System model and definitions, Snapshot algorithms for FIFO channels.

Unit IV:
Distributed Mutex & Deadlock: Distributed mutual exclusion algorithms: Introduction, Preliminaries, Lamport‘s algorithm, Ricart-Agrawala algorithm, Maekawa‘s algorithm, Suzuki– Kasami‘s broadcast algorithm. Deadlock detection in distributed systems: Introduction, System model, Preliminaries, Models of deadlocks, Knapp‘s classification, Algorithms for the single resource model, the AND model and the OR model.

Unit V:
Recovery & Consensus: Check pointing and rollback recovery: Introduction, Background and definitions, Issues in failure recovery, Checkpoint-based recovery, Log-based rollback recovery, Coordinated check pointing algorithm, Algorithm for asynchronous check pointing and recovery. Consensus and agreement algorithms: Problem definition, Overview of results, Agreement in a failure, free system, Agreement in synchronous systems with failures.

Unit VI:
Peer-to-peer computing and overlay graphs: Introduction, Data indexing and overlays, Chord – Content addressable networks, Tapestry.
Distributed shared memory: Abstraction and advantages, Memory consistency models, Shared memory Mutual Exclusion.

Text Books:

1. Distributed Systems Concepts and Design, George Coulouris, Jean Dollimore and TimKindberg, Fifth Edition, Pearson Education, 2012.
2. Distributed computing: Principles, algorithms, and systems, Ajay Kshemkalyani and Mukesh Singhal, Cambridge University Press, 2011.

Reference Books:

1. Distributed Operating Systems: Concepts and Design, Pradeep K Sinha, Prentice Hall ofIndia, 2007.
2. Advanced concepts in operating systems. Mukesh Singhal and Niranjan G. Shivaratri,McGraw- Hill, 1994.
3. Distributed Systems: Principles and Paradigms, Tanenbaum A.S., Van Steen M.,PearsonEducation, 2007.

e-Resources:
1) https://nptel.ac.in/courses/106/106/106106168/

AR-20 : B.Tech - CSE (DATA SCIENCE) **III Year II Semester**

Data Wrangling in Data Science
(Professional Elective-II)

L	T	P	C
3	0	0	3

Subject Code: 20CDE324

Course outcomes:

Upon completion of this course, the students will be able to

- Identify and execute the basic data format.
- Perform the computations with Excel and pdf files
- Understand the concepts of data cleanup
- Explore and analyze the Image and video data
- Understand the concepts web scraping

Unit I:

Introduction to Data Wrangling: Data Wrangling- Importance of Data Wrangling -How is Data Wrangling performed- Tasks of Data Wrangling-Data Wrangling Tools-Introduction to Python-Python Basics-Data Meant to be Read by Machines-CSV Data-JSON Data-XML Data.

Unit II:

Working with excel files and pdf files: Installing Python Packages-Parsing Excel Files-Parsing Excel Files -Getting Started with Parsing-PDFs and Problem Solving in Python-Programmatic Approaches to PDF Parsing-Converting PDF to Text-Parsing PDFs Using pdf miner-Acquiring and Storing Data- Databases.

Unit III:

A Brief Introduction-Relational Databases: MySQL and PostgreSQL-Non-Relational Databases: NoSQL-When to Use a Simple File-Alternative Data Storage.

Unit IV:

Data Cleanup: Why Clean Data?- Data Cleanup Basics-Identifying Values for Data Cleanup-Formatting Data-Finding Outliers and Bad Data-Finding Duplicates-Fuzzy Matching-RegEx Matching- Normalizing and Standardizing the Data-Saving the Data-Determining suitable Data Cleanup-Scripting the Cleanup Testing with New Data

Unit V:

Data Exploration and Analysis: Exploring Data-Importing Data-Exploring Table Functions-Joining Numerous Datasets-Identifying Correlations-Identifying Outliers-Creating Groupings-Analyzing Data-Separating and Focusing the Data, Presenting Data-Visualizing the Data-Charts-Time-Related Data- Maps-Interactives-Words-Images, Video, and Illustrations-Presentation Tools-Publishing the Data-Open Source Platforms

Unit VI:

Web Scraping: What to Scrape and How-Analyzing a Web Page-Network/Timeline-Interacting with JavaScript-In-Depth Analysis of a Page-Getting Pages-Reading a Web Page-Reading a Web Page with LXML-XPath-Advanced Web Scraping-Browser-Based Parsing-Screen Reading with Selenium-Screen Reading with Ghost.PySpidering the Web-Building a Spider with Scrapy-Crawling Whole Websites with Scrapy.

Text Books:

1. Data Wrangling with Python, Jacqueline Kazil& Katharine Jarmul, O'Reilly Media, Inc,2016
2. Data Wrangling with Python: Creating actionable data from raw sources, Dr. Tirthajyoti Sarkar, Shubhadeep Packt Publishing Ltd,2019

Reference Books:

1. Hands-On Data Analysis with Pandas, Stefanie Molin,Packt Publishing Ltd,2019
2. Practical Data Wrangling, Allan Visochek, Packt Publishing Ltd,2017
3. Principles of Data Wrangling: Practical Techniques for Data Preparation, TyeRattenbury, Joseph M. Hellerstein, Jeffrey Heer, Sean Kandel, Connor Carreras, , O'Reilly Media, Inc,2017

AR-20 : B.Tech - CSE (DATA SCIENCE) **III Year II Semester**

ETL Principles
(Professional Elective-III)

L	T	P	C
3	0	0	3

Subject Code: 20CDE331

Course Objective:
- Develop various applications with ETL principles

Course Outcomes:
By completing the course the students will be able to:
- Understand the basic principles of ETL
- Understand various processes like extraction, cleaning, conforming etc.

Unit I:
ETL Data Structures: To Stage or Not to Stage, Designing the Staging Area, Data Structures in the ETL System: Flat files, XML Data Sets, Relational Tables, Independent DBMS Working Tables, Third Normal Form Entity/Relation Models, Non-relational Data Sources, Dimensional Data Models, Fact Tables, Dimension Tables, Atomic and Aggregate Fact Tables, Surrogate Key Mapping Tables

Unit II:
Extracting: Logical Data Map, Components of the Logical Data Map, Using Tools for the Logical Data Map, Building the Logical Data Map- Data Discovery Phase, Data Content Analysis, Collecting Business rules in the ETL Processes, Integrating Heterogeneous Data Sources, Challenge of Extracting from Disparate Platforms, Flat files, XML Sources, Web Log Sources, ERP System Sources

Unit III:
Cleaning and Conforming: Defining Data Quality, Cleaning Deliverables, Known Table Row Counts, Column Nullity, Column Numeric and Date Ranges, Column Length Restriction, Column Explicit Valid Values, Column Explicit Invalid Values, Conformed Dimensions, Designing the Conformed Dimensions, Conformed Facts.

Unit IV:
Delivering Dimension Tables: The Basic Structure of a Dimension, The Grain of a Dimension, Flat Dimensions and Snowflaked Dimensions, Date and Time Dimensions, Big Dimensions, Small Dimensions, Dimensional Roles, Degenerate Dimensions, Slowly Changing Dimensions, Multivalued Dimensions and Bridge Tables

Unit V:
Delivering Fact Tables: Basic Structure of a Fact Table, Surrogate Key Pipeline, Fundamental Grains: Transaction Grain Fact Tables, Periodic Snapshot Fact Table, Accumulating Snapshot Fact Tables, Managing Indexes, Managing Partitions, Outwitting the Rollback Log, Loading the Data, Incremental Loading, Inserting Facts, Updating and Correcting Facts, Negating Facts, updating Facts, Deleting Facts, Factless Fact Tables

Unit VI:
Operations: Scheduling and Support, Migrating to Production, Achieving optimal ETL performance: Estimating Load Time, Vulnerabilities of Long-Running ETL processes, Minimizing Risk of Load Failures, Purging Historic Data, Monitoring ETL System: Measuring ETL Specific Performance Indicators, Measuring Infrastructure Performance Indicators, Tuning ETL Processes, ETL System Security

Text Books:
1. Ralph Kimball, Joe Caserta, "The Data Warehouse ETL Toolkit: Practical Techniques for Extracting, Cleaning, Conforming, and Delivering Data," Wiley, 2004.

References:
1. Silvers, Fon, "Building and Maintaining a Data Warehouse," Ukraine: CRC Press, 2008.

Web References:
1. https://www.coursera.org/learn/extract-transform-and-load-data

AR-20 : B.Tech - CSE (DATA SCIENCE) **III Year II Semester**

Business Intelligence
(Professional Elective-III)

L	T	P	C
3	0	0	3

Subject Code: 20CDE332

Course Objectives:

1. To understand the effect of Business Intelligence(BI) on an organization
2. To understand the strategic advantage of BI, and
3. To acquire the skills necessary for the effective and strategic application of BI technology to assist in the decision making process.
4. To develop real time application using BI

Course Outcomes:

On completion of this course, the students will be able

1. To gain knowledge of Business Intelligence
2. To understand the concepts and architectures of data warehousing.
3. To demonstrate the impact of business reporting, information visualization, and dashboards.
4. To apply business intelligence methods to various situations.
5. To develop business intelligence application for the real life scenario

Unit I: Business Intelligence – Introduction

A Frame work for Business Intelligence (Bl)- The Architecture of Bl - Benefits of business intelligence- how business intelligence differs from competitive intelligence and knowledge management.

Unit II: Data Warehousing

Characteristics of Data Warehousing- Data Marts- Data warehousing process- Data warehousing Architectures – Data Integration and the Extraction, Transformation and Load (ETL) Process- OLAP Versus OLTP- Data warehousing implementation issues – Real time data warehousing

Unit III: Business Reporting, Visual Analytics and Business Performance Management

Data and Information Visualization – Different types of Charts and Graphs- Emergence of Data visualization and Visual analytics - Performance Dashboard - Balance Score Cards – Dashboards Versus Scorecards - Six Sigma as a performance measurement system.

Unit IV: Data mining – Supervised learning

Data mining concepts and applications – Data mining process – Data mining methods – Classification techniques – Decision trees , Case studies

Data mining - Unsupervised learning:

Cluster Analysis – Partition and Hierarchical methods, Association rule mining –Data mining software Tools - Case studies

Unit V: Text Analytics, Text Mining, and Sentiment Analysis

Text analytics and Text mining concepts and definition – Text mining process – Text mining tools – Sentiment analysis overview – Sentiment analysis applications – Sentiment analysis process.

Unit VI: Web Analytics, Web Mining, and Social Analytics
Web mining overview – Web content and Web structure mining – Search Engines - Search Engine Optimization – Web usage mining – Web analytics maturity model and web analytics tools – Social analytics and social network analysis.

Text Book(s):
1.Ramesh Sharda, Dursun Delen, Efraim Turban, Business Intelligence and Analytics, Pearson
10th edition, 2018

Reference Books:
1.Ramesh Sharda, Dursun Delen, Efraim Turban, Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson, 2017
2.David Loshin Morgan, Kaufman, ―Business Intelligence: The Savvy Manager‟s Guide‖, Second Edition, 2012.

AR-20 : B.Tech - CSE (DATA SCIENCE) **III Year II Semester**

Predictive Analytics and IOT
(Professional Elective-III)

L	T	P	C
3	0	0	3

Subject Code: 20CDE333

Course Objectives:
1. This course will introduce predictive analytics using IoT sensor data.
2. The course objective :
3. To understand how predictive analytics can be applied in different domains.
4. To understand applications of Industrial IOT.
5. To understand the role of IOT in Smart cities.

Course Outcomes:
1. Understand the need of Analytics on IoT data.
2. Identify different data formats and applications of AI on IoT data.
3. Understand different domains like Personal healthcare, home, Industrial data and smart cities data.

Unit I: Principles and Foundations of IOT and AI
IOT reference model – IOT platforms – IOT verticals – Big data and IOT- Infusion of AI, Data Science in IOT – cross - industry standard for data mining – AI and IOT platforms

Unit II: Data Access and Distributed Processing for IOT
Data formats: TXT, CSV, XLSX, JSON, HDF5, SQL, NO Sql, HDFS data formats – Spark ML for IoT data

Unit III: Personal IOT
Personal IOT – super shoes by MIT – Continuous glucose monitoring – Hypoglycemia prediction using CGM data – Heart Monitor – Digital assistants

Unit IV: Home IOT
IOT and smart homes – Human activity recognition – HAR using wearable sensors – HAR from videos – smart lighting – Home surveillance

Unit V: AI for the Industrial IoT
Introduction to AI- powered industrial IoT – Use Cases – predictive maintenance using AI, LSTM - Advantages and disadvantages – Electrical load forecasting in industry- STLF using LSTM

Unit VI: AI for smart Cities IoT
Smart Cities – smart traffic management – parking – waste management – Policing – lighting governance – Challenges and benefits.

Text Books:
1. Amita Kapoor, ―Hands-On Artificial Intelligence for IoT‖, Packt Publishing, 2019.
2. Andrew Minteer ―Analytics for Internet of Things‖ ― Packt Publishing, 2017.

AR-20 : B.Tech - CSE (DATA SCIENCE) **III Year II Semester**

Professional Communication Skills Lab

L	T	P	C
0	0	3	1.5

Subject Code: 20HSL302

Course Objectives

- To provide students with a wide range of vocabulary to enable them to take language tests for higher education and employment
- To assist students acquire effective and adequate presentation skills
- To get students learn to collect comprehensive data for a project report
- To help students master techniques of being successful in group discussions
- To improve communication skills of students by making them participate in different language activities
- To prepare students for facing interviews self-assuredly

Course Outcomes

After completion of this course, the students will be able to:

1. State meanings, synonyms, antonyms, analogies, idioms, phrases, one-word substitutes, word roots, prefixes and suffixes for words in general.
2. Present and interpret data on select topics using pre-existing slides.
3. Collect data extensively on a social issue and make it public for the sake of enlightening
   populace.
4. Contribute proactively and extrapolate in group discussions.
5. Make impromptu speeches.
6. Prepare Job Application and Résumé / CV of their own, and face interviews confidently.
7.

List of Experiments

Experiment – 1 Classified Vocabulary
Experiment – 2 Power Point Presentation
Experiment – 3 Project Reports on Social Issues
Experiment – 4 Group Discussion
Experiment – 5 Debate
Experiment – 6 Job Application and Résumé / CV Writing— Mock Interviews

References

1. Advanced Communication Skills Lab. Version 1.0 (Software). K-VAN Solutions Pvt. Ltd.
2. Communication Skills. Sanjay Kumar and Pushpa Lata. Oxford University Press. 2011.
3. Speak Well. K. Nirupa Rani. Orient Blackswan, Hyderabad. 2012.
4. Strengthen Your Communication Skills. M. Hari Prasad. Maruthi Publications, Hyd. 2014.
5. Strengthen Your Steps. M. Hari Prasad. Maruthi Publications, Hyderabad. 2012.
6. Technical Communication. Meenakshi and Sangeetha. OUP. New Delhi. 2013.

AR-20 : B.Tech - CSE (DATA SCIENCE) **III Year II Semester**

Big Data Analytics Lab

L	T	P	C
0	0	3	1.5

Subject Code: 20CDL306

Software Requirements :

1. Hadoop: https://hadoop.apache.org/release/2.7.6.html
2. Java: https://www.oracle.com/java/technologies/javase/javase8u211-later-archive-downloads.html
3. Eclipse : https://www.eclipse.org/downloads/

List of Experiments:

Experiment 1:

Implement the following Data structures in Java

a) Linked Lists b) Stacks c) Queues d) Set e) Map

Experiment 2:

(i) Perform setting up and Installing Hadoop in its three operating modes: Standalone, Pseudo distributed, Fully distributed

(ii) Use web based tools to monitor your Hadoop setup.

Experiment 3:

Implement the following file management tasks in Hadoop:

- Adding files and directories
- Retrieving files
- Deleting files

Experiment 4:

Run a basic Word Count MapReduce program to understand MapReduce Paradigm.

Experiment 5:

Write a map reduce program that mines weather data.

Weather sensors collecting data every hour at many locations across the globe gather a large volume of log data, which is a good candidate for analysis with Map Reduce, since it is semi structured and record-oriented.

Experiment 6:

Use MapReduce to find the shortest path between two people in a social graph.

Hint: Use an adjacency list to model a graph, and for each node store the distance from the original node, as well as a back pointer to the original node. Use the mappers to propagate the distance to the original node, and the reducer to restore the state of the graph. Iterate until the target node has been reached.

Experiment 7:

Implement Friends-of-friends algorithm in MapReduce.

Hint: Two MapReduce jobs are required to calculate the FoFs for each user in a social network .The first job calculates the common friends for each user, and the second job sorts the common friends by the number of connections to your friends.

Experiment 8:

Implement an iterative PageRank graph algorithm in MapReduce.
Hint: PageRank can be implemented by iterating a MapReduce job until the graph has converged. The mappers are responsible for propagating node PageRank values to their adjacent nodes, and the reducers are responsible for calculating new PageRank values for each node, and for re-creating the original graph with the updated PageRank values.

Experiment 9:
Perform an efficient semi-join in MapReduce.
Hint: Perform a semi-join by having the mappers load a Bloom filter from the Distributed Cache, and then filter results from the actual MapReduce data source by performing membership queries against the Bloom filter to determine which data source records should be emitted to the reducers.

Experiment 10:
10. Install and Run Pig then write Pig Latin scripts to sort, group, join, project, and filter your data.

Experiment 11:
11. Install and Run Hive then use Hive to create, alter, and drop databases, tables, views, functions, and indexes

AR-20 : B.Tech - CSE (DATA SCIENCE) **III Year II Semester**

Soft Skills
(Common to All)

L	T	P	C
1	0	2	2

Subject Code: 20SSS301

Course Objectives

- Develop communicative competence in students of engineering.
- Enrich students emotional intelligence and inter personal skills
- Enable students to understand the importance of employing appropriate body language when communicating
- Develop students competence in written communication.
- Train students in interview skills, group discussions and presentation skills to enhance their
  employability skills.
- Bridge the gap between the current skill sets of students and the skills required by a potential employer through practice.
- Make students industry ready by grooming for corporate life.

Course Outcomes

After completion of this course, the students be able to:
Apply communication theory to solve workplace communication issues

1. Demonstrate the communication required in the work place interpersonal and intrapersonal
   communication skills, listening skills along with barriers of communication
2. Interpret the role non verbal communication cultural difference business etiquettes in communication
3. Express and understand complex ideas accurately in written and spoken formats: resume
   writing email writing and report writing.
4. Express technical knowledge and expertise orally through presentations group discussions
   and interviews to enhance employability competence.
5. Preparing students for campus to corporate transition and help to improve their communication competence.
6. Enable students to learn the techniques to acc the tests through English competence and
   demonstrate second language competence to enhance employability skills among students.

Unit – I

Fundamentals of communication: Fundamentals and process of communication: Objectives of communication process of communication types of communication, noise listening skills types of listening essentials of good listening and tips.

Unit – II

Interpersonal communication and emotional intelligence: Managing interpersonal and intrapersonal communication – Role of emotion in interpersonal communication – Barriers to interpersonal communication – Exchange theory – Gateways for effective interpersonal

communication.

Unit – III

Non verbal communication, Attire & Etiquettes : Non verbal Communication and body language kinesics, Polemics, Paralanguage, Hepatics, Handshakes ,appropriate body language and mannerisms for interviews business etiquettes- across different cultures.

Unit – IV

Technical communication and resume writing : written communication, mechanics of writing, report writing , business correspondence – business letter and Email format – meetings and managing meeting – Resume and cove letter writing – Formats.

Unit – V

Presentation and group discussion: Presentation skills prerequisites of effective presentation, format of presentation, Assertiveness strategies of assertive behavior, communication skills for group discussions and interviews, interview techniques.

Unit – VI

Campus to corporate training: Goal setting – Establishing Smart goals, Importance of mission statements, formulation of goals time management – Prioritization, dealing with difficult tasks, getting organized, conflict management – creating a win-win situation, negotiation and persuasion, dealing with Aggressive behavior, interpersonal and team building skills – Managing relationships, Understandings cultural Diversity, Teambuilding process and techniques, coordination in terms.

Text Books

1. Suresh, K. E. (2010). Communication Skills and Soft Skills: An Integrated Approach (With
   Cd). Pearson Education India.
2. Meenakshi Rama,"Business Communication", Oxford University Press, New Delhi
3. Viswanathan, R. (2010). Business communication. Himalaya Publishing House.
4. Butterfields, Jeff Soft skills for Everyone,NewDelhi,Cengage Learning, 2010.

Reference Books

1. Quintanilla, K. M., & Wahl, S. T. (2018). Business and professional communication: Keys for workplace excellence. Sage Publications.
2. Rajput, A. S., & Sharma, S. (2022). Importance of communicating science to the general
   public: an empirical study of top Indian scientists. Weather.
3. Thorpe, E. (2011). Winning at Interviews, 4/e. Pearson Education India.
4. Rovida, E., & Zafferri, G. (2022). The Importance of Soft Skills in Engineering and Engineering Education. New York: Springer.
5. Sinha, R. P. (2003). Current English Grammar and Usage with Composition.
6. Agarwal, N. K. (2009). AN EVALUATION OF KIRAN DESAI'S THE INHERITANCE OF LOSS1. The Grove: Working papers on English studies, (16), 115-128.

AR-20 : B.Tech - CSE (DATA SCIENCE) **IV Year I Semester**

Deep Learning

L	T	P	C
3	0	0	3

Subject Code: 20CDT410

Course Objectives: At the end of the course, the students will be expected to:
- Learn deep learning methods for working with sequential data,
- Learn deep recurrent and memory networks,
- Learn deep Turing machines,
- Apply such deep learning mechanisms to various learning problems.
- Know the open issues in deep learning, and have a grasp of the current research directions.

Course Outcomes: After the completion of the course, student will be able to
- Demonstrate the fundamental concepts learning techniques of Artificial Intelligence, Machine Learning and Deep Learning.
- Discuss the Neural Network training, various random models.
- Explain the Techniques of Keras, TensorFlow, Theano and CNTK
- Classify the Concepts of CNN and RNN
- Implement Interactive Applications of Deep Learning.

Unit I:
Fundamentals of Deep Learning: Artificial Intelligence, History of Machine learning: Probabilistic Modeling, Early Neural Networks, Kernel Methods, Decision Trees, Random forests and Gradient Boosting Machines, Fundamentals of Machine Learning: Four Branches of Machine Learning, Evaluating Machine learning Models, Overfitting and Underfitting.

Unit II: Introducing Deep Learning: Biological and Machine Vision, Human and Machine Language, Artificial Neural Networks, Training Deep Networks, Improving Deep Networks.

Unit III: Neural Networks: Anatomy of Neural Network, Introduction to Keras: Keras, TensorFlow, Theano and CNTK, Setting up Deep Learning Workstation, Classifying Movie Reviews: Binary Classification, Classifying newswires: Multiclass Classification.

Unit IV:
Convolutional Neural Networks: Nerual Network and Representation Learing, Convolutional Layers, Multichannel Convolution Operation, Recurrent Neural Networks: Introduction to RNN, RNN Code, PyTorch Tensors: Deep Learning with PyTorch, CNN in PyTorch

Unit V:
Interactive Applications of Deep Learning: Machine Vision, Natural Language processing, Generative Adversial Networks, Deep Reinforcement Learning.

Unit VI:
Deep Learning Research: Autoencoders, Deep Generative Models: Boltzmann Machines Restricted Boltzmann Machines, Deep Belief Networks.

Text Books:

1. Deep Learning- Ian Goodfellow, Yoshua Bengio and Aaron Courvile, MIT Press, 2016
2. Deep Learning with Python - Francois Chollet, Released December 2017, Publisher(s): Manning Publications, ISBN: 9781617294433
3. Deep Learning Illustrated: A Visual, Interactive Guide to Artificial Intelligence - Jon

Krohn, Grant Beyleveld, Aglaé Bassens, Released September 2019, Publisher(s): Addison-Wesley Professional, ISBN: 9780135116821
4. Deep Learning from Scratch - Seth Weidman, Released September 2019, Publisher(s): O'Reilly Media, Inc., ISBN: 9781492041412

Reference Books:

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

Web Link:

Swayam NPTEL: Deep Learning: https://onlinecourses.nptel.ac.in/noc22_cs22/preview

AR-20 : B.Tech - CSE (DATA SCIENCE) **IV Year I Semester**

Snowflake Cloud Analytics

L	T	P	C
3	0	0	3

Subject Code: 20CDT411

Course Objectives:
The main objective of the course is to master data warehousing on cloud using Snowflake

Course Outcomes:
At the end of the course, the student will be able to
- load & transform data in Snowflake
- scale virtual warehouses for performance and concurrency
- share data and work with semi-structured data
- gain a thorough knowledge of query constructs, DDL & DML operations, managing and monitoring Snowflake accounts and Snowflake's continuous data protection methods.

Unit I:
Snowflake Architecture - Unlocking Business Value, Business Agility Is More Important Than Ever, All Hail the Cloud! , Snowflake Architecture, Database Storage, Micro Partitions, Benefit of Micro Partitioning, Data Clustering, Virtual Warehouses, Caching, Result Cache, Local Disk Cache, Getting Started with Cloud Analytics - Key Cloud Computing Concepts.

Unit II:
Getting Started with Snowflake – Planning, Deciding on a Snowflake Edition, Choosing a Cloud Provider and Region, Examining Snowflake's Pricing Model, Other Pricing Considerations, Examining Types of Snowflake Tools, Creating a Snowflake Account, Connecting to Snowflake.

Unit III:
Building a Virtual Warehouse - Overview of Snowflake Virtual Warehouses, Warehouse Sizes and Features, Multicluster Virtual Warehouses, Virtual Warehouse Considerations, Building a Snowflake Virtual Warehouse.
Getting Started with SnowSQL - Installing SnowSQL, Configuring SnowSQL, SnowSQL Commands, Multiple Connection Names.

Unit IV:
Data Movement – Stages, External Stages, External Tables and Data Lakes, Internal Stages Loading, Bulk Data into Snowflake - Overview of Bulk Data Loading, Bulk Data Loading Recommendations, Bulk Loading with the Snowflake Web Interface, Data Loading with SnowSQL. Continuous Data Loading with Snowpipe - Loading Data Continuously, Snowpipe Auto-Ingest, Building a Data Pipeline Using the Snowpipe Auto-Ingest Option.

Unit V:
Snowflake Administration - Administering Roles and Users, Administering Resource Consumption, Administering Databases and Warehouses, Administering Account Parameters, Administering Database Objects, Administering Data Shares, Administering Clustered Tables, Snowflake Materialized Views.
Snowflake Security Overview – Snowflake security reference architecture, Network and site access, Account and user authentication, Object security, Data security, Security validations,

Snowflake Audit and Logging Business Continuity and Disaster Recovery - Regions and Availability Zones, Data Replication, Failover, and Failback, Business Continuity Process Flow.

Unit VI:
Working with Semi-structured Data- Supported File Formats, Advanced Data Types, Working with XML, Working with JSON, Working with AVRO, Working with Parquet Secure Data Sharing - Secure Data Sharing, Secure Table Sharing, Data Sharing Using a Secure View, Advanced Performance Tuning - Designing Tables for High Performance, Designing High-Performance Queries Optimizing Queries, Optimizing Warehouse Utilization, Monitoring Resources and Account Usage Resource Monitors

Text Books:
1. Mastering Snowflake Solution Supporting Analytics and Data Sharing, Apress
2. Jumpstart Snowflake A Step-by-Step Guide to modern cloud analytics, Apress

Reference Books:
1. Snowflake Essentials Getting Started with Big Data in the Cloud, Apress
2. Snowflake Cookbook: Techniques for building modern cloud data warehousing solutions
3. Snowflake: The Definitive Guide Architecting, Designing, and Deploying on the Snowflake Data Cloud – ORIELLY
4. https://docs.snowflake.com/en/

AR-20 : B.Tech - CSE (DATA SCIENCE) **IV Year I Semester**

Social Media Analytics
(Professional Elective-IV)

L	T	P	C
3	0	0	3

Subject Code: 20CDE441

Course Objective:
• Understand and deal with any social media network, strategy, or campaign.

Course Outcomes:
By completing the course the students will be able to:
• Understand social media categories and types of social media analytics
• Understand the impact of social media analytics integration with and affects other areas of business.

Unit I:
Introduction: Foundation for Analytics, Evolution of Data and the Digital Gap, Social Media Data Sources: Offline and Online, Definition of Social Media, Data Sources in Social Media Channels, Estimated vs. Factual Data Sources, Public and Private Data, Data Gathering in Social Media Analytics, Social Media Network Support of Data Collection, API: Application Programming Interface, Web Crawling or Scraping.

Unit II:
From Data to Insights: Example of a Single Metric Giving Actionable Insight, An Example of a Metric Leading to New Questions, Creating a Plan to Shape Data into Insights, The Planning Stage: Projecting Possible Insights, Analysis of a Social Media Post, The process of Comparison, Data Aggregation, Calculations and Display, Data Display, Social Media and Big Data, Potential Challenges

Unit III:
Analytics in Social Media: Types of Analytics in Social Media, Analytics or Channel Analytics, Social Media Listening: Keyword and Mention-Based Analysis, Demographics, Interests and Sentiment, Advertising Analytics: Focus on Conversions and ROI of Paid Social Media Campaigns, Conversions: The Key to Digital and Social Advertising, CMS Analytics: Measuring the Performance of the Content Management Team, CRM Analytics: Customer Support and Sales via Social Media

Unit IV:
Dedicated vs. Hybrid Tools :Common to all Tools, Dedicated Tools, Advantages of Dedicated Tools, Disadvantages of Dedicated tools, Hybrid Tools, Dedicated Tools with Hybrid Features, Advantages of Hybrid Tools, Disadvantages of Hybrid Tools, Data Integration Tools, Advantages of Data Integration Tools, Disadvantages of Data Integration Tools.

Unit V:
Social Network Landscape: Concept and UX on Social Networks, Features and Their Strategic Value, Interactivity: How Social is the Network, Content Flow on Social Network.

Unit VI:
The Analytics Process: Analysis is Comparison, Investigation beyond Social Analytics, Shaping a Method: The End Game for an Analyst, The Analysis Circle, Dynamic Cycles, The

Analyst Mindset: Making the Right Questions and Running the Right Experiments.

Text Books:

1. Alex Goncalves, "Social Media Analytics Strategy-Using Data to Optimize Business Performance," Apress, 2017.

References:

1. Qiu, Liangfei., Kumar, Subodha, "Social Media Analytics and Practical Applications: The Change to the Competition Landscape," United States: CRC Press, 2021.
2. Sponder, Marshall, "Social Media Analytics: Effective Tools for Building, Interpreting, and Using Metrics," United Kingdom: McGraw-Hill Education, 2011.

Web References:

1. https://www.coursera.org/learn/social-media-analytics-introduction

AR-20 : B.Tech - CSE (DATA SCIENCE) **IV Year I Semester**

Nature Inspired Computing Techniques
(Professional Elective-IV)

L	T	P	C
3	0	0	3

Subject Code: 20CDE442

Course Objective:

- Learn the theoretical foundations of Nature Inspired Computing techniques, how they can be used to solve problems, and in which areas are most useful and effective.

Course Outcomes:

By completing the course the students will be able to:

- Understand the strengths, weaknesses and appropriateness of nature-inspired algorithms.
- Apply nature-inspired algorithms to optimization, design and learning problems.

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Unit I :

Analysis of Algorithms: Analysis of Optimization Algorithms, Nature Inspired Algorithms, Parameter Tuning and Parameter Control: Parameter Tuning, Hyper optimization, Multi objective View, Parameter Control, Simulated Annealing: Algorithm, Basic Convergence Properties, Stochastic Tunneling

Unit II:

Genetic Algorithms: Introduction, Role of Genetic Operators, Choice of Parameters, GA Variants, Differential Evolution: Introduction, Differential Evolution, Variants, Choice of Parameters, Convergence Analysis, Particle Swarm Optimization: Swarm Intelligence, PSO Algorithm, Accelerated PSO, Binary PSO

Unit III:

Cuckoo Search: Cuckoo Breeding Behavior, Levy Flights, Cuckoo Search: Special Cases of Cuckoo Search, Variants of Cuckoo Search, Global Convergence, Applications

Unit IV:

Firefly Algorithms: Firefly Behavior, Standard Firefly Algorithm Variations of Light Intensity and Attractiveness, Controlling Randomization, Firefly Algorithms in Applications

Unit V:

Bat Algorithms: Echolocation of Bats: Behavior of Microbats, Acoustics of Echolocation, Bat Algorithms: Movement of Virtual Bats, Loudness and Pulse Emission, Binary Bat Algorithm, Variants of the Bat Algorithm, Convergence Analysis, Applications: Continuous Optimization, Combinatorial Optimization and Scheduling, Inverse Problems and Parameter Estimation, Classifications, Clustering and Data Mining, Image Processing, Fuzzy Logic and Other Applications

Unit VI:

Flower Pollination Algorithms: Introduction, Characteristics of Flower Pollination, Flower Pollination Algorithms, Multi-Objective Flower Pollination Algorithms, Validation and Numerical Experiments: Single-Objective Test Functions, Multi-Objective Test Functions, Applications: Single-Objective Design Benchmarks, Multi-Objective Design Benchmarks

Text Books:

1. “Nature-Inspired Optimization Algorithms”, Yang, Xin-She, Elsevier Science, 2014.

References:

1. “Nature-Inspired Computing and Optimization: Theory and Applications,” Germany: Springer International Publishing, 2017.

AR-20 : B.Tech - CSE (DATA SCIENCE) **IV Year I Semester**

Reinforcement Learning
(Professional Elective-IV)

L	T	P	C
3	0	0	3

Subject Code: 20CDE443

Course Objective:

- Learn various approaches to solve decision problems with functional models and algorithms for task formulation, Tabular based solutions, Function approximation solutions, policy gradients and model based reinforcement learning.

Course Outcomes:

By completing the course the students will be able to:

- Understand basic concepts of Reinforcement learning
- Identifying appropriate learning tasks for Reinforcement learning techniques
- Understand various methods and applications of reinforcement learning

Unit I:

Introduction: Reinforcement Learning, Examples, Elements of Reinforcement Learning, Limitations and Scope, An Extended Example: Tic-Tac-Toe

Multi-armed Bandits: A k-armed Bandit Problem, Action-value methods, The 10-armed Testbed, Incremental Implementation, Tracking a Nonstationary Problem, Optimistic Initial Values, Upper – Confidence-Bound Action Selection, Gradient Bandit Algorithm

Unit II:

Finite Markov Decision Process: The Agent-Environment Interface, Goals and Rewards, Returns and Episodes, Unified Notataion for Episodic and Continuing Tasks, Policies and Value Functions,

Dynamic Programming: Policy Evaluation, Policy Improvement, Policy Iteration, Value Iteration, Asynchronous Dynamic Programming, Generalized Policy Iteration, Efficiency of Dynamic Programming

Unit III:

Monte Carlo Methods: Monte Carlo Prediction, Monte Carlo Estimation of Action Values, Monte Carlo Control, Monte Carlo Control without Exploring Starts, Off-policy Prediction via Importance Sampling, Incremental Implementation, Discontinuing-aware Importance Sampling, Per-decision Importance Sampling n-step Bootstrapping: n-step TD Prediction, n-step Sarsa, n-step Off-policy Learning, Per-decision methods with Control Variables, A Unifying Algorithm: n-step $Q(\sigma)$

Unit IV:

Off-policy Methods with Approximation: Semi-gradient Methods, Examples of Off-policy Divergence, The Deadly Triad, Linear Value-function Geometry, Gradient Descent in the Bellman Error, The Bellman Error is not Learnable, Gradient-TD methods, Emphatic-TD methods, Reducing Variance.

Unit V:

Eligibility Traces: The λ-return, TD(λ), n-step Truncated λ-return methods, Online λ –return Algorithm, True Online TD(λ), Dutch Traces in Monte Carlo Learning, Sarsa(λ), Variable λ and γ, Off-policy Traces with Control Variables, Watkins's Q(λ) to Tree-Backup(λ)

Unit VI:

Policy Gradient Methods: Policy Approximation and its Advantages, The Policy Gradient Theorem, REINFOECE: Monte Carlo Policy Gradient, REINFORCE with Baseline, Actor-Critic Methods, Policy Gradient for Continuing Problems, Policy Parameterization for Continuous Actions.

Text Books:

1. R. S. Sutton and A. G. Bart,. "Reinforcement Learning - An Introduction," MIT Press, 2018.

References:

1. Szepesvári, Csaba, "Algorithms for Reinforcement Learning," United States: Morgan & Claypool, 2010.
2. Puterman, Martin L., "Markov Decision Processes: Discrete Stochastic Dynamic Programming," Germany: Wiley, 2014.

Web References:

1. https://onlinecourses.nptel.ac.in/noc20_cs74/preview
2. https://www.coursera.org/learn/fundamentals-of-reinforcement-learning

AR-20 : B.Tech - CSE (DATA SCIENCE) **IV Year I Semester**

Cloud Computing
(Professional Elective-V)

L	T	P	C
3	0	0	3

Subject Code: 20CDE451

Course Objectives:
- To explain the evolving computer model caned cloud computing.
- To introduce the various levels of services that can be achieved by cloud.
- To describe the security aspects in cloud.
- To motivate students to do programming and experiment with the various cloud computing environments.

Course Outcomes: At the end of the course, student will be able to
- Illustrate the key dimensions of the challenge of Cloud Computing
- Classify the Levels of Virtualization and mechanism of tools.
- Analyze Cloud infrastructure including Google Cloud and Amazon Cloud.
- Create Combinatorial Auctions for cloud resource and design scheduling algorithms for computing cloud
- Assess control storage systems and cloud security, the risks involved its impact and develop cloud application

Unit I:
Systems Modeling, Clustering and Virtualization: Scalable Computing over the Internet-The Age of Internet Computing, Scalable computing over the internet, Technologies for Network Based Systems, System models for Distributed and Cloud Computing, , Performance, Security and Energy Efficiency

Unit II:
Virtual Machines and Virtualization of Clusters and Data Centers: Implementation Levels of Virtualization, Virtualization Structures/ Tools and Mechanisms, Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation.

Unit III:
Cloud Platform Architecture: Cloud Computing and Service Models, Public Cloud Platforms, Service Oriented Architecture, Programming on Amazon AWS and Microsoft Azure

Unit IV:
Cloud Resource Management and Scheduling: Policies and Mechanisms for Resource Management, Applications of Control Theory to Task Scheduling on a Cloud, Stability of a Two Level Resource Allocation Architecture,

Unit V:
Feedback Control Based on Dynamic Thresholds. Coordination of Specialized Autonomic Performance Managers, Resource Bundling, Scheduling Algorithms for Computing Clouds-Fair Queuing, Start Time Fair Queuing.

Unit VI:
Storage Systems: Evolution of storage technology, storage models, file systems and database, distributed file systems, general parallel file systems. Google file system.

Text Books:

1. Distributed and Cloud Computing, Kai Hwang, Geoffry C. Fox, Jack J. Dongarra MK Elsevier.
2. Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier.

Reference Books:

1. Cloud Computing, A Hands on approach, ArshadeepBahga, Vijay Madisetti, University Press
2. Cloud Computing, A Practical Approach, Anthony T Velte, Toby J Velte, Robert Elsenpeter, TMH
3. Mastering Cloud Computing, Foundations and Application Programming, Raj Kumar Buyya, Christen vecctiola, S Tammaraiselvi, TMH

AR-20 : B.Tech - CSE (DATA SCIENCE) **IV Year I Semester**

Information Retrieval Systems
(Professional Elective-V)

L	T	P	C
3	0	0	3

Subject Code: 20CDE452

Course Objectives:

- To provide the foundation knowledge in information retrieval.
- To equip students with sound skills to solve computational search problems.
- To appreciate how to evaluate search engines.
- To appreciate the different applications of information retrieval techniques in the Internet or Web environment.
- To provide hands-on experience in building search engines and/or hands-on experience in evaluating search engines.

Course Outcomes:

By the end of the course, student will be able to

- Identify basic theories in information retrieval systems
- Classify the analysis tools as they apply to information retrieval systems.
- Illustrate the problems solved in currentIR systems.
- Discuss the advantages of current IR systems
- Summarize the difficulty of representing and retrieving documents.
- Translate the latest technologies for linking, describing and searching the web

Unit I:

Introduction to Information Storage and Retrieval System: Introduction, Domain Analysis of IR systems and other types of Information Systems, IR System Evaluation. Introduction to Data Structures and Algorithms related to Information Retrieval: Basic Concepts, Data structures, Algorithms

Unit II:

Inverted Files: Introduction, Structures used in Inverted Files, Building Inverted file using a sorted array, Modifications to Basic Techniques.

Unit III:

Signature Files: Introduction, Concepts of Signature Files, Compression, Vertical Partitioning, Horizontal Partitioning.

Unit IV:

New Indices for Text: PAT Trees and PAT Arrays: Introduction, PAT Tree structure, algorithms on the PAT Trees, Building PAT trees as PATRICA Trees, PAT representation as arrays.

Unit V:

Stemming Algorithms: Introduction, Types of Stemming Algorithms, Experimental Evaluations of Stemming to Compress Inverted Files

Unit VI:

Thesaurus Construction: Introduction, Features of Thesauri, Thesaurus Construction, Thesaurus construction from Texts, Merging existing Thesauri.

Text Books:

1. Frakes, W.B., Ricardo Baeza-Yates: Information Retrieval Data Structures and Algorithms, Prentice Hall, 1992.
2. Modern Information Retrieval by Yates Pearson Education.
3. Information Storage & Retrieval by Robert Korfhage – John Wiley & Sons.

Reference Books:

1. Kowalski, Gerald, Mark T Maybury: Information Retrieval Systems: Theory and Implementation, Kluwer Academic Press, 1997.
2. Information retrieval Algorithms and Heuristics, 2ed, Springer

AR-20 : B.Tech - CSE (DATA SCIENCE) **IV Year I Semester**

NOSQL Databases
(Professional Elective-V)

L	T	P	C
3	0	0	3

Subject Code: 20CDE453

Course Objective: The student will be able to
- Define, compare and use the four types of NoSQL Databases (Document-oriented, Key-Value Pairs, Column-oriented and Graph).
- Demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Column-oriented NoSQL databases.
- Explain the detailed architecture, define objects, load data, query data and performance tune Document-oriented NoSQL databases.

Course Outcomes: At the end of the course, student will be able to
- Discuss about Aggregate Data Models
- Explain about Master-Slave Replication, Peer-to-Peer Replication
- Describe the Structure of Data, Scaling, Suitable Use Cases
- Make use of Complex Transactions Spanning Different Operations
- Identify Routing, Dispatch and Location-Based Services

Unit I:
Why NoSQL, The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, A (Mostly) Standard Model, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL.

Unit II:
Aggregate Data Models; Aggregates, Example of Relations and Aggregates, Consequences of Aggregate Orientation, Key-Value and Document Data Models, Column-Family Stores, Summarizing Aggregate-Oriented Databases. More Details on Data Models; Relationships, Graph Databases, Schema less Databases, Materialized Views, Modeling for Data Access,

Unit III:
Distribution Models: Single Server, Shading, Master-Slave Replication, Peer-to-Peer Replication, Combining Shading and Replication. Consistency, Update Consistency, Read Consistency, Relaxing Consistency, The CAP Theorem, Relaxing Durability, Quorums. Version Stamps, Business and System Transactions, Version Stamps on Multiple Nodes

Unit IV:
What Is a Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preference, Shopping Cart Data, When Not to Use, Relationships among Data, Multi operation Transactions, Query by Data, Operations by Sets.

Unit V:
Document Databases, What Is a Document Database, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, Ecommerce Applications, When Not to Use, Complex Transactions Spanning different Operations, Queries against Varying Aggregate Structure

Unit VI:

Graph Databases, What Is a Graph Database, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Connected Data, Routing, Dispatch and Location-Based Services, Recommendation Engines, When Not to Use

Text Books:

1. Sadalage, P. & Fowler, No SQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Pearson Addision Wesley, 2012
2. Dan McCreary and Ann Kelly, "Making Sense of NoSQL: A guide for Managers and the Rest of us", 1st Edition, Manning Publication/Dreamtech Press, 2013. (ISBN-13: 978-9351192022)

Reference Books:

1. Dan Sullivan, "NoSQL For Mere Mortals", 1st Edition, Pearson Education India, 2015. (ISBN13: 978-9332557338)
2. Kristina Chodorow, "Mongodb: The Definitive Guide- Powerful and Scalable Data Storage", 2nd Edition, O'Reilly Publications, 2013. (ISBN-13: 978-9351102694)

AR-20 : B.Tech - CSE (DATA SCIENCE) **IV Year I Semester**

Recommender Systems
(Professional Elective-V)

L	T	P	C
3	0	0	3

Subject Code: 20CDE454

Course Objective:
To develop state-of-the-art recommender systems that automates a variety of choice-making strategies with the goal of providing affordable, personal, and high-quality recommendations

Course Outcomes:
By completing the course the students will be able to:
- Understand the basic concepts of recommender systems
- Carry out performance evaluation of recommender systems based on various metrics
- Implement machine-learning and data-mining algorithms in recommender systems data sets.
- Design and implement a simple recommender system.

Unit I:
An Introduction to Recommender Systems: Goals of Recommender Systems, Basic Models of Recommender Systems, Collaborative Filtering Models, Content-Based Recommender Systems, Knowledge-Based Recommender Systems, Domain-Specific Challenges in Recommender Systems, Advanced Topics and Applications.

Unit II:
Neighborhood-Based Collaborative Filtering: Key Properties of Ratings Matrices, Predicting Ratings with Neighborhood-Based Methods, Clustering and Neighborhood-Based Methods, Dimensionality Reduction and Neighborhood Methods, A Regression Modeling View of Neighborhood Methods, Graph Models for Neighborhood-Based Methods

Unit III:
Model-Based Collaborative Filtering: Decision and Regression Trees, Rule-Based Collaborative Filtering, Naïve Bayes Collaborative Filtering, Latent Factor Models, Integrating Factorization and Neighborhood Models

Unit IV:
Content-Based Recommender Systems: Basic Components of Content-Based Systems, Preprocessing and Feature Extraction, Learning User Profiles and Filtering, Content-Based Versus Collaborative Recommendations

Unit V:
Knowledge-Based Recommender Systems: Constraint-Based Recommender Systems, Case-Based Recommenders, Persistent Personalization in Knowledge-Based Systems.

Unit VI:
Evaluating Recommender Systems: Evaluation Paradigms, General Goals of Evaluation Design, Design Issues in Offline Recommender Evaluation, Accuracy Metrics in Offline Evaluation, Limitations of Evaluation Measures

Text Books:

1. Charu .C. Aggarwal, Recommender Systems: The Textbook, Springer, 2016.

Reference Books:

1. Jannach D., Zanker M. andFelFering A., Recommender Systems: An Introduction, Cambridge University Press(2011), 1st ed.
2. Ricci F., Rokach L., Shapira D., Kantor B.P., Recommender Systems Handbook, Springer(2011), 1st edition.
3. Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems For Learning, Springer (2013), 1st ed.
4. J. Leskovec, A. Rajaraman and J. Ullman, Mining of massive datasets, 2nd Ed., Cambridge, 2012

AR-20 : B.Tech - CSE (DATA SCIENCE) **IV Year I Semester**

HRD & Organizational Behavior
(Open Elective)

L	T	P	C
3	0	0	3

Subject Code: 20OET411

COURSE OBJECTIVES:

- CO1:To co-create a comprehensive view of Human Resource Development (HRD) through assessment of theories and practices of HRD
- CO2: To familiarize the students with the components of individual and group behavior in organizational setting
- CO3: To help them learn behavioral skills in managing people at work.
- CO4: To provide basic insight into select contemporary management practices and Strategic Management.
- CO5: To learn theories of motivation and also deals with individual behavior, their personality and perception of individuals.
- CO6: To understand about organizations groups that affect the climate of an entire organization this helps employees in stress management.

COURSE OUTCOMES:

- CO1: To build an understanding and perspective of Human Resource Development as discipline appreciating learning.
- CO2: To learn the skills of developing a detailed plan for need and implementation of HRD program in the organization.
- CO3: To learn role of learning in action as an individual, group and an organization in order to develop creative strategies to organizational problems.
- CO4: To develop a perspective of HRD beyond organizational realities including national HRD
- CO5: To develop positive attitude through personality development and can equip with motivational theories.
- CO6: To attain the group performance and grievance handling in managing the organizational culture.

UNIT-1

HRD-Macro Perspective: HRD Concept, Origin and Need, HRD as a Total System; Approaches to HRD; Human Development and HRD; HRD at Macro and Micro Climate.

UNIT-2

HRD–Micro Perspective: Areas of HRD; HRD Interventions Performance Appraisal, Potential Appraisal, Feedback and Performance Coaching, Training, Career Planning, OD or Systems Development, Rewards

UNIT-3

Employee Welfare and Quality of Work Life and Human Resource Information; Staffing for HRD: Roles of HR Developer; Physical and Financial Resources for HRD; HR Accounting; HRD Audit, Strategic HRD

UNIT-4

Human Resource Training and Development: Concept and Importance; Assessing Training Needs; Designing and Evaluating T&D Programmes; Role, Responsibilities and challenges to Training Managers

UNIT-5

Individual Behavior: Perception-Perceptual process- Impression management- Personality development – Socialization – Attitude- Process- Formation- Positive attitude- Change – Learning – Learning organizations- Reinforcement Motivation – Process- Motives – Theories of Motivation: Maslow's Theory of Human Needs, Douglas McGregor's Theory X and Theory Y, Herzberg's Two-Factor Theory of Motivation

UNIT-6

Group Dynamics: Types of Groups, Stages of Group Development, Group Behavior and Group Performance Factors, Organizational conflicts: Reasons for Conflicts, Consequences of Conflicts in Organization, Types of Conflicts, Strategies for Managing Conflicts, Organizational Climate and Culture, Stress, Causes and effects, coping strategies of stress.

TEXT BOOKS:

1. Nadler, Leonard :Corporat Human Resource Development, Van NostrandReinhold, ASTD, New York .
2. Rao, T.V and Pareek, Udai: Designing and Managing Human Resource Systems,Oxford IBH Pub. Pvt.Ltd., New Delhi , 2005.
3. Rao, T.V: Readings in HRD, Oxford IBH Pub. Pvt. Ltd., New Delhi , 2004.
4. Subba Rao P., Organizational Behaviour, Himalaya Publishing House.Mumbai.
5. Fred Luthans Organizational Behaviour, TMH, NewDelhi.
6. Robins, Stephen P., Fundamentals of Management, Pearson,India.

REFERENCE BOOKS

1. Viramani, B.R and Seth, Parmila: Evaluating Management Development, VisionBooks, New Delhi.
2. Werner &DeSimone (2006). Human Resource Development. Thomson Press, Network.
3. Mankin, David (2009). Human Resource Development. Delhi: Oxford University Press.
4. Hersey, Paul, Dewey E. Johnson & Kenneth H. Blanchard (2013). Management of Organisational Behaviour. PHI.

AR-20 : B.Tech - CSE (DATA SCIENCE) **IV Year I Semester**

PROJECT MANAGEMENT
(Open Elective)

L	T	P	C
3	0	0	3

Subject Code: 20OET412

COURSE OBJECTIVES:

1. To develop an understanding of Project Planning and formation.
2. To make students gaining the knowledge and skills related to Project Analysis.
3. To make student better understand on Selection Criteria and select the best Project.
4. To develop understanding the concepts of Project Financing and Contracts.
5. To familiarize the students with implementation and execution of the project.
6. To make students understandingcomplete and close the project.

COURSE OUTCOMES:

1. To understand the concept of Project Planning and formation.
2. To understandthe keyissues in Project Analysis.
3. To understand Selection Criteria and select the best Project.
4. To understand the concepts of Project Financing and Contracts.
5. To understand how to implement and execute the project.
6. To understand how to complete and close the project.

UNIT – 1

Project Planning and Formation: Project meaning and concepts **–** Overview of total Project Management Cycle – Classification of Projects and Project Formation –Strategic Planning and Capital budgeting – Generation and Screening of Project Ideas – Generation of Ideas – Monitoring the Environment – Corporate Appraisal – Tools for Identify Investment opportunities – Scouting for Project Ideas – Preliminary Screening – Project Rating Index.

UNIT - 2

Project analysis: Issues in Project Analysis - Market and Demand Analysis–conduct of Market Survey,Demand forecasting.Technical analysis – Manufacturing Process Technology, Material Inputs and Utilities, Plant Capacity, Location and Site –Machineries and Equipment, Structures and Civil Works, Environment Aspects.Financial Estimations and projections – Cost of Projects, Means of Finance – Estimates of sales and Productions, Working capital Requirement and its financing, Profitability Projections, Projected Cash flow Statement, Projected Balance Sheet –Time Value of Money

UNIT-3

Project Selection: Selection Criteria– Net Present Value, Benefit Cost Ratio, Internal Rate of return, Urgency, Payback Period, Accounting Rate of Return, Assessment of Various Methods, Investment Evaluation in Practice. Project Selection Under Risk – Risk Analysis in Practice, How Financial Institutions Analyse Risk. Social Cost Benefit Analysis,Rationale for SCBA – UNIDO Approach.

UNIT – 4

Project FinancingandContracts: Financing of Projects **–** Capital Structure, Working Capital**,** Financing Infrastructure Projects, Public Private Partnership, Venture Capital **-** Private Equity, Credit Risk Management.Contracts - Definitions of contract and Contractor.Elements of contracts, offer acceptance and consideration, Valid Contracts, Department execution of work – Master Roll Form 21 – Piece work Agreement form – Work order. Types of Contracts – Lump sum Contract, Lump sum and Schedule contract, Item rate Contract, Sub Contracts, Joint ventures, Arbitration Disputes and claim Settlement.Tender - Contract system with tenders, Quotation, Earnest Money, Security Money – Tender Notice, Tender Form, Bidding – Procedure – Irregularities in Bidding – award

UNIT – 5

Project Implementation: Forms of Project organisation – Human Aspects – of project Management – Pre requisites for successful project implementation –Project Monitoring and Controlling – Parameters for monitoring and Control – Process of Monitoring –Network Techniques for Project Management**–** Developmentof Project Network -Time Estimation **–** Determination of Critical path**–** Scheduling when Resources are Limited - PERT Model **–** CPM Model **–** Network Cost System.

UNIT – 6

Project Completion: Completion of project and Managing Transition Period – Closure of Contracts – Completion of Assets of Projects – Post Project Evaluation and CompletionAudit Report.Management – Scope of the Construction Management, Significance of Construction management, Concept of Scientific Management, Qualities of Manager, Organisation – Authority, Policy, Recruitment process and Training Development of Personal Department, Labour problems, Labour legislation in India, Workmen compensation Act 1923, and subsequent amendments, Minimum Wages Act 1948.

TEXT BOOKS:

1. Narendra Singh, Project management and Control, Himalaya Publishing House, Mumbai 5th Edition
2. Prasanna Chandra: Projects, TMH, New Delhi,2014, 8th Edition.
3. K.Nagarajan: Project Management, New Age International, New Delhi,2010
4. PERT and CPM – L.S Srikanth
5. PERT and CPM – Punmia
6. Construction Management and Planning – Guna and Sen Gupta, B.

REFERENCES:

1. Gray, Larson: Project Management-Tata McGraw Hill-2015
2. Jeffery K.Pinto: Project Management-Pearson Education-2015
3. Enzo Frigenti: Project Management-Kogan, 2015
4. R. Panneerselvam, P. Senthilkumar: Project Management, PHI, 2015
5. Guide to Project Management Body of Knowledge (PMBOK® Guide) of Project Management Institute,USA.

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ENTREPRENEURIAL DEVELOPMENT
(Open Elective)

L	T	P	C
3	0	0	3

Subject Code: 20OET413

Course Objective:

The objective of this course is to expose the students to the subject of entrepreneurial development, so as to prepare them to establish a new enterprise and effectively manage the enterprise.

1. To co-create a comprehensive view of Human Resource Development (HRD) through assessment of theories and practices of HRD
2. To familiarize the students with the components of individual and group behavior in organizational setting
3. To help them learn behavioral skills in managing people at work.
4. To provide basic insight into select contemporary management practices and Strategic Management.
5. To learn theories of motivation and also deals with individual behavior, their personality and perception of individuals.
6. To understand about organizations groups that affect the climate of an entire organization this helps employees in stress management.

Course Outcome:

1. Understand the concept of Entrepreneurship and demonstrate the ability to provide a self analysis on Entrepreneurship qualities in the context of an Entrepreneurial career.
2. Understanding Entrepreneurship Development programmes in India and contents for training for Entrepreneurial competencies.
3. Create appropriate business model and develop well presented business plan that is feasible for the student.
4. Understanding how to manage effectively the selected business.
5. Understanding how to create e-Entrepreneurship.
6. Explain how various disciplines of the venture can be managed.

Unit 1: Entrepreneur and Entrepreneurship:

Nature and Scope of Business. Concept of Entrepreneur & Entrepreneurship,, characteristics of an Entrepreneur, types of Entrepreneurs, Entrepreneur. Role of Entrepreneurship in Economic development. Ethics and social responsibility of an entrepreneur. Future of Entrepreneurship in India.

Unit 2: Entrepreneurship Development in India:

Emergence of entrepreneurial class in India, Environmental factors effecting entrepreneurship, local mobility of Entrepreneurs, Concept of women entrepreneurship and rural entrepreneurship. Development of women Entrepreneurship, problems and remedies of women Entrepreneurship. Entrepreneurship Development programme (EDP) - need and objectives of EDPs, Designing Appropriate training programme for existing and new entrepreneurs. Institutions supporting for EDP

Unit 3 : Creating and starting the venture :
Steps to start an MSME. Meaning of a project. Project Identification- Sources of new Ideas, methods of generating ideas, creative problem solving, and opportunity recognition. Project selection - meaning of project report (Business Plan) & Formulation of a project report, Preparation of sample project report of any one product and service.

Unit 4 : Government and Institutional support to Entrepreneurs:
MSME Development Act-2006. Technology Incubation Centre, Business Incubation Centre, National Skill Development Corporation, Institutional finance – sources of short term and long term capital including Venture capital. Role of SIDBI, NSIC, EXIM Bank and commercial Banks, APSFC, AP Industrial policy (2020-23) - incentives and subsides, industrial estates, AP Skill Development Corporation.

Unit 5: e-Entrepreneurship:
Concept of e-Entrepreneurship, Difference between Entrepreneurship and e-Entrepreneurship, Purpose of Creating e-Entrepreneur, Essence of e-Entrepreneurship, e-Business Ventures in different sectors, Role of information technology in MSME, Problems and prospectus of e-Entrepreneurs in INDIA.

Unit 6 : Managing the venture:
Types of Ownership. Concepts of working capital management, Marketing management, Human Resource management and TQM. Problems and prospects of MSME in India. Profile of Entrepreneurs.

Text Books:

1. H.Nandan: Fundamentals of Entrepreneurship, PHI Learning, New Delhi, 2009
2. S.S.Khanka: Entrepreneurial Development, S.Chand & Company Ltd New Delhi 2009
3. Dr.C.B.Gupta and Dr.S.S.Khanka Entrepreneurship and Small Business Management: Sultan Chand & Sons:,2010
4. Narayana Reddy: Entrepreneurship, Cengage learning, New Delhi, 2010
5. Rajeev Roy: Entrepreneurship, Oxford university press, New delhi,2010
6. Vasat Desai: The Dynamics of Entrepreneurial Development and Management, Himalaya Publishing House, 2011

References:

1. Robert D Hisrich, Michel P Peters, Dean A Sheperd: Entrepreneurship, Tata Mc Graw Hill Education Private ltd, 2009
2. Hisrich: Entrepreneurship, TMH, New Delhi,2009
3. Prasanna Chandra: Projects, TMH, New Delhi,2012
4. K.Nagarajan: Project Management, New Age International, New Delhi,2010

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DIGITAL MARKETING
(Open Elective)

L	T	P	C
3	0	0	3

Subject Code: 20OET414

COURSE OBJECTIVES:

1. To develop an understanding on the digital marketing.
2. To make students gaining the knowledge and skills related to the area of search engine optimization (SEO).
3. To make student better understand on Social Media Optimization (SMO).
4. To develop understanding on SME (Search Engine Marketing) through AdWords.
5. To familiarize the students with the Lead Management & Digital Marketing.
6. To understand the contemporary concepts on digital innovation and trends.

COURSE OUTCOMES:

After completion of the course the student will be able to

1. Understand the concept on digital marketing.
2. Define the concept on search engine optimization (SEO).
3. Describe the concept on Social Media Optimization (SMO).
4. Explain the idea on SME (Search Engine Marketing) through AdWords.
5. Justify the concepts and developments on lead management & digital marketing.
6. Comprehend the contemporary concepts on digital innovation and trends.

UNIT -I:

Introduction to Digital Marketing: Digital Marketing- Importance -Digital Marketing Platforms- Difference between Traditional Marketing and digital Marketing- Advantages of Digital Marketing. Role and functions of a Digital Marketing Manager

UNIT - II:

Search Engine Optimisation: Definition, scope of SEO, on-page optimisation and Off Page Optimisation, Report Preparation- Keywords, Titles, Meta Tags

UNIT –III:

Social Media Optimization (SMO): Meaning and scope of SMO. Social Media Optimization of Facebook- Twitter- LinkedIn- Pinterest: Social media services optimization.

UNIT – IV:

Search Engine Marketing (SME): SME through AdWords, Keyword Selection, Create Text Ads- CPC Bidding- Navigate Ad Words- SEM Metrics & Optimization.

UNIT – V:

Lead Management & Digital Marketing: Web to lead forms- Web to case forms- Lead generation techniques- Social media and lead gen Inbuilt tools for Digital Marketing

UNIT – VI:

Digital Innovation and Trends: The contemporary digital revolution- Digital Transformation framework- Security and Privatization Issues with Digital Marketing- Trends in Digital Marketing

TEXT BOOKS:

1. Chaffey, D. (2019). Digital marketing. Pearson UK.

2. Chaffey, D., & Smith, P. R. (2017). Digital marketing excellence: planning, optimizing and integrating online marketing. Taylor & Francis.

3. Dodson, I. (2016). The art of digital marketing: the definitive guide to creating strategic, targeted, and measurable online campaigns. John Wiley & Sons.

REFERENCES:

1. Kaufman, I., & Horton, C. (2014). Digital marketing: Integrating strategy and tactics with values, a guidebook for executives, managers, and students. Routledge.

2. Stokes, R. (2011). E-Marketing: The essential guide to digital marketing. Quirk eMarketing.

3. Kamalesh K.Bajaj: Debjani Nag: E-commerce - The cutting edge of business, Tata Mc-Graw Hill.

AR-20 : B.Tech - CSE (DATA SCIENCE) **IV Year I Semester**

ENVIRONMENTAL IMPACT ASSESSMENT
(Open Elective)

L	T	P	C
3	0	0	3

Subject Code: 20OET415

Course Objectives:
This Course is intended to build the following objectives:

1. To understand basic concepts of EIA
2. To study different methodologies of EIA
3. To appreciate the significance of ecosystem and environmental protection
4. To prepare environmental audit reports
5. To understand the legal and regulatory compliance
6. To prepare EIA reports for different developmental and industrial establishments

Course Outcomes:
After studying the course, the student:

1. Determine and demonstrate the environment and developmental issues to the public effectively.
2. Assess and evaluate the key EIA methodologies and generate the data.
3. Assess and diagnose the impact of developmental activities on ecosystems.
4. Demonstrate environmental audit protocols to conduct on-site audit for the generation of reports.
5. Demonstrate the environmental and legal compliance suitable for the developmental activities.
6. Examine and generate comprehensive EIA reports to different developmental activities.

Unit-1
Basic Concepts of EIA: History and guiding principles of EIA-EIA Process-types of EIA-Initial Environmental Evaluation (IEE)-elements of EIA-factors affecting EIA during impact evaluation and analysis-preparation of environmental base maps and importance-classification of environmental parameters.

Unit-2
EIA Methodologies: Introduction-criteria for the selection of EIA methodology-EIA Methods: Ad-hoc method-matrix method-networks Method-Environmental Media Quality Index method (EMQIM)-overlay method-cost/benefit analysis.

Unit-3
Ecosystems Assessment: Assessment of Ecosystems-Assessment of impact of development activities on vegetation and wildlife, mitigation-causes and effects of deforestation-environmental impacts of deforestation.

Unit-4
Environmental Auditing: Environmental audit definition-objectives of environmental audit-types of environmental audit-audit protocol-stages of environmental audit-onsite audit activities-post audit activities-evaluation of audit data and preparation of audit report.

Unit-5

Environmental Legislations: Environmental Legislations introduction-The Environmental (Protection) Act-1986-The Water (Prevention and Control of Pollution) Act-1974-The Air (Prevention and Control of Pollution) Act-1981-The Motor Vehicles Act-1988-The Wildlife (Protection) Act-1972.

Unit-6

EIA Report Writing: Introduction - Case studies and preparation of Environmental Impact Assessment (EIA) statement report for coal mining activities – chemical industries – Thermal power plants.

Text Books:

1. Environmental Science and Engineering by Suresh K. Dhameja, S. K. Kataria& Sons Publications (Recent addition), New Delhi.
2. Environmental Impact Assessment Methodologies by Y. Anjaneyulu, B. S. Publications (Recent addition), Sultan Bazar, Kakinada.

Reference Books:

1. Environmental Pollution and Control by Dr. H. S. Bhatia, Galgotia Publications (P) Ltd., New Delhi (Recent addition).
2. Environmental Science and Engineering by J. Glynn and Gary W. Hein Ke, Prentice Hall Publishers (Recent addition).

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ENERGY AUDIT CONSERVATION AND MANAGEMENT (Open Elective)

L	T	P	C
3	0	0	3

Subject Code: 20OET416

Course Objective:
To introduce basic principles of energy auditing and to know something about energy management. Also it provides immense knowledge about energy efficient motors, power factor improvement, lighting and energy instruments. Finally economic aspects are analyzed.

Course Outcomes:
Students will be able to:
CO1: Apply principles of energy auditing and propose energy conservation schemes.
CO2: Demonstrate principle and organizing energy management program.
CO3: Demonstrate the operating principle of energy efficient motors.
CO4: Analyze power factor improvement methods,
CO5: Illumination methods and demonstrate the operation of various energy instruments.
CO6: Analyze and compute the economic aspects of energy consumption.

UNIT I:
Basic principles of energy audit
Energy audit- definitions, concept, types of audit, energy index, cost index, pie charts, Sankey diagrams, load profiles, Energy conservation schemes.

UNIT II:
Energy management
Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting.

UNIT III:
Energy efficient motors
Energy efficient motors , factors affecting efficiency, loss distribution, constructional details, characteristics – variable speed , variable duty cycle systems, RMS hp- voltage variation-voltage unbalance- over motoring- motor energy audit.

UNIT IV:
Power factor improvement
Power factor – Need of power factor -methods of improvement of power factor, location of capacitors.

UNIT V:
Lighting and energy instruments
Good lighting system design and practice, lighting control, lighting energy audit. Energy Instruments wattmeter, data loggers, thermocouples, pyrometers, lux meters, tongue testers.

UNIT VI:
Economic aspects and analysis
Economics Analysis-Depreciation Methods, time value of money, rate of return, present worthmethod, replacement analysis, life cycle costing analysis.

TEXT BOOKS:

1. Energy Management by W.R. Murphy & G. Mckay Butter worth, Elsevier publications. 2012
2. Energy Efficient Electric Motors by John. C. Andres, Marcel Dekker Inc. Ltd – 2nd Edition, 1995
3. Electric Energy Utilization and Conservation by S C Tripathy, Tata McGraw hill Publishing
CompanyLtd, New Delhi.

REFERENCE BOOKS:

1. Energy management by Paulo' Callaghan, Mc – Graw Hill Book company – 1st edition, 1998
2. Energy management hand book by W.C. Turner, John wiley and son, 2001.
3. Energy management and good lighting practice: fuel efficiency booklet12 – EEO.

AR-20 : B.Tech - CSE (DATA SCIENCE) **IV Year I Semester**

OPTIMIZATION TECHNIQUES
(Open Elective)

L	T	P	C
3	0	0	3

Subject Code: 20OET417

COURSE OBJECTIVES

- Enumerate the fundamental knowledge of Linear Programming and Dynamic Programming problems.
- Learn classical optimization techniques and numerical methods of optimization.
- Explain Integer programming techniques and apply different optimization techniques to solve various models arising from engineering areas.

COURSE OUTCOMES

On completion of this course, students should be able to

CO 1 : Solve linear programming problems using simplex method and to use duality principle

CO 2 : Analyze the simplex solutions for the changes in cost coefficients constraint coefficients

CO 3 : Identify the queuing model and to solve them

CO 4 : Enumerate fundamentals of non-linear programming

CO 5 : Solve different dynamic programming problems

CO 6 : Solve problems of decision making under certainity, uncertainity and risk

UNIT I

Introduction to optimization techniques: Linear programming problem, simplex method, duality principle , Big-M method, Two phase simplex method.

UNIT II

Sensivity analysis: Change in the constraints, cost coefficients, coefficients of the constraints, addition and deletion of variable, constraints.

UNIT III

Queuing Theory: Characteristics of Queuing models, Classification, (M/M/1:FCFS/∞/∞), (M/M/1:FCFS/N/∞), (M/M/C:FCFS/∞/∞) models.

UNIT IV

Introduction to Non linear programming: Single variable optimization with and without constraints, multi-variable optimization without constraints, multi-variable optimization with constraints, method of Lagrange multipliers, Kuhn-Tucker condition.

UNIT V

Dynamic Programming: Introduction, Terminology, Bellman‟s Principle of optimality, Applications of dynamic programming, shortest path problem, linear programming problem, Product allocation problem, Cargo load problem.

UNIT VI

Decision Theory: Introduction, Classification of decisions, decision making under certainty, decision making under risk, decision making under uncertainty.

TEXT BOOKS:

1. Operations Research by P. Rama Murthy, New Age Pub
2. Operations Research, S.D.Sharma, Kedarnath Ramanadh Publications.
3. Operations Research by D.S. Hira and Prem Kumar gupta, S.Chand.

REFERENCES BOOKS:

1. Operations Research, J.K. Sharma, MacMilan Pub.
2. Introduction to Operations Research by V. K. Kapoor, S. Chand Publishers
3. Optimization theory & Applications / S.S .Rao / New Age International

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Blockchain Technologies
(Open Elective)

L	T	P	C
3	0	0	3

Subject Code: 20OET418

Course Objectives:
To give students the understanding of emerging abstract models for Blockchain Technology and to familiarize with the functional/operational aspects of crypto currency eco-system, this course covers the technological underpinning of block Chain operations in both theoretical and practical implementation of solutions using Ethereum.

Course Outcomes:
After completion of this course, the students will be able to:
1. Understand block chain technology.
2. Understand Crypto currency
3. Understand Smart contract
4. Use Remix IDE
5. Develop block chain based solutions and write smart contract using Ethereum Framework.
6. Deploy Open source Hyper ledger Architecture

Unit I:
Introduction: Overview of Block chain, History of Blockchain, Peer to Peer Network, Smart Contract, Wallet, Digital Currency, Ledgers, Types of Block chain Platform, Consensus algorithms and their scalability problems, digital cash etc.

Unit II:
Consensus Mechanism &Crypto primitives: Atomic Broad cast, Consensus, Permission Blockchain, Permission less Block chain, Hash functions, digital signatures, public key crypto, verifiable random functions, Zero-knowledge systems.

Unit III:
Bitcoin basics: Bit coin block chain, Challenges and solutions, Different Consensus Mechanism Proof of Work, Proof of Stake, Proof of Activity, Proof of Burn, Proof of Elapsed Time, Proof of Authority, Proof of Importance, alternatives to Bitcoin consensus, Bitcoin scripting language and their use.

Unit IV:
Crypto currency and Wallet: Types of Wallet, Desktop Wallet, App based Wallet, Browser based wallet, Metamask, Creating a account in Metamask, Use of faucet to fund wallet, transfer of crypto currency in metamask.

Unit V:
Contract and Ethereum: Overview of Ethereum, Writing Smart Contract in Solidity, Remix IDE,Different networks of ethereum, understanding blocks practically at blockhcain.com, how to compile and deploy smart contract in remix.

Unit VI:
Understanding Hyperledger Fabric: Overview of Open source Hyperledger project,

Hyperledger Fabric- Architecture, Identities and Policies, Membership and Access Control, Channels, Transaction Validation, Writing smart contract using Hyperledger Fabric.

Text Books:

1. Blockchain: Blueprint for a New Economy by Melanie Swan Narayanan, Bonneau, Felten,Millerand Goldfeder, and Cryptocurrency Technologies - A Comprehensive Princeton University Press.

Reference Books:

1. Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks by Imran Bashier.
2. Mastering Ethereum: Building Smart Contracts and DApps by Andrews Prof. Sandip Chakraborty, Dr. Praveen Jayachandran, Blockchain Architecture Design And Use Cases NPTEL:
https://nptel.ac.in/courses/106/105/106105184/

Reference Links:

1. Dr.Mayank Agarwal, BlockChain[MOOC], NPTEL:
https://onlinecourses.swayam2.ac.in/aic21_ge01/preview

AR-20 : B.Tech - CSE (DATA SCIENCE) **IV Year I Semester**

IT Systems Management
(Open Elective)

L	T	P	C
3	0	0	3

Subject Code: 20OET419

Course Objectives:

- Provides extensive theoretical knowledge of IT infrastructure.
- Enhances the student's computing environment knowledge.
- Provides broad based knowledge of IT System management.
- Develops management skills required for a business environment.
- Builds upon the essential core Network Security and storage management with greater emphasis.

Course Outcomes:

1. Describe the business value and processes of ICT services in an organization and apply that knowledge and skill with initiative to a workplace scenario.
2. Analyze and evaluate the impact of new and current ICT services to an organization.
3. Describe how effective IT Infrastructure Management requires strategic planning with alignment from both the IT and business perspectives in an organization.
4. Characteristics of the network Security that affect user operations.
5. Define, track, and maintain data and data resources and recent trends in IT.
6. Describe E-Commerce and Global System for Mobile Communication.

Unit I:

IT Infrastructure: Overview: Definitions, Infrastructure management activities, Evolutions of Systems since 1960s (Mainframes-to-Midrange-to-PCs-to-Client-server computing-to-New age systems) and their Management, growth of internet, current business demands and IT systems issues, complexity of today's computing environment.

Unit II:

Software Management : SDLC, The Waterfall Model, Advantages, Disadvantages, Conventional Software Management performance, Software Economics.

Unit III:

Current computing environment : Complexity of current computing, multiple technologies.
IT system Management: Common tasks in IT system management, approaches for organization IT management systems context diagram, patterns for IT system Management, Service level management, Financial Management, Capacity Management, availability management.

Unit IV:

Security Management : Computer Security, Internet Security, Physical Security, Identity Management, Access control System, Intrusion Detection.

Unit V:

Storage Management : Types of Storage management, Benefits of storage management, backups, Archive, Recovery, Disaster recovery. Space management, Hierarchical storage management.

Unit VI:

Emerging Trends in IT : Introduction, E-Commerce, Electronic Data Interchange , Global System for Mobile Communication.

Text Books:

1. IT Infrastructure & Its Management, By Phalguni Gupta, Tata McGraw-Hill Education.
   (Unit 1,3,4,5).2009
2. Software Project Management , Walker Royce: pearson Education,2021.(Unit 2).

Reference Books:

1. Ivanka Menken, ITIL V3 Foundation Certification Exam Preparation Course in a Book for

Passing the ITIL V3 Foundation Exam, Second Edition (The Art of Service), 2009. Van Haren, Passing the ITIL Foundation, Van Haren Publishing, 2011.

AR-20 : B.Tech - CSE (DATA SCIENCE) **IV Year I Semester**

API and Micro Services

L	T	P	C
3	0	0	3

Subject Code: 20OET41A

Course Outcomes:

At the end of this course, the student will be able to

- Develop a Spring Data JPA application with Spring Boot
- Implement CRUD operations using Spring Data JPA
- Implement pagination and sorting mechanism using Spring Data JPA
- Implement query methods for querying the database using Spring Data JPA
- Implement a custom repository to customize a querying mechanism using Spring Data JPA
- Understand update operation using query approaches in Spring Data JPA
- Implement Spring Transaction using Spring Data JPA
- Develop RESTful endpoints using Spring REST Processing URI parameters
- Write RESTful services using Spring REST that consumes and produces data in different formats
- Handle exceptions and errors in Spring REST endpoints
- Write Spring based REST clients to consume RESTful services programmatically
- Create secure RESTful endpoints using Spring Security Document and version the Spring REST endpoints Implement CORS in a Spring REST application

Unit I:

Spring 5 Basics : Why Spring, What is Spring Framework, Spring Framework - Modules, Configuring IoC container using Java-based configuration, Introduction To Dependency Injection, Constructor Injection, Setter Injection, What is AutoScanning

Unit II:

Spring Boot: Creating a Spring Boot Application, Spring Boot Application Annotation, What is Autowiring, Scope of a bean, Logger, Introduction to Spring AOP, Implementing AOP advices, Best Practices : Spring Boot Application

Unit III:

Spring Data JPA with Boot: Limitations of JDBC API, Why Spring Data JPA, Spring Data JPA with Spring Boot, Spring Data JPA Configuration, Pagination and Sorting,

Unit IV:

Query Approaches, Named Queries and Query, Why Spring Transaction, Spring Declarative Transaction, Update Operation in Spring Data JPA, Custom Repository Implementation, Best Practices - Spring Data JPA

Unit V:

Web Services: Why Web services, SOA - Service Oriented Architecture, What are Web Services, Types of Web Services, SOAP based Web Services, RESTful Web Services, How to create RESTful Services

Unit VI:

Spring REST: Spring REST - An Introduction, Creating a Spring REST Controller, @RequestBody and ResponseEntity, Parameter Injection, Usage of @PathVariable, @RequestParam and @MatrixVariable, Exception Handling, Data Validation, Creating a

REST Client, Versioning a Spring REST endpoint, Enabling CORS in Spring REST, Securing Spring REST endpoints

Hardware and software configuration

- 4 or 8 GB RAM/126 GB ROM
- Swagger tool suite(opensource)
- OpenJDK 17 or Java 11,Maven 3.2 or above and MySQL 8.0 or above,Spring Tool suite, Postman

Text Books:

1. Spring in action, 5th Edition, Author: Craig Walls, Ryan Breidenbach, Manning books

Web Links [Courses mapped to Infosys Springboard platform]:

Infosys Springboard courses:

1.https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_01296689056211763272_shared/overview [Spring 5 Basics with Spring Boot]

2.https://infyspringboard.onwingspan.com/en/app/toc/lex_4313461831752789500_shared/overview [Spring Data JPA with Boot]

3.https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_012731900963905536190_shared/overview [Spring REST]

AR-20 : B.Tech - CSE (DATA SCIENCE) **IV Year I Semester**

Deep Learning with Tensorflow Lab

L	T	P	C
0	0	3	1.5

Subject Code: 20CDL407

Course Outcomes:

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

- Implement deep neural networks to solve real world problems
- Choose appropriate pre-trained model to solve real time problem
- Interpret the results of two different deep learning models

Software Packages required:

- Keras
- Tensorflow
- PyTorch

List of Experiments:

1. Implement multilayer perceptron algorithm for MNIST Hand written Digit Classification.
2. Design a neural network for classifying movie reviews (Binary Classification) using IMDB dataset.
3. Design a neural Network for classifying news wires (Multi class classification) using Reuters dataset.
4. Design a neural network for predicting house prices using Boston Housing Price dataset.
5. Build a Convolution Neural Network for MNIST Hand written Digit Classification.
6. Build a Convolution Neural Network for simple image (dogs and Cats) Classification
7. Use a pre-trained convolution neural network (VGG16) for image classification.
8. Implement one hot encoding of words or characters.
9. Implement word embeddings for IMDB dataset.
10. Implement a Recurrent Neural Network for IMDB movie review classification problem.

Text Books:

1. Reza Zadeh and Bharath Ramsundar, “Tensorflow for Deep Learning”, O’Reilly publishers, 2018

References:

1. https://github.com/fchollet/deep-learning-with-python-notebooks

AR-20 : B.Tech - CSE (DATA SCIENCE) **IV Year I Semester**

Snowflake Cloud Analytics Lab

L	T	P	C
0	0	3	1.5

Subject Code: 20CDL408

Course Outcomes:

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

- Configure and manage your Snowflake account
- Connect to Snowflake using external tools
- Assign privileges to roles in the account
- Load and unload structured and semi-structured data
- Work with advanced query constructs
- Use cloning and sharing to enhance your development efforts
- Use materialized views, clustering, and search optimization to improve query performance

List of Experiments:

1. How to load data from local file system into snowflake?
2. Implement a procedure for moving data from external stages into snowflake?
3. Develop the procedure for creating file format?
4. Implement a program to load data from S3 (Simple Storage Service) buckets in snowflake table?
5. Implement a program for monitoring data loads?
6. Implement a program for validate errors?
7. Implement a program for stored procedure?
8. Implement a program for a task.
9. Implement a program for clone.
10. Implement a program for Streams.
11. Implement a program for creating Stages/Snowflake DB/Tables?
12. Implement a program for create View and Materialized view?
13. How to load data from CSV/Parquet/ JSON to Snowflake?
14. Implement a procedure for creating cluster?

Text Books:

1. Mastering Snowflake Solution Supporting Analytics and Data Sharing, Apress
2. Jumpstart Snowflake A Step-by-Step Guide to modern cloud analytics, Apress