

# ACADEMIC REGULATIONS, COURSE STRUCTURE

## AND DETAILED SYLLABUS

Effective from the Academic Year 2020-21 onwards

### M. Tech. Two Year Degree Course

(MR20 Regulations)

in

Computer Science and Engineering (CSE)

Department of

Computer Science and Engineering



## MALLA REDDY ENGINEERING COLLEGE (Autonomous)

(An UGC Autonomous Institution, Approved by AICTE and Affiliated to JNTUH Hyderabad,  
Recognized under 2(f) & 12 (B) of UGC Act 1956, Accredited by NAAC with 'A' Grade (II  
Cycle)

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## **MALLA REDDY ENGINEERING COLLEGE (AUTONOMOUS)**

### **MR20 ACADEMIC REGULATIONS (CBCS)** **For M. Tech. (REGULAR) DEGREE PROGRAMME**

Applicable for the students of M. Tech. (Regular) programme admitted from the Academic Year *2020-21* and onwards.

The M. Tech. Degree of Jawaharlal Nehru Technological University Hyderabad shall be conferred on candidates who are admitted to the programme and who fulfill all the requirements for the award of the Degree.

#### **INSTITUTION VISION**

To be a premier center of professional education and research, offering quality programs in a socio-economic and ethical ambience.

#### **INSTITUTION MISSION**

- To impart knowledge of advanced technologies using state-of-the-art infrastructural facilities.
- To inculcate innovation and best practices in education, training and research.
- To meet changing socio-economic needs in an ethical ambience.

#### **DEPARTMENT VISION**

- To attain global standards in Computer Science and Engineering education, training and research to meet the growing needs of the industry with socio-economic and ethical considerations.

#### **DEPARTMENT MISSION**

- To impart quality education and research to undergraduate and postgraduate students in Computer Science and Engineering.
- To encourage innovation and best practices in Computer Science and Engineering utilizing state-of-the-art facilities.
- To develop entrepreneurial spirit and knowledge of emerging technologies based on ethical values and social relevance.

#### **PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)**

**PEO1:** To make the Post Graduates expertise in Computing Profession, solving engineering problems by understanding the core knowledge and research activities.

**PEO2:** To have sufficient breadth and depth of understanding regarding the professional development throughout their career.

**PEO3:** To demonstrate their creativity in all the engineering domains using analysis, strategic design thinking, planning and implementation.

**PEO4:** To make the graduates communicate, recognize and incorporate societal needs in their professional endeavors, and practice about legal and ethical responsibilities.

### **PROGRAMME OUTCOMES(POs)**

**PO1:** An ability to independently carry out research /investigation and development work to solve practical problems

**PO2:** An ability to write and present a substantial technical report/document

**PO3:** Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program

**PO4:** Ability to learn by oneself by being dynamic and engage in life-long learning.

**PO5:** Ability to construct optimal solutions for various problems by creative thinking with awareness of public health safety, culture, society and environmental aspects.

**PO6:** An ability to devise, develop innovative applications to meet the customized needs of industry and society.

**1.0 Post-Graduate Degree Programmes in Engineering & Technology (PGP in E&T) Malla Reddy Engineering College (Autonomous) (MREC-A) offers Two Year (Four Semesters) full-time Master of Technology (M. Tech.) Post Graduate programmes, under Choice Based Credit System (CBCS) in different branches of Engineering and Technology with different specializations.**

**2.0 Eligibility for Admissions:**

**2.1** Admission to the above programme shall be made subject to eligibility, qualification and specialization as prescribed by the Affiliating University from time to time. Admissions shall be made on the basis of merit/rank obtained by the candidates at the qualifying Entrance Test conducted by the Government of Telangana or on the basis of any other order of merit as approved by the University, subject to reservations as laid down by the Govt. from time to time.

**2.2** The medium of instructions for all PG Programmes will be **ENGLISH** only.

**3.0 M.Tech. Programme (PGP in E&T) Structure and Award of Degree:**

**3.1 The M.Tech. Programmes in E & T are of Semester pattern, with Four Semesters consisting of Two academic years, each academic year having Two Semesters (First/ Odd and Second/ Even Semesters). Each Semester shall be of 22 weeks duration (inclusive of Examinations), with a minimum of 90 instructional days per Semester.**

**3.2** A student shall be declared eligible for the award of the M.Tech. Degree, if the student pursues a course of study in not less than two and not more than four academic years. However, the student is permitted to write the examinations for two more years after four academic years of course work, failing which the student shall forfeit the seat in M. Tech. programme.

**3.3** The student shall register for all **68** credits and secure all the **68** credits.

**3.4 UGC/ AICTE** specified definitions/ descriptions are adopted appropriately for various terms and Abbreviations used in these PG academic regulations, as listed below:

**3.4.1 Semester Scheme**

Each Semester shall have 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)'. Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) are taken as 'references' for the present set of Regulations. The terms 'SUBJECT' and 'COURSE' imply the same meaning here and refer to 'Theory Subject', or 'Lab Course', or 'Design/ Drawing Subject', or 'Seminar', or 'Project', or "Technical Paper Writing" as the case may be.

**3.4.2 Credit Courses**

All subjects/courses are to be registered by the student in a semester to earn credits which shall be assigned to each subject/course in an L: T: P: C (Lecture Periods: Tutorial Periods: Practical Periods: Credits) structure based on the following general pattern:

- One credit for one hour/week/semester for theory/lecture (L) / tutorials (T) courses
- One credit for two hours/ week/semester for laboratory/ practical (P) courses

Other student activities like study tour, guest lecture, conference/workshop participations, technical paper presentations, and identified mandatory/audit courses, if any, will not carry credits.

### 3.4.3 Subject / Course Classification

All subjects / courses offered for the Post-Graduate Programme in E & T (M.Tech Degree Programme) are broadly classified as follows. The Institution has followed in general, the guidelines issued by AICTE/UGC.

S.No	Broad Course Classification	Course Group/ Category	Course Description
1	Core Courses (CC)	PC- Professional Core	Includes subjects related to the parent discipline/ department/ branch of Engineering
		Project Work	M.Tech Project / Dissertation
		Seminar	Seminar/ Colloquium based on core contents related to parent discipline/ department/ branch of Engineering
2	Elective Courses (EC)	PE - Professional Electives	Includes elective subjects related to the parent discipline/ department/ branch of Engineering
		OE - Open Electives	Elective subjects which include inter-disciplinary subjects or subjects in an area outside the parent discipline/ department/ branch of Engineering
3	Audit Courses (AC)	Audit Courses	These courses are non-credit courses without evaluation.
<b>Total Number of Credits – 68 credits</b>			

### 3.4.4 Courses of Study:

The following specializations are offered at present for the M. Tech. programme of study.

S.No.	Dept.	Specialization Code	Specialization	Intake
1	CE	11	Structural Engineering (SE)	24
2	EEE	24	Electrical Power Systems (EPS)	24
3	ME	31	Thermal Engineering (TE)	18
4		33	Machine Design (MD)	24
5	CSE	51	Computer Science and Engineering (CSE)	18

Any other programme as approved by the University from time to time.

#### **4 Course Registration:**

- 4.1** A 'Faculty Advisor or Counselor' shall be assigned to each student, who will advise him on the Post Graduate Programme (PGP), its Course Structure and Curriculum, Choice/ Option for Subjects/ Courses, based on his competence, progress, pre-requisites and interest.
- 4.2** The Academic Section of the College invites 'Registration Forms' from students within 15 days from the commencement of class work for the first semester through 'ON-LINE SUBMISSIONS', ensuring 'DATE and TIME Stamping'. The ON-LINE Registration Requests for any 'SUBSEQUENT SEMESTER' shall be completed BEFORE the commencement of SEEs (Semester End Examinations) of the 'CURRENT SEMESTER'.
- 4.3** A Student can apply for ON-LINE Registration, ONLY AFTER obtaining the 'WRITTEN APPROVAL' from the Faculty Advisor, which should be submitted to the College Academic Section through the Head of Department (a copy of it being retained with Head of Department, Faculty Advisor and the Student).
- 4.4** If the Student submits ambiguous choices or multiple options or erroneous entries during ON-LINE Registration for the Subject(s) / Course(s) under a given/ specified Course Group/ Category as listed in the Course Structure, only the first mentioned Subject/ Course in that Category will be taken into consideration.
- 4.5** Subject/ Course Options exercised through ON-LINE Registration are final and CANNOT be changed, nor can they be inter-changed; further, alternate choices will also not be considered. However, if the Subject/ Course that has already been listed for Registration (by the Head of Department) in a Semester could not be offered due to any unforeseen or unexpected reasons, then the Student shall be allowed to have alternate choice - either for a new Subject (subject to offering of such a Subject), or for another existing Subject (subject to availability of seats), which may be considered. Such alternate arrangements will be made by the Head of Department, with due notification and time-framed schedule, within the FIRST WEEK from the commencement of Class-work for that Semester.

#### **5 Attendance Requirements:**

The programmes are offered on a module basis with each subject/course being considered as a module.

- 5.1 Attendance in all classes (Theory/Laboratories/Seminar/Project Work) is compulsory. The minimum required attendance in each theory / Laboratory etc. is 75% including the attendance of mid-term examination / Laboratory and the days of attendance in sports, games, NCC and NSS activities for appearing for the Semester End Examination (SEE). A student shall not be permitted to appear for the Semester End Examinations (SEE) if his attendance is less than 75%.
- 5.2 Condonation of shortage of attendance in each subject up to 10% (65% and above and below 75%) in each semester shall be granted by the College Academic Committee (CAC).
- 5.3 Shortage of Attendance below 65% in each subject shall not be condoned.
- 5.4 Students whose shortage of attendance is not condoned in any subject are not eligible to write their Semester End Examination of that subject and their registration shall stand cancelled.
- 5.5 A stipulated fee prescribed by the CAC, shall be payable towards Condonation for shortage of attendance.
- 5.6 A candidate shall put in a minimum required attendance in at least three (3) theory subjects in I Year I semester for promoting to I Year II Semester. In order to qualify for the award of the M.Tech. Degree, the candidate shall complete all the academic requirements of the subjects, as per the course structure.
- 5.7 A student shall not be promoted to the next semester unless the student satisfies the attendance requirement of the present Semester, as applicable. The student may seek readmission into that semester when offered next. If any candidate fulfills the attendance requirement in the present semester, the student shall not be eligible for readmission into the same class.

## **6 Academic Requirements:**

The following academic requirements have to be satisfied, in addition to the attendance requirements mentioned in item 5.

- 6.1 A candidate shall be deemed to have secured the minimum academic requirement in a subject if he secures a minimum of 40% of marks in the Semester End Examination and a minimum of 50% of the total marks in the Semester End Examination and Continuous Internal Evaluation taken together. In case the candidate does not secure the minimum academic requirement in any subject he has to reappear for the Semester End Examination in that subject. A candidate shall be given one chance to re-register for the subject if the internal marks secured by the candidate are less than 50% and failed in that subject. This is allowed for a maximum of three subjects and should register within two weeks of commencement of that semester class work. In such a case, the candidate must re-register for the subjects and secure the required minimum attendance. The candidate's attendance in the re-registered subject(s) shall be calculated separately to decide upon the eligibility for writing the Semester End Examination in those subjects. In the event of the student taking another chance, the

student's Continuous Internal Evaluation (CIE) marks and Semester End Examination (SEE) marks obtained in the previous attempt stands cancelled.

6.2 If the student secured 'F' grade in any subject he/she can apply for recounting / revaluation by paying prescribed fee. If the student is not satisfied after the results declaration of recounting / revaluation he/she can apply for challenge valuation with the prescribed fee. College appoints a faculty member; student can bring another faculty member who taught the respective subject at least once (proof should be provided). The faculty member should be from any autonomous college affiliated to JNTUH or JNTUH constituent colleges.

## 7 Evaluation - Distribution and Weightage of Marks:

The performance of a student in each semester shall be evaluated subject - wise (irrespective of credits assigned) for 100 marks for Theory, Practicals, Seminar, Drawing / Design, Project, and Minor Courses etc.,. The Theory / Practical courses are evaluated with two components. 1. Continuous Internal Evaluation (CIE), 2. Semester End Examination (SEE). The distribution shall be 30 marks for CIE and 70 marks for SEE decided in the Academic Council.

### 7.1 Theory Courses :

#### 7.1.1 Continuous Internal Evaluation (CIE):

CIE shall be conducted for all courses of PG Programmes twice in a semester (2 Midterm examinations) with the help of objective, subjective evaluation and regular assignments. Each midterm examination consists of objective, subjective paper and one assignment. The objective and subjective test shall be evaluated to 40 % and 50 % for duration of 120 mins and the assignment evaluated for 10 % of the allocated internal marks.

The division of marks for CIE is as given below:

<b>Mid – Term Examination</b>				
<b>Part</b>	<b>Type of Questions</b>	<b>No. of questions</b>	<b>Marks per question</b>	<b>Total</b>
Part A	Multiple-choice questions	10	1	10
	Fill-in the blanks	10	1	10
	<b>Sub-Total</b>			20
Part B	Compulsory questions [With Module-wise internal choice]	5	5	25
<b>Mid-Term Exam Total</b>				45
Assignment				05
<b>Grand Total</b>				50

\*The CIE will be conducted for 50 marks and scaled to 30 marks.



The first mid-term examination shall be conducted for the first 50% of the syllabus, and the second mid-term examination shall be conducted for the remaining 50% of the syllabus. First Assignment should be submitted before the conduct of the first mid-term examinations, and the Second Assignment should be submitted before the conduct of the second midterm examinations. The weightage for the midterm examination shall be given as 70% of the best performing midterm examination and 30% of the other performing midterm examination. The student shall appear for both midterm examinations. In case for any specific reason the student appears only for one midterm examination, only 70% weightage of that examination shall be considered.

### 7.1.2 Semester End Examination (SEE):

Semester End Examination (SEE) shall be conducted for all courses of PG Programmes at the end of the Semester. Duration of the examination is 3 hours. The paper setting and evaluation of all courses carried out by external examiners. The examiners will be selected by the chief controller of examination/ Principal.

Type of Questions	No. of Questions	Marks per Question	Total
Essay Type Answer Questions [For each question there will be an 'either or choice', which means that there will be two questions from each module and the student should answer either of the two questions.]	5	14	70

### 7.2 Practical Courses:

#### 7.2.1 Continuous Internal Evaluation (CIE):

CIE marks shall be awarded with a distribution of 40% for day - to-day performance and timely submission of lab records, 40% for internal lab exam (best out of two exams) and 20% for viva-voce. The CIE will be conducted for 50 marks and scaled to 30 marks.

#### 7.2.2 Semester End Examination (SEE):

SEE marks shall be awarded with a distribution of 20% for design/procedure/schematic diagram of the given experiment, 40% for conduction of experiment, 20% for results and 20% for viva - voce. For conducting SEE (with duration of 3 hours), one internal examiner and one external examiner will be appointed by the Chief Controller of Examinations/Principal of the college. The external examiner should be selected from outside the college among the autonomous / reputed institutions from a panel of three examiners submitted by the concerned Head of the Department.

### 7.3 Seminar:

There shall be a seminar presentation during III semester. For seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the department in a report form and shall make an oral presentation before the Departmental Academic Committee consisting of Department PG Coordinator, Supervisor and two other senior faculty members of the department. For Seminar there will be only internal evaluation. Out of the total allocated marks distribution of marks shall be 30% for the report, 50% for presentation and 20% for the queries. A candidate has to secure a minimum of 50% of marks to be declared successful. If the student fails to fulfill minimum marks, the student has to reappear during the supplementary examinations. There shall be no semester end examinations for the seminar.

### 7.4 Evaluation of Project/ Dissertation Work :

Every candidate shall be required to submit a thesis or dissertation on a topic approved by the Project Review Committee.

**7.4.1** A Project Review Committee (PRC) shall be constituted with Head of the Department as Chairperson/Department PG Coordinator, Project Supervisor and one senior faculty member of the Departments offering the M. Tech. programme.

**7.4.2** Registration of Project Work: A candidate is permitted to register for the project work after satisfying the attendance requirement of all the subjects, both theory and practical.

**7.4.3** After satisfying 7.4.2, a candidate has to submit, in consultation with his Project Supervisor, the title, objective and action plan of his project work to the PRC for approval. Only after obtaining the approval of the PRC the student can initiate the Project work.

**7.4.4** If a candidate wishes to change his supervisor or topic of the project, he can do so with the approval of the PRC. However, the PRC shall examine whether or not the change of topic/supervisor leads to a major change of his initial plans of project proposal. If yes, his date of registration for the project work starts from the date of change of Supervisor or topic as the case may be.

**7.4.5** A candidate shall submit his project status report in two stages at least with a gap of 2 months between them.

**7.4.6** The work on the project shall be initiated at the beginning of the III Semester and the duration of the project is two semesters. A candidate is permitted to submit Project Thesis only after successful completion of all theory and practical courses with the approval of PRC not earlier than 40 weeks from the date of registration of the project work. For the approval of PRC the candidate shall submit the draft copy of thesis to the Head of the Department and make an oral presentation before the PRC.

**Note:** *The project supervisor/guide has to ensure that the student has to publish a minimum of one paper based on his/her thesis in an International Journal of*

*repute preferably in UGC CARE-Group I list.*

- 7.4.7** For the final approval by the PRC, the soft copy of the thesis should be submitted for ANTI-PLAGIARISM check for the quality and the plagiarism report should be included in the final thesis. If the similarity information is less than 24%, then only thesis will be accepted for submission.
- 7.4.8** Three copies of the Project Thesis certified by the supervisor, HOD shall be submitted to the Chief Controller of Examinations /Principal for project evaluation (Viva Voce).
- 7.4.9** For Project/Dissertation phase-I in III Semester is internal evaluation only. The evaluation marks shall be carried out with a distribution of 70% evaluated by the PRC and 30% by Supervisor. The Supervisor and PRC will examine the Problem Definition, Objectives, Scope of Work and Literature Survey in the same domain. A candidate has to secure a minimum of 50% of the allocated marks to be declared successful for Project work Part-I. If the student fails to fulfill minimum marks, the student has to reappear during the supplementary examination.
- 7.4.10** For Project/Dissertation phase-II in IV Semester is an external evaluation. The evaluation shall be carried out by the External examiner appointed by the Chief Controller of Examinations/Principal. For this, the Head of the Department shall submit a panel of 3 examiners, eminent in that field, with the help of the supervisor/guide concerned. The distribution of marks followed by Quality of the work (Plagiarism), Paper publication, nature of the work (Tools & software used and Innovative ideas), presentation and Viva-Voce - each for 20% of allocated marks. The candidate has to secure minimum of 50% marks in Project Evaluation (Viva-Voce) examination.
- 7.4.11** If the student fails to fulfill as specified in 7.4.10, based on the recommendation of the external examiner, the student will reappear for the Viva-Voce examination with the revised thesis only after three months. In the reappeared examination also, fails to fulfill, the student will not be eligible for the award of the degree.
- 7.4.12** The Head of the Department shall coordinate and make necessary arrangements for the conduct of Project Viva-Voce examination.

## **7.5 Non-Credit Courses:**

### **7.5.1 Audit Courses:**

Audit Courses offered in any Semester, a '**Satisfactory Participation Certificate**' shall be issued to the student from the concerned authorities, only after securing  $\geq 65\%$  attendance in such a course. No marks or Letter Grade shall be allotted for these activities.

## **8 Examinations and Assessment - The Grading System:**

- 8.1** Grades will be awarded to indicate the performance of each student in each Theory Subject, or Lab / Practicals, or Seminar, or Project, etc., based on the % marks obtained in CIE + SEE (Continuous Internal Evaluation + Semester End Examination, both taken together) as specified in Item 6 above, and a corresponding Letter Grade shall be given.
- 8.2** As a measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades (UGC Guidelines) and corresponding percentage of marks shall be followed:

<b>% of Marks Secured (Class Intervals)</b>	<b>Grade Points</b>	<b>Letter Grade (UGC Guidelines)</b>
≥ 90%,	10	O (Outstanding)
(≥ 80%, <90%)	9	A+ (Excellent)
(≥ 70%, < 80%)	8	A (Very Good)
(≥ 60%, < 70%)	7	B+ (Good)
(≥ 55%, < 60%)	6	B (Average)
(≥ 50%, < 55%)	5	C (Pass)
(< 50%)	0	F(Fail)
Absent	0	Ab

- 8.3** A student obtaining F Grade in any Subject shall be considered 'failed' and is required to reappear as 'Supplementary Candidate' in the Semester End Examination (SEE), as and when conducted. In such cases, his Internal Marks (CIE Marks) in those Subjects will remain the same as those he obtained earlier.
- 8.4** A student not appeared for examination then 'Ab' Grade will be allocated in any Subject shall be considered 'failed' and will be required to reappear as 'Supplementary Candidate' in the Semester End Examination (SEE), as and when conducted.
- 8.5** A Letter Grade does not imply any specific Marks percentage and it will be the range of marks percentage.
- 8.6** In general, a student shall not be permitted to repeat any Subject/ Course (s) only for the sake of 'Grade Improvement' or 'SGPA/ CGPA Improvement'.
- 8.7** A student earns Grade Point (GP) in each Subject/ Course, on the basis of the Letter Grade obtained by him in that Subject/ Course. The corresponding 'Credit Points' (CP) is computed by multiplying the Grade Point with Credits for that

particular Subject/ Course.

**Credit Points (CP) = Grade Point (GP) x Credits .... For a Course**

**8.8** The Student passes the Subject/ Course only when he gets  $GP \geq 5$  (C Grade or above).

**8.9** The Semester Grade Point Average (SGPA) is calculated by dividing the Sum of Credit Points ( $\sum CP$ ) secured from ALL Subjects/ Courses registered in a Semester, by the Total Number of Credits registered during that Semester. SGPA is rounded off to TWO Decimal Places. SGPA is thus computed as:

$$\text{SGPA} = \frac{\{\sum_{i=1}^N C_i G_i\}}{\{\sum_{i=1}^N C_i\}} \dots \text{For each Semester}$$

where 'i' is the Subject indicator index (takes into account all Subjects in a Semester), 'N' is the no. of Subjects 'REGISTERED' for the Semester (as specifically required and listed under the Course Structure of the parent Department),  $C_i$  is the no. of Credits allotted to the  $i^{\text{th}}$  Subject, and  $G_i$  represents the Grade Points (GP) corresponding to the Letter Grade awarded for that  $i^{\text{th}}$  Subject.

**8.10** The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student over all Semesters considered for registration. The CGPA is the ratio of the Total Credit Points secured by a student in ALL registered Courses in ALL Semesters, and the Total Number of Credits registered in ALL the Semesters. CGPA is rounded off to TWO Decimal Places. CGPA is thus computed from the II Semester onwards, at the end of each Semester, as per the formula:

$$\text{CGPA} = \frac{\{\sum_{j=1}^M C_j G_j\}}{\{\sum_{j=1}^M C_j\}} \dots \text{for all S semesters registered}$$

(i.e., upto and inclusive of S semesters,  $S \geq 2$ )

where 'M' is the TOTAL no. of Subjects (as specifically required and listed under the Course Structure of the parent Department) the Student has 'REGISTERED' from the 1<sup>st</sup> Semester onwards upto and inclusive of the Semester S ( obviously  $M > N$  ), 'j' is the Subject indicator index (takes into account all Subjects from 1 to S Semesters),  $C_j$  is the no. of Credits allotted to the  $j^{\text{th}}$  Subject, and  $G_j$  represents the Grade Points (GP) corresponding to the Letter Grade awarded for that  $j^{\text{th}}$  Subject. After registration and completion of I Semester however, the SGPA of that Semester itself may be taken as the CGPA, as there are no cumulative effects.

### Illustration of calculation of SGPA

Course/Subject	Credits	Letter Grade	Grade Points	Credit Points
Course 1	3	A	8	3X8=24
Course 2	3	O	10	3X10=30
Course 3	3	B	6	3X6=18
Course 4	3	A+	9	3X9=27
Course 5	2	B+	7	2X7=14
Course 6	2	A	8	2X8=16
Course 7	2	B	6	2X6=12
	18			141
<b>SGPA = 141/18 = 7.83</b>				

### Illustration of calculation of CGPA

Semester	Credits	SGPA	Credits X SGPA
Semester I	18	7	18 X 7 = 126
Semester II	18	6	18 X 6 = 108
Semester III	16	6.5	16 X 6.5 = 104
Semester IV	16	7.25	16 X 7.25 = 116
	68		454
<b>CGPA = 454/68 = 6.67</b>			

**8.11** For Calculations listed in Item 8.6 – 8.10, performance in failed Subjects/ Courses (securing 'F' Grade) will also be taken into account, and the Credits of such Subjects/Courses will also be included in the multiplications and summations.

### 9. Award of Degree and Class:

**9.1** A Student who registers for all the specified Subjects/ Courses as listed in the Course Structure, satisfies all the Course Requirements, and passes the examinations prescribed in the entire PG Programme (PGP), and secures the required number of **68** Credits (with CGPA  $\geq$  5.0), shall be declared to have

‘QUALIFIED’ for the award of the M.Tech. degree in the chosen Branch of Engineering and Technology with specialization as he admitted.

**9.2 Award of Class**

After a student has satisfied the requirements prescribed for the completion of the programme and is eligible for the award of M. Tech. Degree, he shall be placed in one of the following three classes based on the CGPA:

<b>Class Awarded</b>	<b>CGPA</b>
First Class with Distinction	$\geq 8.00$
First Class	$\geq 6.50$ and $< 8.00$
Second Class	$\geq 5.00$ and $< 6.50$

**9.3** A student with final CGPA (at the end of the PGP)  $< 5.00$  will not be eligible for the Award of Degree.

**9.4** Students will be eligible for the award of ‘**Gold Medal**’ , if he/she passes all the subjects / courses in first appearance within the first academic years (or four sequential semesters) from the date of commencement of first year first semester and should have secure CGPA  $\geq 8.00$  at the end of four sequential semesters.

**10 Withholding of Results:**

If the student has not paid the dues, if any, to the Institution/University or if any case of indiscipline is pending against him, the result of the student will be withheld and he will not be allowed into the next semester. His degree will be withheld in such cases.

## **11 Transitory Regulations:**

- 11.1** If any candidate is detained due to shortage of attendance in one or more subjects, they are eligible for re-registration to maximum of two earlier or equivalent subjects at a time as and when offered.
- 11.2** The candidate who fails in any subject will be given two chances to pass the same subject;  
otherwise, he has to identify an equivalent subject as per MR18 Academic Regulations.

## **12. Student Transfers:**

- 12.1** There shall be no Branch/Specialization transfers after the completion of Admission Process.
- 12.2** The students seeking transfer to MALLA REDDY ENGINEERING COLLEGE (Autonomous)- MREC(A) from various other Universities/ institutions have to pass the failed subjects which are equivalent to the subjects of MREC(A), and also pass the subjects of MREC(A) which the students have not studied at the earlier institution. Further, though the students have passed some of the subjects at the earlier institutions, if the same subjects are prescribed in different semesters of MREC (A), the students have to study those subjects in MREC (A) in spite of the fact that those subjects are repeated.
- 12.3** The transfer students from other Universities / Institutions to MREC (A) who are on rolls will be provided one chance to write internal examinations in the failed subjects and/or subjects not studied as per the clearance letter issued by the JNTUH.

## **13. General:**

- 13.1 Credit:** A module by which the course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching (lecture or tutorial) or two hours of practical work/field work per week.
- 13.2 Credit Point:** It is the product of grade point and number of credits for a course.
- 13.3** Wherever the words “he”, “him”, “his”, occur in the regulations, they shall include “she”, “her” also.
- 13.4** The academic regulation should be read as a whole for the purpose of any interpretation.
- 13.5** In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the College Academic Committee headed by the Principal is final.



## MALPRACTICES RULES

### DISCIPLINARY ACTION FOR IMPROPER CONDUCT IN EXAMINATIONS

<b>Sl.No.</b>	<b>Nature of Malpractices/ Improper conduct</b>	<b>Punishment</b>
	<b>If the candidate:</b>	
<b>1. (a)</b>	<b>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 candidate which can be used as an aid in the SEE)</b>	<b>Expulsion from the examination hall and cancellation of the performance in that course only.</b>
<b>(b)</b>	<b>Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.</b>	<b>Expulsion from the examination hall and cancellation of the performance in that course only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.</b>
<b>2</b>	<b>Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to that course of the examination (theory or practical) in which the candidate is appearing.</b>	<b>Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the courses of that Semester. The Hall Ticket of the candidate shall be cancelled.</b>
<b>3</b>	<b>Impersonates any other candidate in connection with</b>	<b>The candidate who has impersonated shall be expelled from examination hall.</b>

	the examination.	The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the courses of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining courses of that semester. The candidate is also debarred for two consecutive semesters from class work and all SEE. The continuation of the programme by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester. The candidate is also debarred for two consecutive semesters from class work and all SEE. The continuation of the programme by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that course.
6	Refuses to obey the orders of the Chief Controller of Examinations (CCE) /	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in

	<p><b>Controller of Examinations (CE)/ Assistant Controller of Examinations (ACE) / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either 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 relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the 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</b></p>	<p><b>that course and all other courses the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the courses of that semester. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police cases registered against them.</b></p>
<p><b>7</b></p>	<p><b>Leaves the exam hall taking away answer scriptor intentionally tears of the script or any part thereof inside or outside the examination hall.</b></p>	<p><b>Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred for two consecutive semesters from class work</b></p>

		and all SEE. The continuation of the programme by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester. The candidate 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 clause 6 to 8.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester. 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	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester.
11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that course and all other courses the candidate has appeared including practical examinations and project work of that SEE.

<b>12</b>	<b>If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the CCE for further action toward suitable punishment.</b>	
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**Note: The student(s) found indulging in malpractices during the CIE also will be punished based on the recommendations of the College Academic Committee.**

**Malpractices identified by squad or special invigilators**

1. Punishments to the students as per the above guidelines.

**MALLA REDDY ENGINEERING COLLEGE (Autonomous)  
COMPUTER SCIENCE AND ENGINEERING (CSE)**

**Proposed Course Structure for PG - M.Tech. (Computer Science and Engineering)  
Programme (MR-20 Regulations)**

**I YEAR I SEMESTER**

S. No	Category	Course Code	Name of the Course	Contact Hours/Week			Credits
				L	T	P	
1	PCC	A5101	Advanced Data Structures	3	-	-	3
2	PCC	A5102	Ethical Hacking and Computer Forensic	3	-	-	3
3	PEC-I	A5103	Big Data Analytics	3	-	-	3
		A5104	Data Science				
		A5105	Machine Learning				
4	PEC-II	A5106	Cloud & Mobile Application and Development	3	-	-	3
		A5107	Introduction to Intelligent Systems				
		A5108	Software Architecture and Design Patterns				
5	HSMC	A0H08	Research Methodology and IPR	2	-	-	2
6	PCC	A5109	Advanced Data Structures Lab	-	-	4	2
7	PEC	A5110	Big Data Analytics Lab	-	-	4	2
		A5111	Data Science Lab				
		A5112	Machine Learning Lab				
8	AC	A00A4	English for Research Paper Writing	2	-	-	-
<b>Total</b>				<b>16</b>	<b>-</b>	<b>8</b>	<b>18</b>
				<b>Contact Hours: 24</b>			

**I YEAR II SEMESTER**

S. No	Category	Course Code	Name of the Course	Contact Hours/Week			Credits
				L	T	P	
1	PCC	A5113	Advanced Computer Networks	3	-	-	3
2	PCC	A5114	Web Services	3	-	-	3
3	PCC	A5115	Advanced Databases	2	-	-	2
4	PEC-III	A5116	Advanced Data Mining	3	-	-	3
		A5117	Computer Vision				
		A5118	Soft Computing				
5	PEC-IV	A5119	Software Engineering and Modeling	3	-	-	3
		A5120	Software Quality Assurance and Testing				
		A5121	Storage Area Networks				
6	PCC	A5122	Web Services Lab	-	-	4	2
7	PEC	A5123	Advanced Data Mining Lab	-	-	4	2
		A5124	Computer Vision Lab				
		A5125	Soft Computing Lab				
8	AC	A00A5	Value Education	2	-	-	-
<b>Total</b>				<b>16</b>	<b>-</b>	<b>8</b>	<b>18</b>
				<b>Contact Hours: 24</b>			

## II YEAR I SEMESTER

S. No	Category	Course Code	Name of the course	Contact hours/week			Credits
				L	T	P	
1	PEC-V	A5126	Parallel and Distributed Algorithms	3	-	-	3
		A5127	Wireless Sensor Networks				
		A5128	Information Retrieval Techniques				
2	OEC	A5129	Business Analytics	3	-	-	3
		A0B22	Advanced Optimization Techniques				
		A5130	Blockchain Technology and its Applications				
3	PROJ	A5131	Seminar	-	-	4	2
4	PROJ	A5132	Project / Dissertation Phase - I	-	-	16	8
<b>Total</b>				<b>6</b>	<b>-</b>	<b>20</b>	<b>16</b>
				<b>Contact Hours: 26</b>			

## II YEAR II SEMESTER

S. No	Category	Course Code	Name of the course	Contact hours/week	Credits
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				<b>L</b>	<b>T</b>	<b>P</b>	
1	PROJ	A5133	Project / Dissertation Phase - II	-	-	32	16
<b>Total</b>				<b>-</b>	<b>-</b>	<b>32</b>	<b>16</b>
<b>Contact Hours: 32</b>							

- PCC - Professional Core Course
- PEC - Professional Elective Course
- OEC - Open Elective Course
- PROJ - Project

<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>M.Tech I Sem</b>		
<b>Code: A5101</b>	<b>ADVANCED DATA STRUCTURES</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: 3</b>		<b>3</b>	<b>-</b>	<b>-</b>

**Prerequisites:** Data structures and Object Oriented Programming

**Course Objectives:**

This course provides the students to learn and understand the theoretical and practical solutions for the fundamental design, analysis, and implementation of basic data structures like Stacks, Queues, Heaps, Searching, Sorting, Trees and Graphs, Significance of algorithms in the computer field, various aspects of algorithm development.

**Module I: Introduction to Algorithms and Representations [10 Periods]**

**Algorithms Notations:** Algorithms, Performance analysis- time complexity and space complexity, Asymptotic Notation, Big Oh, Omega and Theta notations, Complexity Analysis Examples.

**Data structures and Representations:** Linear List ADT, Array representation, Linked representation, Vector representation, Singly Linked Lists: Insertion-Deletion-Search operations, Doubly Linked Lists: Insertion-Deletion operations, Circular lists, Representation of 1D and 2D arrays, sparse matrices and their representation.

**Module II: Linear Data Structures [9 Periods]**

**Stack and Queue:** Stack and Queue ADTs, array and linked list representations, infix to Postfix Conversion using Stack, Implementation of recursion, Circular Queue: Insertion-Deletion, Dequeue ADT, Array and Linked List Representations, Priority Queue ADT.

**Heap:** Implementation using Heaps, Insertion into Max Heap, Deletion from Max Heap, java.util package: Array List, Linked List, Vector classes, Stacks and Queues, Iterator.

**Module III: Searching and Sorting [9 Periods]**

**A: Searching**

Linear and binary search methods, Hashing-Hash functions, Collision Resolution methods-Open Addressing, Chaining, Hashing in java.util- HashMap, HashSet, Hash table.

**B: Sorting**

Bubble, Insertion, Quick, Merge, Heap, Radix, Comparison of sorting methods.

**Module IV: Non-Linear Data Structures-I [10 Periods]**

**Trees:** Ordinary and Binary trees terminology, Properties of Binary trees, Binary tree ADT, representations, recursive and non-recursive traversals, Threaded binary trees.

**Graphs:** Graphs terminology, Graph ADT, Representations, Graph Traversals/Search Methods-DFS and BFS, Java code for Graph Traversals, Applications of Graphs- Minimum Cost Spanning Tree using Kruskal's algorithm, Dijkstra's algorithm for Single Source Shortest Path Problem.



**Module V: Non-Linear Data Structures-II****[10 Periods]**

**Search Trees:** Binary search tree, Binary search tree ADT, insertion, deletion and searching operations, Balanced search trees, AVL trees-Definition and examples only, Red Black trees, Definition and examples.

**B-Trees:** Definition, insertion and searching operations, Trees in java.util- Tree Set, Tree Map Classes, Tries (examples only), Comparison of Search trees. Text compression, Huffman coding and decoding, Pattern matching-KMP algorithm.

**TEXT BOOKS**

1. S. Sahni, “**Data structures Algorithms and Applications in Java**”, Universities Press.
2. Clifford A. Shaffer, “**Data structures and Algorithm analysis in Java**”, 3<sup>rd</sup> Edition, Courier Corporation.

**REFERENCE BOOKS**

1. Deitel and Deitel, “**Java for Programmers**”, Pearson Education.
2. R. Lafore, “**Data structures and Algorithms in Java**”, Pearson Education.

**E-RESOURCES**

1. <https://www.cise.ufl.edu/~sahni/cop3530/presentations.htm>
2. <https://books.google.co.in/books?id=KK3DAgAAQBAJ&printsec=frontcover&dq=data+structures+and+algorithm+analysis+in+java>
3. <https://www.cse.msu.edu/~cse802/Papers/sammon.pdf>
4. <http://nptel.ac.in/courses/106102064/1/>

**Course Outcomes:**

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

1. **Understand** the fundamental concepts related to basic data structures.
2. **Design** and Analyze the implementation of linear data structures.
3. **Apply** the concept related to different searching and sorting techniques.
4. **Learn** and implement the concept of nonlinear data structures.
5. **Acquire** knowledge regarding search trees and applications.

<b>CO- PO Mapping</b>						
<b>(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak</b>						
<b>COs</b>	<b>Program Outcomes (POs)</b>					
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
<b>CO1</b>	3		2	3		
<b>CO2</b>	2		3		3	2
<b>CO3</b>	2		3	2		
<b>CO4</b>	2		3	2		
<b>CO5</b>	2		3	2		3

<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>M.Tech I Sem</b>		
<b>Code: A5102</b>	<b>ETHICAL HACKING AND COMPUTER FORENSIC</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: 3</b>		<b>3</b>	<b>-</b>	<b>-</b>

**Prerequisites: Cryptography and Network Security**

**Course Objectives:**

The objective of this course is to make the students to study about fundamental in ethical hacking and learn computer forensics, be familiar with forensics tools and to acquire knowledge in analyzing and validating forensics data.

**UNIT – I: Introduction:**

**[9 Periods]**

Hacking Impacts, The Hacker Framework: Planning the test, Sound Operations, Reconnaissance, Enumeration, Vulnerability Analysis, Exploitation, Final Analysis, Deliverable, Integration Information Security Models: Computer Security, Network Security, Service Security, Application Security, Security Architecture Information Security Program: The Process of Information Security, Component Parts of Information Security Program, Risk Analysis and Ethical Hacking

**UNIT – II: The Business Perspective:**

**[9 Periods]**

Business Objectives, Security Policy, Previous Test Results, Business Challenges Planning for a Controlled Attack: Inherent Limitations, Imposed Limitations, Timing is Everything, Attack Type, Source Point, Required Knowledge, Multi-Phased Attacks, Teaming and Attack Structure, Engagement Planner, The Right Security Consultant, The Tester, Logistics, Intermediates, Law Enforcement. Preparing for a Hacking case study example Technical Preparation, Social Engineering,

**Module III: Introduction To Computer Forensics**

**[11periods]**

**A: Computer Forensics**

Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of CF techniques - Incident and incident response methodology - Forensic duplication and investigation.

**B: Incident Response**

Preparation for IR: Creating response tool kit and IR team. - Forensics Technology and Systems - Understanding Computer Investigation – Data Acquisition.

**Module IV: Evidence Collection And Forensics Tools**

**[10**

**periods]**

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

**Module V: Analysis And Validation**

**[9**

**periods]**

Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics

### TEXT BOOKS:

1. EC-Council, “Ethical Hacking and Countermeasures Attack Phases”, Cengage Learning
2. Michael Simpson, Kent Backman, James Corley, “Hands-On Ethical Hacking and Network Defense”, Cengage Learning
3. Nelson, Phillips, Enfinger, Steuart, “**Computer Forensics and Investigations**”, Cengage Learning, India Edition, 2008.

### REFERENCE BOOKS

1. John R.Vacca, “Computer Forensics”, Cengage Learning, 2005.
2. Richard E.Smith, “Internet Cryptography”, 3 rd Edition Pearson Education, 2008.
3. MarjieT.Britz, “Computer Forensics and Cyber Crime”: An Introduction”, 3<sup>rd</sup>Edition, Prentice Hall, 2013.
4. James S. Tiller, “The Ethical Hack: A Framework for Business Value Penetration Testing”, Auerbach Publications, CRC Press

### E-RESOURCES

1. <https://repo.zenk-security.com/Magazine%20E-book/EN-Ethical%20Hacking.pdf>
2. <http://ebook.eqbal.ac.ir/Security/Forensics/Guide%20to%20Computer%20Forensics%20and%20Investigations.pdf>.
3. <http://cybersd.com/sec2/lect/Chapter%207.pdf>
4. <http://nptel.ac.in/courses/106105031/>
5. <https://nptel.ac.in/courses/106/105/106105217/>

### Course Outcomes

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

1. **Discuss** the hacking framework, computer security and ethical hacking.
2. **Apply** security in view business perspective.
3. **Explain** computer forensics.
4. **Use** forensics tools
5. **Analyze** and validate forensics data

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	Program Outcomes (POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2					2
CO2	2					3
CO3				3	2	2
CO4	3		2	2		
CO5	3		2	3		3

<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>M.Tech II Sem</b>		
<b>Code: A5103</b>	<b>BIG DATA ANALYTICS (Professional Elective – I)</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: 3</b>		<b>3</b>	<b>-</b>	<b>-</b>

**Pre-Requisites:** Data Mining

**Course Objectives:**

**This course provides the students to understand** big data for business intelligence, learn business case studies for big data analytics, understand noSQL big data management and to perform map-reduce analytics using Hadoop and related Tools.

**Module I: Introduction to Big data [10 Periods]**

What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.

**Module II: NoSQL [10 Periods]**

Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations.

**Module III: HDFS [10 Periods]**

**A: Hadoop**

Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts,

**B: I/O**

Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures.

**Module IV: Mapreduce [10 Periods]**

MapReduce workflows, Module tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats

**Module V: Data Models [8 Periods]**

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

manipulation, HiveQL queries.HiveQL queries. Hive database tables, views, functions and Indexes

### TEXT BOOKS

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "**Big Data, Big Analytics: Emerging**"
2. Tom White, "**Hadoop: The Definitive Guide**" 3rd Edition, O'reilly.

### REFERENCE BOOKS

1. Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
3. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
4. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
5. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
6. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
7. Alan Gates, "Programming Pig", O'Reilley, 2011.
8. DT Editorial Services by BIG DATA Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R and Data Visualization

### E-RESOURCES

1. [http://newton.uam.mx/xgeorge/uea/Lab\\_Prog\\_O\\_O/materiales\\_auxiliares/Big\\_Java\\_4th\\_Ed.pdf](http://newton.uam.mx/xgeorge/uea/Lab_Prog_O_O/materiales_auxiliares/Big_Java_4th_Ed.pdf)
2. <http://www.isical.ac.in/~acmsc/WBDA2015/slides/hg/Oreilly.Hadoop.The.Definitive.Guide.3rd.Edition.Jan.2012.pdf>
3. <https://static.googleusercontent.com/media/research.google.com/en//archive/mapreduce-osdi04.pdf>
4. <http://www.comp.nus.edu.sg/~ooibc/mapreduce-survey.pdf>
5. <http://freevidelectures.com/Course/3613/Big-Data-and-Hadoop/18>

### Course Outcomes:

At the end of the course, students will be able to

1. **Develop** simple applications using concepts like stack, queues and classes.
2. **Analyze** file systems such as GFS and HDFS.
3. **Design** applications by applying Map reduce concepts.
4. **Build** up programs by making use of I/O.
5. **Explore** and inspect the big data using programming tools like Pig and Hive.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	Program Outcomes (POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1		1			
CO2	1		1	2	2	1
CO3	1		2	2	2	1
CO4	1	1				1
CO5	1		1		2	2



<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>M.Tech I Sem</b>		
<b>Code: A5104</b>	<b>DATA SCIENCE (Professional Elective – I)</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: 3</b>		<b>3</b>	<b>-</b>	<b>-</b>

**Prerequisites: Probability and Statistics**

**Course Objectives:**

This course will make the students to provide with the knowledge and expertise to become a proficient data scientist, demonstrate an understanding of statistics and machine learning concepts that are vital for data science, understanding R and produce Program code to statistically analyze a dataset and critically evaluate data visualizations based on their design and use for communicating stories from data.

**Module I: Fundamentals of Data science and R programming [9 Periods]**

**A:**Introduction to core concepts and technologies: Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications.

**B:R Programming,** R data types and objects, reading and writing data, sub setting, R Objects, Essentials of the R Language, Installing R, Running R, Packages in R, Calculations,Complex numbers in R, Rounding, Arithmetic, Modulo and integer quotients, Variable names and assignment, Operators, Integers, Factors, Logical operations

**Module II: Maintenance of Data and R Fundamental Concepts [10 Periods]**

**A:Data collection and management:** Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, using multiple data sources.

**B: R Fundamental Concepts:** control structures, vectors, arrays, Lists, components, functions, data frames, factors tables, Classes, Statistical Analysis with R

**Module III:Data analysis [9 Periods]**

**A: Basics of Data Analysis**

Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT.

**B: Algorithms**

Basic machine learning algorithms, Linear regression, SVM, Naive Bayes.

**Module IV: Data visualization [10 Periods]**

Introduction, Types of data visualization, Data for visualization: Data types, Data encodings, Retinal variables, Mapping variables to encodings, Visual encodings.

**Module V:Data Science-Applications [10 Periods]**

Applications of Data Science, Technologies for visualization, Bokeh (Python), Recent trends in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science.

**TEXT BOOKS**

1. Alberto Boschetti, Luca Massaron, “**Python Data Science Essentials**”, Packt

- Publications, 2<sup>nd</sup> Edition, 2016.
2. Davy Cielen, Arno Meysman, Mohamed Ali, “**Introducing Data Science: Big Data, Machine Learning, and more, using Python tools**”, Manning Publications; First Edition, 2016.
  3. R Programming for Data Science by Roger D. Peng
  4. The Art of R Programming by Prashanth Singh, Vivek Mourya, Cengage Learning
  5. India

#### REFERENCE BOOKS

1. Cathy O’Neil and Rachel Schutt. “**Doing Data Science, Straight Talk From The Frontline**”. O’Reilly.
2. Jure Leskovek, AnandRajaraman and Jeffrey Ullman.” **Mining of Massive Datasets**”. v2.1, Cambridge University Press.

#### E-RESOURCES

1. <https://www.analyticsvidhya.com/blog/2016/02/complete-tutorial-learn-data-science-scratch/>
2. <https://www.edureka.co/blog/learn-python-for-data-science/>
3. <https://www.cs.upc.edu/~robert/teaching/estadistica/rprogramming.pdf>

#### Course Outcomes:

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

1. **Understand** the fundamentals of data science and R programming
2. **Explain** how data is collected, managed and stored for data science and R Programming fundamental concepts.
3. **Analyze** the data by applying various techniques.
4. **Explore** data visualization techniques.
5. **Investigate** several applications in data science.

<b>CO- PO Mapping</b> (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
<b>COs</b>	<b>Program Outcomes (POs)</b>					
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
<b>CO1</b>	2					
<b>CO2</b>		2		3		
<b>CO3</b>	2		2			
<b>CO4</b>					2	
<b>CO5</b>	3					2



<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>M.Tech I Sem</b>		
<b>Code: A5105</b>	<b>MACHINE LEARNING (Professional Elective – I)</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: 3</b>		<b>3</b>	<b>-</b>	<b>-</b>

**Prerequisites:** Artificial Intelligence

**Course Objectives:**

This course provides the students to learn the concept of how to learn patterns, fundamentals in python and concepts from data without being explicitly programmed in various IOT nodes, design and analyze various machine learning algorithms and techniques with a modern outlook focusing on recent advances, explore supervised and unsupervised learning paradigms of machine learning and to investigate Deep learning technique and various feature extraction strategies.

**Module I: Supervised Learning and Introduction to Python [10 Periods]**

**A: Introduction to Python** - Python Basics, Objects- Python Objects, Standard Types, Other Built-in Types, data structures, Control of flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling Python packages - JSON, XML, HTTPLib, URLLib, SMTPLib

**B: Basic methods:** Distance-based methods, Nearest-Neighbors, Decision Trees, Naive Bayes  
**Linear models:** Linear Regression, Logistic Regression, Generalized Linear Models  
**Support Vector Machines, Nonlinearity and Kernel Methods. Beyond Binary Classification:** Multi-class/Structured Outputs, Ranking.

**Module II: Unsupervised Learning [9 Periods]**

**Clustering:** K-means/Kernel K-means, Dimensionality Reduction: PCA and kernel PCA, Matrix Factorization and Matrix Completion, Generative Models (mixture models and latent factor models)

**Module III: Machine Learning algorithms [9 Periods]**

**A: Machine Learning Algorithms**

Evaluating Machine Learning algorithms and Model Selection.

**B: Ensemble Methods.**

Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random forests)

**Module IV: Sparse Models [9 Periods]**

Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning.

**Module V: Learning techniques [11 Periods]**

Scalable Machine Learning (Online and Distributed Learning), A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference - Recent trends in various learning techniques of machine learning and classification methods for IOT applications, various models for IOT applications.

## TEXT BOOKS

1. Tom M. Mitchell, “**Machine Learning**”, MGH, 1<sup>st</sup> Edition, 2013.
2. Stephen Marsland, “**Machine Learning: An Algorithmic Perspective**”, Chapman and Hall / CRC, 2<sup>nd</sup> Edition, 2014.
3. Core Python Programming, Wesley J. Chun, Second Edition, Pearson., 2<sup>nd</sup> Edition, 2006

## REFERENCE BOOKS

1. Kevin Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman,” The Elements of Statistical Learning”, Springer 2009 (freely available online)
3. Christopher Bishop, “Pattern Recognition and Machine Learning”, Springer, 2007.
4. Core Python Programming, Wesley J. Chun, Second Edition, Pearson., 3<sup>rd</sup> Edition, 2012

## E-RESOURCES

1. <http://www.zuj.edu.jo/download/machine-learning-tom-mitchell-pdf/>
2. <https://www.learnpython.org/>
3. <http://index-of.es/Python/Core.Python.Programming.2nd.Edition.Wesley.Chun.2006.pdf>
4. <http://index-of.es/Python/Core.Python.Applications.Programming.3rd.Edition.pdf>
5. [https://www.davekuhlman.org/python\\_book\\_01.pdf](https://www.davekuhlman.org/python_book_01.pdf)
6. <http://www.ntu.edu.sg/home/egbhuang/pdf/ieee-is-elm.pdf>
7. [www.fxpal.com/publications/a-genetic-algorithm-for-video-segmentation-and-summarization.pdf](http://www.fxpal.com/publications/a-genetic-algorithm-for-video-segmentation-and-summarization.pdf)
8. <http://nptel.ac.in/courses/106106139/>
9. <http://nptel.ac.in/courses/106105152/>

## Course Outcomes:

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

1. **Identify** the way of extracting features that can be used for a particular machine learning approach in various IOT and Fundamentals in python
2. **Explore** unsupervised learning techniques
3. **Compare** and contrast pros and cons of various machine learning techniques and to get an insight of when to apply a particular machine learning approach.
4. **Analyze** various machine learning approaches and paradigm mathematically.
5. **Investigate** various learning approaches.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	Program Outcomes (POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2			2	
CO2	3		2			
CO3	2		2			
CO4	2			2		1
CO5	2					

<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>M.Tech I Sem</b>		
<b>Code: A5106</b>	<b>CLOUD &amp; MOBILE APPLICATION AND DEVELOPMENT (Professional Elective-II)</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: 3</b>		<b>3</b>	<b>-</b>	<b>-</b>

**Prerequisites: Cloud Computing**

**Course Objectives:**

This course enables the students to learn the basic fundamentals in mobile cloud, architecture, classification and associated cooperation approaches, study the utilization of resources in mobile clouds, study about the maintenance, simulate and develop mobile cloud applications.

**Module I: Fundamentals of Mobile cloud [10 Periods]**

Mobile Connectivity Evolution: From Single to Multiple Air Interface Devices, Network Evolution: The Need for Advanced Architectures.

**Module II: Approaches [9 Periods]**

Mobile Clouds: An Introduction, Cooperation and Cognition in Mobile Clouds, Mobile Cloud Classification and Associated Cooperation Approaches.

**Module III: Utilization of resources [9 Periods]**

**A: Resource sharing**

Sharing Device Resources in Mobile Clouds.

**B: Enabling technologies**

Wireless Communication Technologies, Building Mobile Clouds.

**Module IV: Maintenance of Mobile Cloud [10 Periods]**

Mobile Cloud Formation and Maintenance, Cooperative Principles by Nature, Social Mobile Clouds, Green Mobile Clouds: Making Mobile Devices More Energy Efficient.

**Module V: Mobile apps [10 Periods]**

Mobile Clouds Applications, Future Developments of Mobile Clouds.

Android OS design and Features – Android development framework, Android Application Lifecycle – Activities, Activity lifecycle, activity states, monitoring state changes

**TEXT BOOKS**

1. Frank H. P. Fitzek, Marcos D. Katz, “**Mobile Clouds: Exploiting Distributed Resources in Wireless, Mobile and Social Networks**”, Wiley Publications, ISBN: 978-0-470- 97389-9, Jan 2014.
2. Dijiang Huang Huijun Wu, “**Mobile Cloud Computing: Foundations and Service Models**”, Morgan Kaufmann, First Edition, 2018.
3. Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox) , 2012
4. Android Application Development for Java Programmers, James C Sheusi, Cengage Learning, 2013

## REFERENCE BOOKS

1. Paul J. Deitel, Harvey M. Deitel, Abbey Deitel, and Michael Morgano, **Android for Programmers: An App-Driven Approach**, Prentice Hall, November 3, 2011.
2. Richard Rodger, “**Beginning Mobile Application Development in the Cloud**”, Wiley, 2011.

## E-RESOURCES

1. <https://leseprobe.buch.de/images-adb/8d/01/8d01a05a-1854-4e56-ae54-ce8fcd5c6237.pdf>
2. <https://onlinelibrary.wiley.com/doi/book/10.1002/9781118801338>
3. <http://nptel.ac.in/courses/106105167/31>

## Course Outcomes:

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

1. **Understand** the fundamentals of Mobile cloud.
2. **Analyze** classification and associated cooperation approaches.
3. **Investigate** several technologies and implement the way of sharing resources.
4. **Explore** the formation of mobile cloud and know about its maintenance.
5. **Develop** Mobile applications.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	Program Outcomes (POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2					3
CO2	2					2
CO3			3	2		
CO4				2	2	
CO5	2				2	3

<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>M.Tech I Sem</b>		
<b>Code: A5107</b>	<b>INTRODUCTION TO INTELLIGENT SYSTEMS (Professional Elective - II)</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: 3</b>		<b>3</b>	<b>-</b>	<b>-</b>

**Prerequisites: Artificial Intelligence, Data Structures**

**Course Objectives:**

The aim of the course is to introduce to the field of Artificial Intelligence (AI) with emphasis on its use to solve real world problems for which solutions are difficult to express using the traditional algorithmic approach. It explores the essential theory behind methodologies for developing systems that demonstrate intelligent behaviour including dealing with uncertainty, learning from experience and following problem solving strategies found in nature.

**Module I: Fundamentals of Intelligent systems-I [9 Periods]**

Biological foundations to intelligent systems I: Artificial neural networks, Backpropagation networks, Radial basis function networks, and recurrent networks.

**Module II: Foundations to Intelligent systems-II 10 Periods]**

Biological foundations to intelligent systems II: Fuzzy logic, knowledge Representation and inference mechanism, genetic algorithm, and fuzzy neural networks.

**Module III: Search Techniques [9 Periods]**

**A: Search Techniques-I**

Search Methods Basic concepts of graph and tree search. Three simple search methods: breadth-first search, depth-first search, iterative deepening search.

**B: Search Techniques-II**

Heuristic search methods: best-first search, admissible evaluation functions, hill climbing search, Optimization and search such as stochastic annealing and genetic algorithm.

**Module IV: Knowledge Representation [10 Periods]**

Knowledge representation and logical inference Issues in knowledge representation. Structured representation, such as frames, and scripts, semantic networks and conceptual graphs. Formal logic and logical inference. Knowledge-based systems structures, its basic components. Ideas of Blackboard architectures.

**Module V: Learning and evolutionary algorithms [10 Periods]**

Reasoning under uncertainty and Learning Techniques on uncertainty reasoning such as Bayesian reasoning, Certainty factors and Dempster-Shafer Theory of Evidential reasoning, A study of different learning and evolutionary algorithms, such as statistical learning and induction learning. Recent trends in Fuzzy logic, Knowledge Representation.

**TEXT BOOKS**

1. James M. Keller, Derong Liu, David B. Fogel, “**Fundamentals of Computational Intelligence: Neural Networks, Fuzzy Systems, and Evolutionary Computation**”, John Wiley & Sons, 13-Jul-2016.
2. Elaine Rich, “**Artificial Intelligence**”, Tata McGraw-Hill Education, 2004.

## REFERENCE BOOKS

1. Luger G.F. and Stubblefield W.A. (2008),” **Artificial Intelligence: Structures and strategies for Complex Problem Solving**”. Addison Wesley, 6th edition.
2. Russell S. and Norvig P. (2009). “**Artificial Intelligence: A Modern Approach**”. Prentice-Hall, 3<sup>rd</sup> edition.

## E-RESOURCES

1. <https://books.google.co.in/books?id=c1fzgQj5lhkC&printsec=frontcover&dq=intelligent+systems&hl=en&sa=X&ved=0ahUKEwlrLv0LncAhUKaI8KHVO2Cd8Q6AEIKDAA#v=onepage&q=intelligent%20systems&f=false>
2. <http://www.nptelvideos.in/2012/11/intelligent-systems-and-control.html>
3. <https://freevideolectures.com/course/2348/intelligent-systems-and-control>

## Course Outcomes:

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

1. **Demonstrate** knowledge of the fundamental principles of intelligent systems.
2. **Understand** the algorithms and its applications
3. **Analyze** and compare the relative merits of a variety of AI problem solving techniques. and indexes.
4. **Explore** various knowledge representation techniques.
5. **Learn and apply** the evolutionary and learning algorithms.

<b>CO- PO Mapping</b> (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	Program Outcomes (POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1			3			2
CO2		2				
CO3	2		2	2	2	
CO4	3		2			
CO5	2		2			2

<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>M.Tech I Sem</b>		
<b>Code: A5108</b>	<b>SOFTWARE ARCHITECTURE AND DESIGN PATTERNS (Professional Elective-II)</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: 3</b>		<b>3</b>	<b>-</b>	<b>-</b>

**Prerequisites:** Software Engineering

**Course Objectives:**

This course makes the students to learn the different types of Software Architectures and analyze various architectures such as Comprehensive and Quantitative approaches to implement the different types of Design patterns such as Creational, Structural and Behavioral patterns.

**Module I: Introduction to Software Architecture [10 Periods]**

**Envisioning Architecture:** Architecture Business Cycle, Software Architecture, Architectural patterns, reference models, reference architectures, architectural structures and views.

**Creating Architecture:** Quality Attributes, Achieving qualities, Architectural styles and patterns, Designing Architecture, Documenting Software Architectures, Reconstructing Software Architecture.

**Module II: Analyzing Architectures [9 Periods]**

**Comprehensive Approach:** Architecture Evaluation, Architecture design decision making ATAM.

**Quantitative Approach:** Decision Making Context, Basics of CBAM, Implementing CBAM, Case Study.

**Module III: Moving from one to many system [9 Periods]**

**A: Software Product Lines**

Overview, Software Product Lines, Scoping, Building Systems from Off-the-Shelf Components.

**B: Architecture**

What Makes Software Product Lines Difficult? Software Architecture in Future.

**Module IV: Design Pattern Catalog-1 [10 Periods]**

**Patterns:** Pattern Description, Organizing catalogs, role in solving design problems, selection and usage.

**Creational and Structural Patterns:** Abstract factory builder, factory method, prototype, singleton, adapter, bridge, composite, façade, flyweight, Proxy.

**Module V: Design Pattern Catalog-2 [10 Periods]**

**Behavioral Patterns:** Chain of responsibility, command, Interpreter, iterator, mediator, memento, observer, state, strategy, template method, visitor. Case Studies: A-7E–A case study in utilizing architectural structures.

**World Wide Web:** A Case study in interoperability, Air Traffic Control-Case Study in designing for high availability, Celsius Tech – Case Study in product line development.

## TEXT BOOKS

1. Len Bass, Paul Clements & Rick Kazman, “**Software Architecture in Practice**”, Third Edition, Pearson Education, 2013.
2. Erich Gamma, “**Design Patterns**”, Pearson Education, 1995.

## REFERENCE BOOKS

1. Luke Hohmann, “**Beyond Software Architecture**”, Addison Wesley, 2003.
2. ParthaKuchana, “**Software Architecture Design Patterns in Java**”, Auerbach Publications; 1<sup>st</sup>Edition, 2004.

## E-RESOURCES

1. <http://disi.unal.edu.co/dacursci/sistemasycomputacion/docs/SWEBOK/Addison%20Wesley%20-%20Software%20Architecture%20In%20Practice%202nd%20Edition.pdf>
2. <https://goo.gl/XHf4Skr>
3. <http://handbookofsoftwarearchitecture.com>
4. <http://technav.ieee.org/tag/1570/software-architecture>
5. <http://www.springer.com/in/book/9783319658308#otherversion=9783319658315>
6. <http://ndl.iitkgp.ac.in/document/xttk-4kfhvUwVIXBW-YWRHK2WM4hGzyP-7P1EGjmLQteaTTfT9e5x3lNfo1dkNFKA2TH8BFRA34WT93f7vOClg>
7. [http://ndl.iitkgp.ac.in/document/xttk-4kfhvUwVIXBW-YWRHHjhOkwn-Nw1F1n-B5L9QQwwLxs5C\\_RQWWA-I82gWvUowtpyPjqm26fq2PVA1VaOg](http://ndl.iitkgp.ac.in/document/xttk-4kfhvUwVIXBW-YWRHHjhOkwn-Nw1F1n-B5L9QQwwLxs5C_RQWWA-I82gWvUowtpyPjqm26fq2PVA1VaOg)

## Course Outcomes:

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

1. **Analyze** the Computer architecture and different processor architectures
2. **Explore** and analyze the architectures
3. **Illustrate** organization and operation of current generation parallel computer systems, including multiprocessor and multi-core systems
4. **Understand** patterns descriptions and solving problems and use of creational and structural patterns.
5. **Apply** design patterns, behavioral patterns and World Wide Web to case studies.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	Program Outcomes (POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3					
CO2	2					
CO3			2			
CO4	2		3			
CO5	2			3		3



<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>M.Tech. I Semester</b>		
<b>Code: A0H08</b>	<b>RESEARCH METHODOLOGY AND IPR</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: 2</b>		<b>2</b>	<b>-</b>	<b>-</b>

**PREREQUISITES: Nil**

**Course Objectives:** The objective of the course is to make students familiar with the basics of research methodology and various types of Intellectual Properties, IPR legislations and policies.

**Module I: Research Problem**

**[6 Periods]**

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

**Module II: Technical Writing and Research Proposal**

**[7 Periods]**

Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

**Module III: Intellectual Property Rights**

**[6 Periods]**

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

**Module IV: Patent Rights**

**[6 Periods]**

Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

**Module V: Case Studies**

**[7 Periods]**

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

**REFERENCE BOOKS**

1. Prabhuddha Ganguli: ‘Intellectual Property Rights’ Tata Mc-Graw –Hill, New Delhi
2. M.Ashok Kumar and Mohd.Iqbal Ali: “Intellectual Property Right” Serials Pub.
3. Carlos M.Correa- “Intellectual property rights , The WTO and Developing countries”-Zed books
4. Law relating to patents, trademarks, copyright designs, Wadehra, B.L. & 2 ed. Universal Law Publishing 2000.
5. C.R.Kothari, “Research Methodology” New Age International Publishers, Fourth edition, 2018.

6. Donald Cooper & Pamela Schindler, "Business Research Methods", TMGH, 9th edition.
7. Alan Bryman & Emma Bell, "Business Research Methods", Oxford University Press.

**E-RESOURCES:**

1. [https://www.wto.org/english/tratop\\_e/trips\\_e/trips\\_e.htm](https://www.wto.org/english/tratop_e/trips_e/trips_e.htm)
2. [https://www.wto.org/english/thewto\\_e/whatis\\_e/tif\\_e/agrm7\\_e.htm](https://www.wto.org/english/thewto_e/whatis_e/tif_e/agrm7_e.htm)
3. <http://nptel.ac.in/courses/110999906/>
4. <http://nptel.ac.in/courses/109105112/>

**Course Outcomes:**

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

1. Comprehend the concepts of research methodology and its concepts.
2. Realize the concepts of literature review and developing a research proposal.
3. Understand the basic concepts of Intellectual property rights.
4. Understand the types of patents and their procedures.
5. Recognize the recent developments in IPR administration.

<b>CO- PO Mapping</b> (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
<b>COs</b>	<b>Program Outcomes (POs)</b>					
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
<b>CO1</b>	3	3			3	3
<b>CO2</b>	3	3			3	3
<b>CO3</b>	3	3			3	3
<b>CO4</b>	3	3			3	3
<b>CO5</b>	3	3			3	3

<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>M.Tech I Sem</b>		
<b>Code: A5109</b>	<b>ADVANCED DATA STRUCTURES LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: 2</b>		<b>-</b>	<b>-</b>	<b>4</b>

**Prerequisites:** Computer Programming  
**Software Requirement: JDK**

**Course Objectives:**

This objective of the course is to provide the students to implement the applications using Linear Data Structures, Non-linear Data Structures, Searching and Sorting techniques, and deploy the shortest path algorithms.

**List of experiments:**

- Write Java programs to implement the following (using arrays and linked lists):  
a) List ADT, b) Stack ADT, c) Queue ADT
- Write a Java program to read an infix expression and convert into postfix using stacks ADT.
- Write a Java program to implement circular queue ADT using an array
- Write a Java program using stack and queue to test the given string is a palindrome or not.
- Write Java programs to implement the following using a singly linked list.  
a) Stack ADT, b) Queue ADT, c) priority queue ADT
- Write Java programs to implement the deque (double ended queue) ADT using  
a) Array, b) Singly linked list, c) Doubly linked list.
- Write a Java program to perform the following operations in binary search tree: a) Creation, b) Insert a key, c) Search for a key, c) Delete an element.
- Write a Java program to implement all the functions of a dictionary (ADT) using Hashing.
- Write a Java program to implement the following:  
a) Dijkstra’s algorithm for Single source shortest path problem.  
b) Kruskal’s algorithm to generate minimum cost spanning tree.  
c) KMP algorithm for Pattern matching.
- Write Java programs for the implementation of BFS and DFS for a given graph.
- Write Java programs for implementing the following sorting methods:  
a) Bubble, b) Insertion, c) Quick, d) Merge, e) Heap, f) Radix, g) Binary Tree
- Write a Java program to perform the following operations in B-tree: a) Insertion b) Searching.

**REFERENCE BOOKS**

- S.Sahni, “**Data Structures Algorithms and Applications in Java**”, Universities Press.
- Clifford Shaffer, “**Data structures and Algorithm analysis in Java**”, 3<sup>rd</sup> Edition, Courier Corporation.

**Course Outcomes:**

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

- Design** and analyze the implementation of linear data structures and applications.

2. **Apply** the concepts related to different searching techniques.
3. **Implement** the sorting techniques.
4. **Learn** and implement the concept of nonlinear data structures and applications.
5. **Study** and deploy the shortest path algorithms.

<b>CO- PO Mapping</b>						
<b>(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak</b>						
<b>Cos</b>	<b>Program Outcomes (POs)</b>					
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
<b>CO1</b>	2		2			
<b>CO2</b>	2	3	2			
<b>CO3</b>	2		2	3		
<b>CO4</b>					2	3
<b>CO5</b>			2	3		1

<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>M.Tech II Sem</b>		
<b>Code: A5110</b>	<b>BIG DATA ANALYTICS LAB ( Professional Elective –I lab)</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: 2</b>		<b>-</b>	<b>-</b>	<b>4</b>

**Prerequisites:** Computer programming, Linux

**Software Requirements:** Hadoop, Linux, VMware

**Course Objectives:**

This objective of the course is to provide the students to study and understand the execute the experiments related to Big data using Hadoop.

**List of Programs:**

1. Installation of Hadoop
2. File Management tasks in Hadoop
3. Word Count Map Reduce program to understand Map Reduce Paradigm
4. Weather Report POC-Map Reduce Program to analyze time-temperature statistics and generate report with max/min temperature.
5. Implementing Matrix Multiplication with Hadoop Map Reduce
6. Pig Latin scripts to sort,group, join,project, and filter your data.
7. Hive Databases,Tables,Views,Functions and Indexes

**BOOKS**

1. Dr. M.S.Vijaya Dr. N.Radha V. Pream Sudha on Big Data Analytics Lab Manual: Step by Step Guide to Hadoop, Pig, Hive and MongoDB
2. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.
3. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 2012.

**REFERENCE BOOKS:**

1. Bill Franks, Taming the Big Data Tidal wave: Finding Opportunities in Huge Data Streams with advanced analytics, John Wiley & sons, 2012.
2. Glenn J. Myatt, Making Sense of Data, John Wiley & sons, 2007 Pete Warden, Big Data Glossary, O'Reilly, 2011

**Course Outcomes:**

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

1. **Understand** the big data in Hadoop
2. **Explore** and analyze Files, Mapreduce programs.
2. **Implement** applications using Hadoop programs, POC Map Reduce, Matrix Multiplication
3. **Apply** the Pig Latin scripts using hadoop.
4. **Implement and explore** Hive Databases, tables, views, functions and indexes.

<b>CO- PO Mapping</b>						
<b>(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak</b>						
<b>COs</b>	<b>Program Outcomes (POs)</b>					
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
<b>CO1</b>	3	1		2	2	2
<b>CO2</b>	1					1
<b>CO3</b>	1			2	2	2
<b>CO4</b>				1		1
<b>CO5</b>	1	2		1		1

<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>M.Tech I Sem</b>		
<b>Code: A5111</b>	<b>DATA SCIENCE LAB (Professional Elective-I Lab)</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: 2</b>		<b>-</b>	<b>-</b>	<b>4</b>

**Prerequisites:** Computer Programming  
**Software Requirement: R**

**Course Objectives:**

To make students understand learn about a Data science – R Programming, way of solving problems and to teach students to write programs and solve problems.

**List of experiments:**

What is R and RStudio? R is a statistical software program. It has extremely useful tools for data exploration, data analysis, and data visualization. It is flexible and also allows for advanced programming. RStudio is a user interface for R, which provides a nice environment for working with R.

**Introduction to R Programming:**

1. Write an R program to evaluate the following expression  $ax+b/ax-b$ .
2. Write an R program to read input from keyboard (hint: readLine()).
3. Write an R program to find the sum of n natural numbers:  $1+2+3+4+\dots+n$
4. Write an R program to read n numbers.
  - (i) Sum of all even numbers (ii) Total number of even numbers.
5. Write an R program to read n numbers.
  - (i) Total number of odd numbers (ii) Sum of all odd numbers
6. Write an R program to obtain
  - (i) sum of two matrices A and B (ii) subtraction of two matrices A and B
  - (iii) Product of two matrices.
7. Write an R program for “declaring and defining functions “
8. Write an R program that uses functions to add n numbers reading from keyboard
9. Write an R program uses functions to swap two integers.
10. Write an R program that use both recursive and non-recursive functions for implementing theFactorial of a given number, n.
11. Write an R program to reverse the digits of the given number {example 1234 to be written as 4321 }
12. Write an R program to implement
  - (i)Linear search (ii) Binary Search.
13. Write an R program to implement
  - (i)Bubble sort (ii) selection sort.
14. Write a R program to implement the data structures
  - (i) Vectors (ii) Array (iii) Matrix (iv) Data Frame (v) Factors
15. Write a R program to implement scan(), merge(), read.csv() and read.table() commands.
16. Write an R program to implement “Executing Scripts” written on the note pad, bycalling to the R console.
17. Write a R program, Reading data from files and working with datasets
  - (i)Reading data from csv files, inspection of data.

- (ii) Reading data from Excel files.
18. Write a R program to implement Graphs
- (i) Basic high-level plots
  - (ii) Modifications of scatter plots
  - (iii) Modifications of histograms, parallel box plots.

**REFERENCE BOOKS**

1. Big data – Black Book: 2015 edition: dreamtech press. Pg. (490- 642)
2. Introducing to programming and problem solving by scala, mark c. lewis, lisa lacher. CRC press, second edition.

**Suggested Links:**

1. <https://www.tutorialspoint.com/scala/>
2. <https://www.tutorialspoint.com/r/>

**Course Outcomes:**

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

1. **Design** and analyze the implementation of R programs.
2. **Apply** the data science and R concepts related to different problems using R studio.
3. **Implement** the searching techniques.
4. **Learn** and implement the concept of sorting, data structures, commands and applications.
5. **Study** and deploy the data sets and graphs

<b>CO- PO Mapping</b>						
<b>(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak</b>						
<b>Cos</b>	<b>Program Outcomes (POs)</b>					
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
<b>CO1</b>	3		2			
<b>CO2</b>	2	3	2			
<b>CO3</b>	2	2	2	3		
<b>CO4</b>					3	1
<b>CO5</b>			2	3	1	

<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>M.Tech I Sem</b>		
<b>Code: A5112</b>	<b>MACHINE LEARNING LAB (Professional Elective-I Lab)</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: 2</b>		<b>-</b>	<b>-</b>	<b>4</b>

**Prerequisites:** Computer Programming, Python

**Software Requirement:** Python

### **Course Objectives:**

This objective of the course is to provide the students to implement the various supervised and unsupervised learning techniques along with the clustering and classification methods.

### **List of experiments:**

1. Implement simple linear regression.
2. Implement the multivariate linear regression.
3. Implement simple logistic regression and multivariate logistics regression.
4. Implement decision trees.
5. Implement a classification algorithm.
6. Implement random forests algorithm
7. Implement K-means with example
8. Implement KNN algorithms with example.
9. Implement SVM on any applicable datasets.
10. Implement neural networks
11. Implement PCA.
12. Implement anomaly detection and recommendation.

### **REFERENCE BOOKS**

1. Willi Richert, Luis Pedro Coelho, "Building Machine Learning with Python", Packt Publishing, 2013.

### **Course Outcomes:**

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

1. **Study** of various statistical methods.
2. **Deploy** classification techniques for a real time data set.
3. **Implement** clustering algorithms for any data set.
4. **Explore** the dimensionality reduction procedures.
5. **Examine** the anomaly detection methods.

<b>CO- PO Mapping</b> (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
<b>Cos</b>	<b>Program Outcomes (POs)</b>					
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
<b>CO1</b>	2		3			
<b>CO2</b>	2		3			
<b>CO3</b>	1	1	1		2	2
<b>CO4</b>		1	1			1
<b>CO5</b>	1		1		2	



<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>M.Tech I Sem</b>		
<b>Code: A0A04</b>	<b>ENGLISH FOR RESEARCH PAPER WRITING</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: Nil</b>		<b>2</b>	<b>-</b>	<b>-</b>

**Prerequisites:** Nil

**Course Objectives:** The objective of the course is to provide the knowledge on structuring paragraphs, paraphrasing and preparation of research documents related to abstract, literature review, methods and results.

**Module I [6 Periods]**

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

**Module II [7 Periods]**

Clarifying Who Did What, Highlighting Your Findings, Hedging and criticising, paraphrasing and plagiarism, sections of a paper, abstracts. Introduction.

**Module III [6 Periods]**

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

**Module IV [6 Periods]**

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

**Module V [7 Periods]**

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions. Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

**REFERENCE BOOKS**

1. Goldbort R (2006) Writing for Science, Yale University Press.
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press.
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.

**Course Outcomes:**

**At the end of the course, students will be able to**

1. **Structure** the sentences and paragraphs.
2. **Elaborate** the various sections of research papers.
3. **Explore** the check list in research documents.
4. **Apply** the key skills to coin the title, abstract, introduction and literature review.

5. **Inspect** the skills required for preparing experimental results and discussions.

<b>CO- PO Mapping</b> (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
<b>COs</b>	<b>Program Outcomes (POs)</b>					
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
<b>CO1</b>		2			1	
<b>CO2</b>		2		1		
<b>CO3</b>		2				2
<b>CO4</b>		2			1	
<b>CO5</b>		2			1	

<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>M.Tech II Sem</b>		
<b>Code: A5113</b>	<b>ADVANCED COMPUTER NETWORKS</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: 3</b>		<b>3</b>	<b>-</b>	<b>-</b>

**Prerequisites:** Operating Systems

**Course Objectives:**

This course makes the students to learn and understand the concepts of Linux and C programming, to study the Shell programming, file concepts and directory management in network programming for inter process communication using pipes, FIFOs, signals, semaphores, message queues and explain socket programming to design the client/server environment, to examine network Programming for performing TCP, and UDP connections.

**Module I: Introduction to Linux and Shell Programming [9 Periods]**

**Introduction to Linux:** Linux Utilities, File handling utilities, Security by file permissions, Process utilities, Disk utilities, Networking utilities, Filters, Text processing utilities, Backup utilities. Bourne again shell (bash).

**Shell Programming:** Introduction, Pipes and Redirection, Running a Shell Script, Shell as a Programming Language, Shell meta characters, File name substitution, Shell variables, Command substitution, Shell commands, Environment, Quoting, Test command, Control & Arithmetic structures, Shell script examples. Review of C Concepts: Arrays, Strings, Pointers, Function pointers, Structures, Unions.

**Module II: Files and Directory Management [9 Periods]**

**Files:** Files- File Concept, File types File System Structure, Inodes, File Attributes, file I/O in C using system calls, kernel support for files, file status information-stat family, file and record locking-lockf and fcntl functions, file permissions- chmod, fchmod, file ownership-chown, lchown, fchown, links-soft links and hard links – symlink, link, unlink.

**Directory Management:** File and Directory management, Directory contents, Scanning Directories, Directory file APIs. Process concept, Kernel support for process, Process Attributes, Control and Creation, Replacing a process image, Waiting for process, Process termination, Zombie process, Orphan process.

**Module III: Signals and IPC [10 Periods]**

**A: Signals**

Introduction to Signals, Signal generation and handling, Kernel support for signals, Signal function, unreliable signals, reliable signals, kill, raise, alarm, pause, abort, sleep functions.

**B: Interprocess Communication (IPC)**

Introduction, Pipes creation, IPC between related processes using unnamed pipes, FIFOs-creation, IPC between unrelated processes using FIFOs (Named pipes), differences between unnamed and named pipes, popen and pclose library functions, Message queues, semaphores and shared memory. Message Queues, Kernel support, UNIX system V APIs

for messages, client/server example. Semaphores-Kernel support for semaphores, UNIX system V APIs for semaphores.

**Module IV: Shared Memory and Sockets**

**[10 Periods]**

**Shared Memory:** Shared Memory, Kernel support, UNIX system V APIs for Shared memory, Client/Server example.

**Sockets:** Network IPC, Introduction to Unix Sockets, IPC over a network, Client-Server model, Address formats, Socket system calls for Connection Oriented, Communication, Socket system calls for Connectionless, Communication, Example, Client/Server Programs, Single Server-Client connection, Multiple simultaneous clients, Socket options, Set sock opt, get sock opt,fcntl.

**Module V: Network Programming and Remote Method Invocation [10 Periods]**

**Network Programming:** Network Programming in Java, Network basics, TCP sockets, UDP sockets (datagram sockets), Server programs to handle one and multiple connections (using multithreaded server).

**RMI:** Basic RMI Process, Implementation details-Client-Server Application.

**TEXT BOOKS**

1. T. Chan, “**Unix System Programming using C++**”, PHI.
2. Sumitabha Das, “**Unix Concepts and Applications**”, TMH, 4<sup>th</sup> Edition.

**REFERENCE BOOKS**

1. W.R.Stevens, “**Advanced Programming in the UNIX environment**”, Pearson Education, 2<sup>nd</sup> Edition.
2. W. R. Stevens, Bill Fenner, A. M. Rudoff, “**Unix Network Programming The Sockets Networking API**”, Pearson Education, Vol.-I.

**E-RESOURCES**

1. [https://openlibrary.org/books/OL24607430M/UNIX\\_system\\_programming\\_using\\_C](https://openlibrary.org/books/OL24607430M/UNIX_system_programming_using_C)  
<https://zimslifeintcs.files.wordpress.com/2011/12/sumitabhadhas.pdf>
2. <http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=414638>
3. <http://www.springer.com/in/book/9781447152538>
4. <http://nptel.ac.in/courses/117106113/>
5. <https://comptechdoc.org/>

**Course Outcomes:**

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

1. **Learn** the basic set of commands and utilities in Linux/UNIX systems.
2. **Originate** file and directories in UNIX programming.
3. **Devise** the signals, Inter process communication systems.
4. **Make use of** socket to implement client/server environment.
5. **Explore** the Network Programming and RMI in detail.

<b>CO- PO Mapping</b>						
<b>(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak</b>						
<b>COs</b>	<b>Program Outcomes (POs)</b>					
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
<b>CO1</b>	1		1			
<b>CO2</b>	1		1			
<b>CO3</b>			1		1	

<b>C04</b>			1		2	1
<b>C05</b>	1		1	1	2	3

<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>M.Tech II Sem</b>		
<b>Code: A5114</b>	<b>WEB SERVICES</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: 3</b>		<b>3</b>	<b>-</b>	<b>-</b>

**Prerequisites:** Java Programming

**Course Objectives:**

This course enables the students to learn, understand the basic concepts of web services, implementation model, study the architecture and its standards, illustrate the concepts of XML documents, SOAP for registering and discovering services and discuss SOA services and its security.

**Module I: Distributed Computing and Web Services [9 Periods]**

**Introduction** Evolution and Emergence of Web Services, Evolution of distributed computing. Core distributed computing technologies–client/server, CORBA, JAVA RMI, Micro Soft DCOM, MOM, Challenges in Distributed Computing, role of J2EE and XML in distributed computing, emergence of Web Services and Service Oriented Architecture (SOA).

**Web Services:** Introduction, Basic operational model of Web services, Tools and technologies enabling web services, Benefits and Challenges of using web Services.

**Module II: Web Service Architecture and WSDL [10 Periods]**

**Web Services:** Web Service Architecture –Web services Architecture and its characteristics, core building blocks of web services, standards and technologies available for implementing web services, web services communication, and basic steps of implementing web services, Describing Web Services.

**WSDL:** WSDL introduction, nonfunctional service description, WSDL 1.1 Vs WSDL 2.0, WSDL document, WSDL elements, WSDL binding, WSDL tools, WSDL port type, limitations of WSDL.

**Module III: XML and SOAP [10 Periods]**

**A: XML**

Brief overview of XML–XML Document structure, XML name spaces, Defining structure in XML documents, Reuse of XML schemes, Document navigation and transformation.

**B: Simple Object Access Protocol (SOAP)**

Introduction, Inter-application communication and wire protocols, SOAP as a Messaging protocol, Structure of a SOAP message, SOAP Envelope, Encoding, Service Oriented Architectures, SOA revisited, Service roles in a SOA, Reliable messaging, Enterprise Service Bus, SOA Development Life Cycle, SOAP HTTP binding, Communication model, Error handling.

**Module IV: Services and UDDI [10 Periods]**

**Registering and Discovering Services:** Registering and Discovering Services: Role of Service Registries, Service discovery, Universal Description, Discovery and Integration.

**UDDI:** UDDI Architecture, UDDI Data Model, Interfaces, UDDI Implementation, UDDI with WSDL, UDDI specification, Service Addressing and Notification, Referencing and addressing Web Services, Web Services Notification.

**Module V: Web Services and Service Management [9 Periods]**

**Web Services:** SOA and web services security considerations, Network-level security mechanisms, Application-level security topologies, XML security standards, Semantics and Web Services, Semantic interoperability problem, Role of Meta Data, Service Meta Data.

**Service Management:** Overview of .NET and J2EE, SOA and Web Service Management, Managing Distributed System, Enterprise management Framework, Standard distributed management frame works, Web service management, Richer schema languages, WS-Meta data Exchange.

**TEXT BOOKS**

1. Michael P. Papazoglou, “**Web Services & SOA Principles and Technology**”, Second Edition.
2. S. Chatterjee, J. Webber, “**Developing Enterprise Web Services**”, Pearson Education.

**REFERENCE BOOKS**

1. S. Graham and others, “**Building web Services with Java**”, Pearson Education, 2<sup>nd</sup> Edition.
2. Sunil Mathew, Michael Stevens, Sameer Tyagi, James McGovern, “**Java web Services Architecture**”, Elsevier Science, Morgan Kaufmann Publishers, 2005.

**E-RESOURCES**

1. <https://www.abebooks.com/Web-Services-SOA-Principles-Technology-2nd/12698437230/bd>
2. <http://notes.specworld.in/web-services-notes-pdf-ws-notes-pdf/>
3. <http://ieeexplore.ieee.org/xpl/mostRecentIssue.jsp?punumber=4629386>
4. <http://dl.acm.org/citation.cfm?id=1088876>
5. <https://www.coursera.org/learn/python-network-data/lecture/0CpCx/video-service-oriented-architectures>
6. <http://nptel.ac.in/courses/105102015/11>

**Course Outcomes:**

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

1. **Understand** the fundamental theoretical concept related to web services such as Client server, CORBA, JAVA RMI, Microsoft DCOM, MOM and Service oriented architectures.
2. **Develop** a web application architectures characteristics and applying WSDL concept to develop a web application.
3. **Design** and develop a web application using SOAP protocol, XML and Inter communication protocols.
4. **Apply** the concepts for UDDI registries, addressing and notifications.

5. **Analyze** a secure web application using network security mechanisms like, .NET, J2EE and Richer schema languages.

<b>CO- PO Mapping</b>						
<b>(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak</b>						
<b>COs</b>	<b>Program Outcomes (POs)</b>					
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
<b>CO1</b>	1		2			
<b>CO2</b>					3	2
<b>CO3</b>			1		1	
<b>CO4</b>					1	
<b>CO5</b>				3	1	



<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>M.Tech II Sem</b>		
<b>Code: A5115</b>	<b>ADVANCED DATABASES</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: 2</b>		<b>2</b>	<b>-</b>	<b>-</b>

**Prerequisites:** Database Management Systems

**Course Objectives:**

This course enables the students to learn the modeling and design of databases, acquire knowledge on parallel and distributed databases and its applications, Study the usage and applications of Object Oriented database, and understand the principles of intelligent databases, usage of advanced data models, learn emerging databases such as XML, Cloud and Big Data and acquire inquisitive attitude towards research topics in databases.

**Module I: Parallel And Distributed Databases [10 Periods]**

Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures – Parallel Systems- Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism – Design of Parallel Systems- Distributed Database Concepts - Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed query processing –case studies.

**Module II : Object And Object Relational Databases [9 Periods]**

Concepts for Object Databases: Object Identity – Object structure – Type Constructors – Encapsulation of Operations – Methods – Persistence – Type and Class Hierarchies – Inheritance – Complex Objects – Object Database Standards, Languages and Design: ODMG Model – ODL – OQL – Object Relational and Extended – Relational Systems: Object Relational features in SQL/Oracle – Case Studies.

**Module III: Intelligent Databases [10 Periods]**

**A: Active Databases**

Syntax and Semantics (Starburst, Oracle, DB2)- Taxonomy- Applications- Design Principles for Active Rules- Temporal Databases: Overview of Temporal Databases- TSQL2- Deductive Databases: Logic of Query Languages – Datalog- Recursive Rules- Syntax and Semantics of Datalog Languages- Implementation of Rules and Recursion- Recursive Queries in SQL

**B: Spatial Databases**

Spatial Data Types- Spatial Relationships- Spatial Data Structures-Spatial Access Methods- Spatial DB Implementation.

**Module IV: Advanced Data Models [10 Periods]**

Mobile Databases: Location and Handoff Management - Effect of Mobility on Data Management - Location Dependent Data Distribution - Mobile Transaction Models - Concurrency Control - Transaction Commit Protocols- Multimedia Databases- Information Retrieval- Data Warehousing- Data Mining- Text Mining.

**Module V: Emerging Technologies [9 Periods]**

XML Databases: XML-Related Technologies-XML Schema- XML Query Languages- Storing XML in Databases-XML and SQL- Native XML Databases- Web Databases- Geographic Information Systems- Biological Data Management- Cloud Based Databases:

Data Storage Systems on the Cloud- Cloud Storage Architectures-Cloud Data Models- Query Languages- Introduction to Big Data-Storage-Analysis.

### TEXT BOOKS

1. Thakare Jadhav Kedar, “**Advance Database Management**”, **Technical Publications, 2008.**
2. S. K. Singh, “**Database Systems: Concepts, Design and Applications**”, Pearson Education India, 2011.

### REFERENCE BOOKS

1. R. Elmasri, S.B. Navathe, “**Fundamentals of Database Systems**”, Fifth Edition, Pearson Education/Addison Wesley, 2007.
2. Thomas Cannolly and Carolyn Begg, “**Database Systems, A Practical Approach to Design, Implementation and Management**”, Third Edition, Pearson Education, 2007.
3. Henry F Korth, Abraham Silberschatz, S. Sudharshan, “**Database System Concepts**”, Fifth Edition, McGraw Hill, 2006.
4. C.J.Date, A.Kannan and S.Swamynathan, “**An Introduction to Database Systems**”, Eighth Edition, Pearson Education, 2006.
5. Raghu Ramakrishnan, Johannes Gehrke, “**Database Management Systems**”, McGraw Hill, Third Edition 2004.

### E-RESOURCES

1. <https://books.google.co.in/books?id=qNCmBRufKBAC&dq=Parallel+Systems-+Distributed+Systems+%E2%80%93+Parallel+Databases:+I/O+Parallelism+%E2%80%93+Inter+and+Intra+Query+Parallelism&hl=en&sa=X&ved=0ahUKEwj83K-18bncAhUMLY8KHX2qCI8Q6AEIKDAA>.
2. <http://www.inf.ed.ac.uk/teaching/courses/adbs/slides/adbs.pdf>
3. <https://books.google.co.in/books?id=qNCmBRufKBAC&dq=Parallel+Systems-+Distributed+Systems+%E2%80%93+Parallel+Databases:+I/O+Parallelism+%E2%80%93+Inter+and+Intra+Query+Parallelism&hl=en&sa=X&ved=0ahUKEwj83K-18bncAhUMLY8KHX2qCI8Q6AEIKDAA>.
4. <http://nptel.ac.in/courses/106104135/>

### Course Outcomes:

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

1. **Select** the appropriate high-performance database like parallel and distributed database.
2. **Aware** of representing the model and real-world data using object-oriented database.
3. **Design** a semantic based database to meaningful data access
4. **Embed** the rule set in the database to implement intelligent databases
5. **Represent** the data using XML database for better interoperability and to solve the issues related to the data storage and retrieval.

<b>CO- PO Mapping</b>						
<b>(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak</b>						
<b>COs</b>	<b>Program Outcomes (POs)</b>					
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
<b>CO1</b>	1					
<b>CO2</b>	1		1		2	
<b>CO3</b>	1		1		1	
<b>CO4</b>	1		2		3	2
<b>CO5</b>	1		2		3	3

<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>M.Tech I Sem</b>		
<b>Code: A5116</b>	<b>ADVANCED DATA MINING (Professional Elective - III)</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: 3</b>		<b>3</b>	<b>-</b>	<b>-</b>

**Prerequisites: Data Mining**

**Course Objectives:**

This course aims the students to develop the abilities of critical analysis to data mining systems and applications, to implement practical and theoretical understanding of the technologies for data mining and to understand the strengths and limitations of various data mining models.

**Module I: Data mining Overview and Advanced Pattern Mining [9 Periods]**

Data mining tasks – mining frequent patterns, associations and correlations, classification  
Data mining tasks – mining frequent patterns, associations and correlations, classification  
Bayes method Naive Bayes ,KNN method, and regression for predictive analysis, cluster  
analysis , outlier analysis; advanced pattern mining in multilevel, multidimensional space  
– mining multilevel associations, mining multidimensional associations, mining  
quantitative association rules, mining rare patterns and negative patterns.

**Module II: Advance Classification [10 Periods]**

Classification by back propagation, support vector machines, classification using  
frequent patterns, other classification methods – genetic algorithms, back propagation,  
roughset approach, fuzzy set approach

**Module III: Advance Clustering [10 Periods]**

**A: Density - based methods**

DBSCAN, OPTICS, DENCLUE

**B: Grid-Based methods**

STING, CLIQUE; Exception – maximization algorithm; clustering High- Dimensional  
Data; Clustering Graph and Network Data.

**Module IV: Web and Text Mining [9 Periods]**

Introduction, web mining, web content mining, web structure mining, we usage mining,  
Text mining – unstructured text, episode rule discovery for texts, hierarchy of categories,  
text clustering

**Module V: Temporal and Spatial Data Mining [10 Periods]**

Introduction; Temporal Data Mining – Temporal Association Rules, Sequence Mining,  
GSP algorithm, SPADE, SPIRIT Episode Discovery, Time Series Analysis, Spatial  
Mining – Spatial Mining Tasks, Spatial Clustering. Data Mining Applications.

**TEXT BOOKS**

1. Jiawei Hang Micheline Kamber, Jian pei, Morgan Kaufmannn, “**Data Mining Concepts and Techniques**.”
2. Arun K Pujari, “**Data Mining Techniques**”, Universities Press.

## REFERENCE BOOKS

1. Pang-Ning Tan, Vipin kumar, “**Introduction to Data Mining**”, Michael Steinbach, Pearson.
2. T.VSveresh Kumar, B.Esware Reddy, Jagadish S Kalimani, “**Data Mining Principles & Applications**”, Elsevier.

## E-RESOURCES

1. <http://myweb.sabanciuniv.edu/rdehkharghani/files/2016/02/The-Morgan-Kaufmann-Series-in-Data-Management-Systems-Jiawei-Han-Micheline-Kamber-Jian-Pei-Data-Mining.-Concepts-and-Techniques-3rd-Edition-Morgan-Kaufmann-2011.pdf>.
2. <https://books.google.co.in/books?id=O6F9iwsqZQwC&printsec=frontcover&dq=temporal+and+spatial+data+mining+%2Bpdf&hl=en&sa=X&ved=0ahUKEwimv9qA1LncAhWIr48KHTIfAK0Q6AEITzAF#v=onepage&q&f=false>
3. <http://nptel.ac.in/courses/106106093/35>
4. <https://freevideolectures.com/course/2280/database-design/35>

## Course Outcomes

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

1. **Understand** the fundamentals in data mining.
2. **Explore** various classification techniques.
3. **Implement** clustering techniques and to apply it on various datasets.
4. **Investigate** several web and text mining techniques.
5. **Describe** temporal and spatial data mining process.

<b>CO- PO Mapping</b> (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
<b>COs</b>	<b>Program Outcomes (POs)</b>					
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
<b>CO1</b>			3			2
<b>CO2</b>		2				
<b>CO3</b>	2		2	2	2	
<b>CO4</b>	3		2			
<b>CO5</b>	2		2			2

<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>M.Tech II Sem</b>		
<b>Code: A5117</b>	<b>COMPUTER VISION (Professional Elective-III)</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: 3</b>		<b>3</b>	<b>-</b>	<b>-</b>

**Pre-Requisites:** Linear algebra, Vector calculus, Data Structures and Programming.

**Course Objectives:**

**This course makes the students to understand** both the theoretical and practical aspects of computing with images, study the foundation of image formation, measurement, and analysis, recognize the geometric relationships between 2D images and the 3D world and know the principles of state-of-the-art deep neural networks.

**Module I: Introduction to Image Analysis and Matlab [9 periods]**

**A:Overview,** computer imaging systems, lenses, Image formation and sensing, Image analysis, pre-processing and Binary image analysis

**B:Matlab:** Digital image Representation, displaying images, writing images, Image types, converting between classes, array indexing, control flow, operators, files, functions, data debugging, commands, and example programs

**Module II: Processing of Image [9 periods]**

Edge detection, Edge detection performance, Hough transform, corner detection

**Module III: Introduction to Segmentation and Filtering [9 periods]**

**A:** Segmentation- Active contours, Split and Merge, Mean shift and Mode finding, Normalized cuts, Graph cuts and Energy based methods, Morphological filtering

**B:** Fourier transform- Fourier Transform pairs, Two-dimensional Fourier transforms, Weiner filtering, Application: Sharpening, blur and noise removal.

**Module IV: Introduction to Feature Extraction [9 periods]**

Feature extraction, shape, histogram, color, spectral, texture, using CVIP tools, Feature analysis, feature vectors, distance /similarity measures, data preprocessing

**Module V: Pattern Analysis [12 periods]**

Clustering: K-Means, K-Medoids, Mixture of Gaussians Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised Classifiers: Bayes, KNN, ANN models;

Dimensionality Reduction: PCA, LDA, ICA, and Non-parametric methods. Recent trends in Activity Recognition, computational photography, Biometrics

**TEXT BOOKS**

1. Martin A. Fischler, Oscar Firschein, “Readings in Computer vision: Issues, Problems, Principles, and Paradigms”, Morgan Kaufmann,1987.
2. William K. Pratt, “Introduction to Digital Image Processing”, CRC Press, 2013

## REFERENCE BOOKS

1. Richard Szeliski,” Computer Vision: Algorithms and Applications”, Springer London, 05-Nov-2010.
2. S. Nagabhushana,” Computer Vision and Image Processing”, New Age International, 2005
3. Gonzales/ Woods/ Eddins, Digital Image Processing using MATLAB, 2nd edition, Gatesmark Publishing, ISBN 9780982085400
4. N.Efford, Digital Image Processing, Addison Wesley 2000, ISBN 0-201-59623-7
5. M Sonka, V Hlavac and R Boyle, Image Processing, Analysis and Machine Vision, PWS 1999, ISBN 0-534-95393-
6. Pratt.W.K., Digital Image Processing, John Wiley and Sons, New York, 1978
7. MATLAB: The Language of Technical Computing, computation, visualization, programming using MATLAB, 2001

## E-RESOURCES

1. [http://web.itu.edu.tr/hulyayalcin/Signal\\_Processing\\_Books/2010\\_Szeliski\\_Computer\\_Vision.pdf](http://web.itu.edu.tr/hulyayalcin/Signal_Processing_Books/2010_Szeliski_Computer_Vision.pdf)
2. [https://web.stanford.edu/class/ee254/software/using\\_ml.pdf](https://web.stanford.edu/class/ee254/software/using_ml.pdf)
3. [http://www.cse.iitm.ac.in/~vplab/courses/CV\\_DIP/PDF/LECT\\_EDGE\\_DET.pdf](http://www.cse.iitm.ac.in/~vplab/courses/CV_DIP/PDF/LECT_EDGE_DET.pdf)
4. <http://nptel.ac.in/courses/112101098/25>
5. [http://imageprocessingplace.com/downloads\\_V3/dipum2e\\_downloads/dipum2e\\_sample\\_book\\_material\\_downloads/DIPUM2E\\_Chapter02\\_Pgs\\_13-50.pdf](http://imageprocessingplace.com/downloads_V3/dipum2e_downloads/dipum2e_sample_book_material_downloads/DIPUM2E_Chapter02_Pgs_13-50.pdf)
6. <https://www.mccormick.northwestern.edu/documents/students/undergraduate/introduction-to-matlab.pdf>

## Course Outcomes:

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

1. **Understand** the concepts in Image Analysis. and matlab concepts.
2. **Explore** the processing techniques in Image.
3. **Investigate** several techniques in segmentation and filtering.
4. **Comprehend** and apply feature extraction techniques.
5. **Developed** the practical skills necessary to build computer vision applications

CO- PO Mapping						
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	Program Outcomes (POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2		1	1		
CO2			1		1	
CO3	1		2		2	3
CO4	1	1	2	1	3	1
CO5	2		2	2	3	3

<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>M.Tech II Sem</b>		
<b>Code: A5118</b>	<b>SOFT COMPUTING ( Professional Elective –III)</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: 3</b>		<b>3</b>	<b>-</b>	<b>-</b>

**Pre-Requisites** Basic knowledge of mathematics

**Course Objectives:**

This course makes the students to learn soft computing concepts and techniques, foster their abilities in designing appropriate technique for a given scenario, implement soft computing based solutions for real-world problems, give students knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms and to provide student a hand-on experience on MATLAB to implement various strategies.

**Module I: Introduction to Soft Computing and Neural Networks [8 Periods]**

Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics, Linear Saturating Function, Art Model

**Module II: Fuzzy Logic [8 Periods] Fuzzy**

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

**Module III: Neural Networks and Advanced Learning Techniques [10 Periods]**

**A: Neural Networks**

Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks Back Propagation Algorithm, Error Back Propagation Algorithm (EBPA), Radial Basis Function Networks, CPN (Counterpropagation network), Convolutional neural network

**B: Reinforcement Learning**

Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advances in Neural networks.

**Module IV: Genetic Algorithms [7 Periods]**

Introduction to Genetic Algorithms (GA), Genetic Algorithm, analysis of Fuzzy Vs Crisp Logic, perceptron Training Algorithm, Applications of GA in Machine Learning, Machine Learning Approach to Knowledge Acquisition, Hebb's Rule, Delta Rule

**Module V: Matlab/Python Lib & Deep Learning [15 Periods]**

Introduction to Matlab/Python, Arrays and array operations, Functions and Files, Study of neural network toolbox and fuzzy logic toolbox, Simple implementation of Artificial Neural Network and Fuzzy Logic.

### TEXT BOOKS

1. S. N. Sivanandam&S.N.Deepa, “**PRINCIPLES OF SOFT COMPUTING**”, John Wiley & Sons, 2007.
2. N. P. Padhy, S. P. Simon, “**Soft Computing: With MATLAB Programming**” Oxford University Press, 2015.

### REFERENCE BOOKS

1. Jyh:Shing Roger Jang, Chuen:Tsai Sun, EijiMizutani, “**Neuro:Fuzzy and Soft Computing**”, Prentice:Hall of India, 2003.
2. George J. Klir and Bo Yuan, “**Fuzzy Sets and Fuzzy Logic: Theory and Applications**”, Prentice Hall, 1995. 3. MATLAB Toolkit Manual

### E-RESOURCES

1. <https://bookboon.com/en/introduction-to-soft-computing-ebook>
2. [http://www.vssut.ac.in/lecture\\_notes/lecture1423723637.pdf](http://www.vssut.ac.in/lecture_notes/lecture1423723637.pdf)
3. [https://onlinecourses.nptel.ac.in/noc18\\_cs13/preview](https://onlinecourses.nptel.ac.in/noc18_cs13/preview)
4. <https://lecturenotes.in/subject/124/soft-computing-sc>
5. <https://bharadwajakumar.files.wordpress.com/2019/06/soft-computing-ebook.pdf>
6. <http://instalzonetrak.weebly.com/blog/sn-sivanandam-and-sn-deepa-principles-of-soft-computing-wiley-india-2007-pdf>

### Course Outcomes:

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

1. **Identify** and describe soft computing techniques and their roles in building intelligent machines
2. **Implement** fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.
3. **Employ** genetic algorithms to combinatorial optimization problems.
4. **Evaluate** and compare solutions by various soft computing approaches for a given problem.
5. **Investigate** recent trends in deep learning.

<b>CO- PO Mapping</b> (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
<b>COs</b>	<b>Program Outcomes (POs)</b>					
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
<b>CO1</b>	1	1	1	1	1	1
<b>CO2</b>	1		1		2	
<b>CO3</b>	2		2		3	
<b>CO4</b>	2	1	2		3	1
<b>CO5</b>	1	1	1		2	3



<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>M.Tech II Sem</b>		
<b>Code: A5119</b>	<b>SOFTWARE ENGINEERING AND MODELING (Professional Elective – IV)</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: 3</b>		<b>3</b>	<b>-</b>	<b>-</b>

**Pre-Requisites:** Software Engineering

**Course Objectives:**

This course provides the students to understand the importance of process models, learn about project management, phases in software process, make them to know about the different organization structures and study about several project management tools.

**Module I: Software Process Models [10 Periods]**

Software Process Maturity: Software maturity Framework, Principles of Software Process Change, Software Process Assessment, The Initial Process, The Repeatable Process, The Defined Process, The Managed Process, The Optimizing Process. Process Reference Models: Capability Maturity Model (CMM), CMMI, PCMM, PSP, TSP. **Classical Modeling Techniques example.**

**Module II: Project Management [10 Periods]**

Software Project Management Renaissance: Conventional Software Management, Evolution of Software Economics, Improving Software Economics, The old way and the new way.

Life-Cycle Phases and Process artifacts: Engineering and Production stages, inception phase, elaboration phase, construction phase, transition phase, artifact sets, management artifacts, engineering artifacts and pragmatic artifacts, model-based software architectures.

**Module III: Workflows and Planning [10 Periods]**

**A: Workflows**

Workflows and Checkpoints of process: Software process workflows, Iteration workflows, Major milestones, Minor milestones, Periodic status assessments.

**B: Process Planning**

Work breakdown structures, Planning guidelines, cost and schedule estimating process, iteration planning process, Pragmatic planning.

**Module IV: Project Organization [10 Periods]**

Project Organizations: Line-of- business organizations, project organizations, evolution of organizations, process automation.

Project Control and process instrumentation: The seven core metrics, management indicators, quality indicators, life-cycle expectations, Pragmatic software metrics, and metrics automation.

**Module V: Case Study [8 Periods]**

CCPDS-R Case Study and Future Software Project Management Practices: Modern Project Profiles, Next-Generation software Economics, Modern Process Transitions.

### TEXT BOOKS:

1. Watts S. Humphrey, “**Managing the Software Process**”, Pearson Education.
2. Walker Royce, “**Software Project Management**”, Pearson Education.

### REFERENCE BOOKS

1. Robert Wysocki,” **Effective Project Management: Traditional, Agile, Extreme**”, Sixth edition, Wiley India, reprint 2011.
2. Watts S. Humphrey, “**An Introduction to the Team Software Process**”, Pearson Education, 2000
3. James R. Persse,”**Process Improvement essentials**”, O’Reilly, 2006
4. Bob Hughes & Mike Cotterell,”**Software Project Management**”, fourth edition, TMH, 2006
5. Andrew Stellman& Jennifer Greene,”**Applied Software Project Management**”, O’Reilly, 2006.
6. Scott Berkun ,”**The Art of Project Management**” , SPD, O’Reilly, 2011.
7. Andrew Stellman& Jennifer Greene,”**Applied Software Project Management**”, SPD, O’Reilly, reprint 2011.
8. Jim Highsmith,” **Agile Project Management**”, Pearson education, 2004.

### E-RESOURCES

1. <http://moosehead.cis.umassd.edu/cis365/reading/Defining-the-Software-Process.pdf>.
2. [www.philadelphia.edu.jo/.../pdf/file3840fd5c6eab47be9d52c06c2e974886.pdf](http://www.philadelphia.edu.jo/.../pdf/file3840fd5c6eab47be9d52c06c2e974886.pdf)
3. <http://index-f.co.uk/Engineering/Introduction%20to%20Software%20Engineering.pdf>
4. <http://160592857366.free.fr/joe/ebooks/ShareData/Software%20Engineering%20-%20Principles%20and%20Practice%20By%20Hans%20van%20Vliet%20-%20Wiley%202007.pdf>
3. <http://nptel.ac.in/courses/106101061/29>.

### Course Outcomes:

At the end of the course, students will be able to

1. **Describe** and determine the purpose and importance of project management
2. **Analyze** the project management methods.
3. **Design** checkpoints and planning process.
4. **Compare** and **differentiate** organization structures and project structures.
5. **Implement** a project to manage project schedule, expenses and resources with the application of suitable project management tools.

<b>CO- PO Mapping</b> (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	Program Outcomes (POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	1	2	2		
CO2	1	1	1	2	2	2
CO3	1	1	1	2	2	2
CO4	1		1	2	2	2
CO5	1	1	1	2	2	2

<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>M.Tech II Sem</b>		
<b>Code: A5120</b>	<b>SOFTWARE QUALITY ASSURANCE AND TESTING (Professional Elective-IV)</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: 3</b>		<b>3</b>	<b>-</b>	<b>-</b>

**Prerequisites:** Software Engineering

**Course Objectives:**

This course provides the students to learn, describe and determine the purpose, importance of Software Quality Assurance (SQA) Framework and its Standards, state the metrics, measurements and methodology in quality assurance, study the Standards, metrics, methodologies, establishing policies, SDLC process, techniques and software testing tools like automated testing tools, Load Runner, Win runner and Rational Testing Tools, Silk test, Java Testing Tools, J Meter testing, assessing, project management in Client / Server and web applications by providing security.

**Module I: SQA Framework and Quality Standards[10 Periods]**

**SQA Framework and Standards:** What is Quality in SQA, Components, SQA Plan, Steps to develop and implement a SQA Plan.

**Quality Standards:** ISO 9000 and Companion ISO Standards, CMM, CMMI, PCMM, Malcom Balridge, 3 Sigma and 6 Sigma.

**Module II: Metrics and Methodologies**

**[10 Periods]**

**SQA Metrics and Measurement Software Quality Metrics:** Product Quality metrics, In-Process Quality Metrics, Metrics for Software Maintenance, Examples of Metric Programs

**Software Quality Metrics methodology:** Establish Quality Requirements, Identify Software quality metrics, Implement software quality metrics, Analyze software metrics results, Validate Software Quality Metrics, Software Quality Indicators, Fundamentals in Measurement theory.

**Module III: Software Testing Methodologies[9 Periods]**

**A: Software Testing Strategy and Environment**

Establishing testing policy, structured approach to testing, test factors, Economics of System Development Life Cycle (SDLC) Testing.

**B: Software Testing Methodology**

Verification and validation, functional and structural testing, work bench concept, eight considerations in developing testing methodologies, testing tactics checklist.

**Module IV: Techniques and Tools[10 Periods]**

**Software Testing Techniques:** Black-Box, Boundary value, Bottom-up, Branch coverage, Cause-Effect graphing, CRUD, Database, Exception, Gray-Box, Histograms, Inspections, JADs, Pareto Analysis, Prototyping, Random Testing, Risk-based Testing, Regression Testing, Structured Walkthroughs, Thread Testing, Performance Testing, White-Box Testing.

**Software Testing Tools:** Taxonomy of Testing tools, Methodology to evaluate automated testing tools, Load Runner, Win runner and Rational Testing Tools, Silk test, Java Testing Tools, J Meter, J MODULE and Cactus.

**MODULE V: Testing Process and Applications** [9 Periods]

**Testing Process: Eleven Step Testing Process:** Assess Project Management Development Estimate and Status, Develop Test Plan, Requirements Phase Testing, Design Phase Testing, Program Phase Testing, Execute Test and Record Results, Acceptance Test, Report test results, testing software installation, Test software changes, Evaluate Test Effectiveness.

**Testing Specialized Systems and Applications:** Testing Client/Server and Web applications, testing off the Shelf Components, Testing Security, Testing a data Warehouse.

**TEXT BOOKS**

1. William E. Perry, “**Effective Methods for Software Testing**”, Wiley India, 2nd Edition, 2006.
2. Mordechai Ben-Menachem Garry S. Mar Liss, “**Software Quality**”, Thomson Learning Publication, 1997.
3. K.V.K.K. Prasad, “**Software Testing Tools**”, Dream Tech Publishers, Third Edition 2009.

**REFERENCE BOOKS**

1. BoriesBeizer, “**Software Testing Techniques**”, 2<sup>nd</sup> Edition, Dream Tech Press.
2. G.Gord on Schulmeyer, James I. Mc Manus, “**Hand book of Software Quality Assurance**”, International Thomson Computer Press, 2<sup>nd</sup> Edition.

**E-RESOURCES**

1. <https://hientl.files.wordpress.com/2011/12/effective-methods-for-software-testing2.pdf>
2. <http://www.softwaretestinggenius.com/download/EMFST.pdf>
3. [https://www.adturtle.biz/LP\\_TA/index.cfm?T=436379](https://www.adturtle.biz/LP_TA/index.cfm?T=436379)
4. <http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=32>
5. <http://dl.acm.org/citation.cfm?id=2597724>
6. <http://nptel.ac.in/courses/106101061/18>
7. [http://ndl.iitkgp.ac.in/document/zyMnqgZQXCJME6wgSqrU87VCGcelOw5mZ-5ybmrhKB\\_j79VQPP0\\_ZQHLqcOopPDoaFWWhZybCrPg\\_joTbBU8ZpGA](http://ndl.iitkgp.ac.in/document/zyMnqgZQXCJME6wgSqrU87VCGcelOw5mZ-5ybmrhKB_j79VQPP0_ZQHLqcOopPDoaFWWhZybCrPg_joTbBU8ZpGA)

**Course Outcomes:**

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

1. **Define** state-of-the-art, and apply their findings to framework for software testing and quality assurance.
2. **Analyze** different approaches to software testing and quality assurance, metrics measurement, and select optimal solutions for different situations and projects.
3. **Demonstrate** software testing & quality assurance and apply that knowledge in SDLC, functional, structural testing, other testing methods their future research & its practice.
4. **Evaluate** different testing tools and techniques

5. **Justify** the testing process and its applications in quality assurance for client/server, web applications with security.

<b>CO- PO Mapping</b> (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
<b>COs</b>	<b>Program Outcomes (POs)</b>					
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
<b>CO1</b>	1	1				
<b>CO2</b>	1		1		3	1
<b>CO3</b>	1		2		2	
<b>CO4</b>	1		2	1	2	1
<b>CO5</b>	1		2	2	2	1

<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>M.Tech II Sem</b>		
<b>Code: A5121</b>	<b>STORAGE AREA NETWORKS (Professional Elective-IV)</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: 3</b>		<b>3</b>	<b>-</b>	<b>-</b>

**Prerequisites:** Computer Networks

**Course Objectives:**

This course makes to study and understand storage area networks, fundamentals of data creation, storage, architecture, components, data protection, storage methods, information availability, and monitoring and management of data centers. Further, policies, backup recovery techniques, storage virtualization, security management are discussed in detail using case studies and concern applications.

**Module I: Introduction to Information Storage and Management [9 Periods]**

**Introduction:** Review data creation, Amount of data being created and understand the value of data to a business, Challenges in data storage and data management.

**Data Centre Infrastructure:** Solutions available for data storage, Core elements of a data center infrastructure, Role of each element in supporting business activities.

**Module II: Storage Systems Architecture [10 Periods]**

**Physical Components:** Hardware and Software Components of Host Environment, Key protocols and concepts used by each component, Physical and Logical components of connectivity environment, Physical components of a Disk Drive and function, Logical Constructs of a Physical Disk, Access characteristics, and Performance Implications.

**Data Protection:** Different RAID levels and their suitability for different application environments: RAID 0, 1, 3, 4, 5, RAID 0+1, 1+0, 6, Compare and contrast integrated and modular storage systems, High-level architecture and working of an intelligent storage system.

**Module III: Introduction to Networked Storage [9 Periods]**

**A: Evolution of networked storage**

Architecture, Components, Topologies of FC-SAN, NAS, and IPSAN, Benefits of different networked storage options.

**B: Storage Methods**

Need for long-term archiving solutions, CAS fulfills the need, Different networked storage options for different application environments.

**Module IV: Information Availability, Monitoring & Managing Datacenter [10 Periods]**

**Business Continuity and Disaster Recovery:** Planned/unplanned outages and impact of downtime, Impact of downtime, Business Continuity Vs Disaster Recovery, RTO and RPO, Identify single points of failure in storage infrastructure, Solutions to mitigate failures.

**Backup/Recovery Topologies:** Replication technologies, Business Continuity, Remote Replication technologies, Identify key areas to monitor in a data center, Industry standards for data center monitoring and management, Key metrics to monitor different components in a storage infrastructure, Key management tasks in a data center.

**Module V: Storage Virtualization and Case Studies [10Periods] Securing**

**Storage and Storage Virtualization:** Information security, Critical security attributes for information systems, Storage security domains, List and analyzes common threats in each domain, Virtualization technologies, Block-level and File level virtualization technologies and processes.

**Case Studies:** Technologies described in course are reinforced with EMC examples of actual solutions. Realistic case studies enable participant to design most appropriate solution for given sets of criteria.

**TEXT BOOKS**

1. G. Somasundaram, Alok Shrivastava, “**Information Storage and Management**”, Wiley, 2010.
2. Meeta Gupta, “**Storage Area Network Fundamentals**”, Pearson Education Limited, 2002.

**REFERENCE BOOKS**

1. Robert Spalding, “**Storage Networks: The Complete References**”, Tata McGraw Hill, 2003.
2. Marc Farley, “**Building Storage Networks**”, Tata McGraw Hill, 2001.

**E RESOURCES:**

1. <https://www.mikeownage.com/mike/ebooks/Information%20Storage%20and%20Management.pdf>
2. <https://books.google.co.in/books?isbn=158705065X>
3. <https://books.google.co.in/books?isbn=158705065X>
4. [http://ndl.iitkgp.ac.in/document/uT7ohQ3kN8pP8OwteoNZ9LnctkAcqauU6wfpkbQYZW6tW3GrMe8ltD4hID7okN1Oxl\\_e6yKh2APw\\_XypNAE6qg](http://ndl.iitkgp.ac.in/document/uT7ohQ3kN8pP8OwteoNZ9LnctkAcqauU6wfpkbQYZW6tW3GrMe8ltD4hID7okN1Oxl_e6yKh2APw_XypNAE6qg)
5. <http://ieeexplore.ieee.org/document/5386862/?reload=true>
6. <http://www.lazysystemadmin.com/2010/04/storage-area-network-san-video-tutorial.html>

**Course Outcomes:**

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

1. **Identify** and describe the functions to build data center networking for switch network.
2. **Describe** different components of a storage infrastructure, types of RAID implementations and data protection.
3. **Evolution of** Network storage and storage methods for application environments.
4. **Demonstrate** Information Availability, Monitoring & Managing Datacenter and list solutions for failures and recovery
5. **Apply** the Secure storage virtualization and case studies and applications.

<b>CO- PO Mapping</b> (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
<b>COs</b>	<b>Program Outcomes (POs)</b>					
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
<b>CO1</b>	1		1			
<b>CO2</b>	1		1		1	
<b>CO3</b>	1				1	
<b>CO4</b>	1	1	1	1	2	2
<b>CO5</b>	2	2	1	1	3	2

<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>M.Tech II Sem</b>		
<b>Code: A5122</b>	<b>WEB SERVICES LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: 2</b>		<b>-</b>	<b>-</b>	<b>4</b>

**Prerequisites:** Java Programming

**Software Requirements:** JDK

**Course Objectives:**

This objective of the course is to provide the students to implement WSDL Services, web-based applications with request and response operations and applications using database connectivity.

**List of Programs:**

1. Write a program to implement WSDL Service (Hello Service, WSDL File)
2. Write a program the service provider can implement a single getPrice(), static bind() and getProduct operation.
3. Assume four users user1, user2, user3 and user4 having the passwords pwd1, pwd2, pwd3 and, pwd4 respectively. Write a servlet for doing the following.
  - a. Create a Cookie and add these four user id's and passwords to this Cookie.
  - b. Read the user id and passwords entered in the Login form and authenticate with the values (user id and passwords) available in the cookies. If he is a valid user(i.e., user-name and password match) you should welcome him by name(user-name) else you should display “ You are not an authenticated user “.
4. Write a program to implement the operation can receive request and will return a response in One-Way operation.
5. Write a program to implement the operation can receive request and will return a response in Request – Response operations
6. Write a program to implement to create a simple web service that converts the temperature from Fahrenheit to Celsius (using HTTP Post Protocol).
7. Write a program to implement business UDDI Registry entry.
8. Write a program to implement a Web based service consumer.
9. Write a program to implement a Windows application based web service consumer.
10. Install a database(Mysql or Oracle) and explore the basic commands.
11. Create a table which should contain at least the following fields: name, password, email-id, phone number(these should hold the data from the registration form). Practice 'JDBC' connectivity. Write a java program/servlet/JSP to connect to that database and extract data from the tables and display them. Experiment with various SQL queries. Insert the details of the users who register with the web site, whenever a new user clicks the submit button in the registration page.
12. Beans Assignment – Automobile the Traffic Light.

**REFERENCE BOOKS**

1. Michael P. Papazoglou, “**Web Services & SOA Principles and Technology**”, Second Edition

**Course Outcomes:**

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

1. Design and implement web services for single and multiuser applications.



2. Develop the responsive services using HTTP.
3. Implement the web based services for customer operations.
4. Deploy the web services with the database connectivity.
5. Apply the web based concepts in real time applications.

<b>CO- PO Mapping</b>						
<b>(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak</b>						
<b>COs</b>	<b>Program Outcomes (POs)</b>					
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
<b>CO1</b>			1		1	
<b>CO2</b>			1		2	1
<b>CO3</b>	1		1	2	1	2
<b>CO4</b>		1			1	
<b>CO5</b>			1			3

<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>M.Tech I Sem</b>		
<b>Code: A5123</b>	<b>ADVANCED DATA MINING LAB (Professional Elective-I Lab)</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: 2</b>		<b>-</b>	<b>-</b>	<b>4</b>

**Prerequisites:** Computer Programming, Python

**Software Requirement:** Python

**Course Objective:**

The objective of this lab is to get an overview of the various data mining techniques and can able to demonstrate them usingpython.

**List of Experiments**

1. The probability that it is Friday and that a student is absent is 3 %. Since there are 5 school days in a week, the probability that it is Friday is 20 %. What is theprobability that a student is absent given that today is Friday? Apply Baye’s rule in python to get the result. (Ans:15%)
2. Extract the data from database usingpython
3. Implement k-nearest neighbors classification usingpython
4. Given the following data, which specify classifications for nine combinations of VAR1 and VAR2 predict a classification for a case where VAR1=0.906 and VAR2=0.606, using the result of k-means clustering with 3 means (i.e., 3centroids)

VAR1	VAR	CLAS
	2	S
1.713	1.586	0
0.180	1.786	1
0.353	1.240	1
0.940	1.566	0
1.486	0.759	1
1.266	1.106	0
1.540	0.419	1
0.459	1.799	1
0.773	0.186	1

5. The following training examples map descriptions of individuals onto high, medium and low credit-worthiness.

medium	skiing	design	single	twenties	no ->highRisk
high	golf	trading	married	forties	yes ->lowRisk
low	speedway	transport	married	thirties	yes ->medRisk
medium	football	banking	single	thirties	yes ->lowRisk
high	flying	media	married	fifties	yes ->highRisk
low	football	security	single	twenties	no ->medRisk
medium	golf	media	single	thirties	yes ->medRisk
medium	golf	transport	married	forties	yes ->lowRisk
high	skiing	banking	single	thirties	yes ->highRisk
low	golf	unemployed	married	forties	yes ->highRisk

Input attributes are (from left to right) income, recreation, job, status, age-group, home-owner. Find the unconditional probability of `golf` and the conditional probability of

`single' given `medRisk' in the dataset?

6. Implement linear regression using python.
7. Implement Naïve Bayes theorem to classify the English text
8. Implement an algorithm to demonstrate the significance of genetic algorithm
9. Implement the finite words classification system using Back-propagation algorithm

### REFERENCE BOOKS

1. Machine Learning – Tom M. Mitchell, MGH
2. Fundamentals of Speech Recognition By Lawrence Rabiner and Biing – Hwang Juang.
3. Machine Learning: An Algorithmic Perspective, Stephen Marsland, Taylor & Francis

**Course Outcomes:** After the completion of the “Advanced Data Mining” lab, the student can able to:

1. **Analyze and Understand** complexity of Data mining and machine Learning algorithms and their limitations;
2. **Understand and Apply** modern notions in data analysis-oriented computing;
3. **Implement** of confidently applying common Machine Learning algorithms in practice and implementing their own;
4. **Learn and apply** of performing experiments in Machine Learning using real-world data.
5. **Study and Implement** Algorithms/ methods using Programming

<b>CO- PO Mapping</b> (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
<b>COs</b>	<b>Program Outcomes (POs)</b>					
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
<b>CO1</b>	2	1	3			
<b>CO2</b>	3		3			
<b>CO3</b>	1	1	1	2	2	2
<b>CO4</b>		1	1		1	1
<b>CO5</b>	1		1		2	

<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>M.Tech II Sem</b>		
<b>Code: A5124</b>	<b>COMPUTER VISION LAB (Professional Elective –III lab)</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: 2</b>		<b>-</b>	<b>-</b>	<b>4</b>

**Prerequisites:** Computer programming, Python

**Software Requirements:** Python

**Course Objectives:**

This objective of the course is to provide the students to study and understand the execute the experiments related to computer vision, Image processing applications using Python.

**List of Programs:**

1. Installation of
2. Python operations and the image processing toolbox
  - i) Image enhancement ii) Image compression iii) color image processing, iv) image morphologyPython
3. Basic image processing operations and histograms algorithms
  - i) Resizing (scaling ) and rotation ii) Quantization iii) Histogram
4. Image filtering in spatial and in frequency domain using Python commands
5. Observe the following
  - i. shift
  - ii. Linearity
  - iii. Scaling
  - iv. rotation
  - v. Exchange between magnitude and phase
6. Image Restoration
7. Image compression
8. Video tracking

**BOOKS**

1. Hands-On Image Processing with Python, Sandipan Dey, Pact publishing 1<sup>st</sup> edition 2018.
2. Python 3 Image Processing, Ashwin pajankar, BPB publications, 2019.
3. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, IncDigital Image Processing Second Edition

**e-resources:**

1. [https://www.tau.ac.il/~bilevich/Image\\_Processing/Lab\\_Manual\\_Image\\_Processing.pdf](https://www.tau.ac.il/~bilevich/Image_Processing/Lab_Manual_Image_Processing.pdf)
2. [http://imageprocessingplace.com/downloads\\_V3/dipum2e\\_downloads/dipum2e\\_sample\\_book\\_material\\_downloads/DIPUM2E\\_Chapter02\\_Pgs\\_13-50.pdf](http://imageprocessingplace.com/downloads_V3/dipum2e_downloads/dipum2e_sample_book_material_downloads/DIPUM2E_Chapter02_Pgs_13-50.pdf)

**Course Outcomes:**

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

1. **Explore**Python and its operations.
2. **Explore** and analyze image processing operations,
3. **Implement**Python functions in Image processing applications

4. **Apply** the Image enhancement using Python
5. **Implement and explore** video tracking using Python

<b>CO- PO Mapping</b>						
<b>(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak</b>						
<b>COs</b>	<b>Program Outcomes (POs)</b>					
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
<b>CO1</b>	3	1			1	1
<b>CO2</b>	1	3	2	3	3	2
<b>CO3</b>				2	2	
<b>CO4</b>	2	2				2
<b>CO5</b>	1					1

<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>M.Tech II Sem</b>		
<b>Code: A5125</b>	<b>SOFT COMPUTING LAB (Professional Elective –III lab)</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: 2</b>		<b>-</b>	<b>-</b>	<b>4</b>

**Prerequisites:** Basics of Neural Networks

**Software Requirements:** JDK / Python

**Course Objectives:**

This objective of the course is to provide the students to study and analyze the fuzzy logic concepts, back propagation algorithms, with the analysis of CPN,GA and crisp logics. Further, explore the implementation of Hebb’s rule, delta rule and classification.

**List of Programs:**

1. Write a program for implementing Linear Saturating Function.
2. Study and analysis of Art Model.
3. To perform Union,Intersection and Complement operations.
4. Write a program for Back Propagation Algorithm.
5. Write a program for Error Back Propagation Algorithm (EBPA) Learning.
6. Study and analysis of CPN.
7. Study and analysis of Genetic Algorithm Life Cycle.
8. Study and analysis of Fuzzy Vs Crisp Logic.
9. Write a program of perceptron Training Algorithm.
10. Write a program to implement Hebb’s Rule.
11. Write a program to implement of Delta Rule.
12. Write a program for implementing any one classifier.

**REFERENCE BOOKS**

1. S.N. Shivnandam, “**Principle of soft computing**”, Wiley Publication.
2. S. Rajshekaran and G.A.V. Pai, “Neural Network, Fuzzy logic And Genetic Algorithm”, PHI.
3. Jack M. Zurada, “Introduction to Artificial Neural Network System” Jaico Publication.
4. Simon Haykins, “Neural Network- A Comprehensive Foundation”.

E-resources:

<https://lecturenotes.in/subject/124/soft-computing-sc>

<https://bharadwajakumar.files.wordpress.com/2019/06/soft-computing-ebook.pdf>

**Cours\*e Outcomes:**

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

1. **Understand** the in-depth concepts of various network models.
2. **Explore** and analyze evolutionary algorithms.
3. **Implement** applications using neural networks.
4. **Apply** the Hebb’s rule and Delta rule.
5. **Implementand explore** classification algorithms.

<b>CO- PO Mapping</b>						
<b>(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak</b>						
<b>COs</b>	<b>Program Outcomes (POs)</b>					
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
<b>CO1</b>	3	2	1	3	1	2
<b>CO2</b>	2					
<b>CO3</b>		3	1	2	2	1
<b>CO4</b>	2			1		
<b>CO5</b>	1				1	1

<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>M.Tech II Sem</b>		
<b>Code: A0A05</b>	<b>VALUE EDUCATION</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: Nil</b>		<b>2</b>	<b>-</b>	<b>-</b>

**Prerequisites:** Nil

**Course Objectives:** The course deals about value of education and self- development, Imbibe good values in students and know about the importance of character.

**Module I** **[6Periods]**  
Values and self-development -Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements.

**Module II** **[7 Periods]**  
Importance of cultivation of values, Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness, Honesty, Humanity. Power of faith, National Unity, Patriotism.Love for nature, Discipline.

**Module III** **[6 Periods]**  
A:Personality and Behavior Development - Soul and Scientific attitude, Positive Thinking. Integrity and discipline, Punctuality,  
B: Love and Kindness, Avoid fault Thinking, Free from anger, Dignity of labour.

**Module IV** **[7 Periods]**  
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.

**Module V** **[6 Periods]**  
Character and Competence -Holy books vs Blind faith, Self-management and Good health Science of reincarnation, Equality, Nonviolence,Humility, Role of Women, All religions and same message, Mind your Mind, Self-control, Honesty, Studying effectively.

#### **REFERENCE BOOKS**

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

#### **Course Outcomes:**

After completion of the course, students should be able to:

1. **Understand**self-development and moral values
2. **Explore** the importance of character and cultivation of values
3. **Apply** the personality development methods
4. **Analyze** the association and cooperation principles
5. **Elaborate** the principles of religions and good health science.



<b>CO- PO Mapping</b>						
<b>(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak</b>						
<b>COs</b>	<b>Program Outcomes (POs)</b>					
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
<b>CO1</b>					2	2
<b>CO2</b>					2	2
<b>CO3</b>					2	3
<b>CO4</b>					2	2
<b>CO5</b>					2	2

<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>M.Tech III Sem</b>		
<b>Code: A5126</b>	<b>PARALLEL AND DISTRIBUTED ALGORITHMS (Professional Elective-V)</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: 3</b>		<b>3</b>	<b>-</b>	<b>-</b>

**Prerequisites:** Computer Architecture

**Course Objectives:**

This course provides the students to learn and understand the basic of parallel and distributed algorithms, message passing, Partitioning, Divide and Conquer strategies. The use of Pipelined Computations Synchronization and Programming with shared memory. Apply these algorithms in Distributed shared memory systems and programming to solve problems in distributed, internet, and various other applications.

**Module I: Parallel Computers [10 Periods]**

**Basic Techniques:** Parallel Computers for increase Computation speed, Types of Parallel Computers.

**Cluster Computing:** Interconnected Computers as a computing platform, Cluster Configurations, Setting up a dedicated Beowulf style cluster.

**Module II: Message-Passing Computing [9 Periods]**

**Message Passing:** Basics, Evaluating Parallel programs, Debugging and evaluating parallel programs empirically.

**Partitioning and Divide and Conquer strategies:** Introduction to Partitioning Strategies, Partitioning and Divide and Conquer with Examples.

**Module III: Pipelined Computations [10 Periods]**

**A: Pipelining**

Pipeline Techniques, Computing platform for pipelined applications.

**B: Pipeline Programs**

Examples, Adding numbers, Sorting numbers, Prime number generation, Solving a system of linear equations.

**Module IV: Synchronization and Programming with shared memory [9 Periods]**

**Synchronization:** Synchronous Computations, load balancing, distributed termination examples.

**Programming with Shared memory:** Shared memory multiprocessor constructs for specifying parallel list sharing data parallel programming languages and constructs, open MP.

**Module V: Distributed shared memory systems and Programming [10 Periods]**

**Distributed shared memory systems:** Distributed shared memory, achieving constant memory distributed shared memory programming primitives.

**Algorithms:** Sorting algorithms, Compare and Exchange sorting algorithms, Sorting on specific networks, Other sorting algorithms, Numerical algorithms, Matrix multiplication, Solving a system of linear equations.

## TEXT BOOKS

1. Barry Wilkinson, Michael Allen, “**Parallel Programming**”, Pearson Education, 2<sup>nd</sup> Edition.
2. B. Chapman, G. Jost, and Ruud van der Pas, “**Using OpenMP**”, MIT Press, 2008.

## REFERENCE BOOKS

1. Peter S. Pacheco, “**An introduction to parallel programming**”, Morgan Kaufmann, 2011.
2. Quinn, “**Parallel programming in C with MPI and OpenMP**”, Tata McGraw Hill, 2003.

## E-RESOURCES

1. <https://goo.gl/JvM3fU>
2. [http://hermes.survey.ntua.gr/web/FreeBooks/Parallel\\_and\\_Distributed\\_Computing.pdf](http://hermes.survey.ntua.gr/web/FreeBooks/Parallel_and_Distributed_Computing.pdf)
3. <https://www.dagstuhl.de/Reports/99/99291.pdf>
4. <http://reports-archive.adm.cs.cmu.edu/anon/ml2011/CMU-ML-12-111.pdf>
5. [http://ndl.iitkgp.ac.in/document/yVCWqd6u7wgye1qwH9xY724XlqQGV2Msy4QUygyrM\\_d5Yo\\_yAP0nDWoQalPSovkEPXdPMMJMRXx5-x16kZcErg](http://ndl.iitkgp.ac.in/document/yVCWqd6u7wgye1qwH9xY724XlqQGV2Msy4QUygyrM_d5Yo_yAP0nDWoQalPSovkEPXdPMMJMRXx5-x16kZcErg)
6. [http://ndl.iitkgp.ac.in/document/xttk-4kfhvUwVIXBW-YWREHSqJNXZ5-IVmA63e1fa\\_-0\\_8cKDQQ5jyqonM7KTHNTudziB4dzdyILzljXhs6BWw](http://ndl.iitkgp.ac.in/document/xttk-4kfhvUwVIXBW-YWREHSqJNXZ5-IVmA63e1fa_-0_8cKDQQ5jyqonM7KTHNTudziB4dzdyILzljXhs6BWw)

## Course Outcomes:

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

1. **Understand** the basic concepts related to parallel and distributed computing, use of parallel computers for enhance performance with cluster computing.
2. **Illustrate** message passing parallel algorithms of Portioning and Divide and Conquer strategies.
3. **Design** and develop applications with use of pipelined computations and pipeline programs
4. **Use of** Synchronization and Programming with shared memory in parallel programming languages like Open MP.
5. **Explore** various parallel algorithms and programming concepts for solving the problems to achieve constant distributed shared memory.

CO- PO Mapping						
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	Program Outcomes (POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1		1			
CO2	1		1			
CO3	1		1		1	
CO4	1		1		1	1
CO5	1		1	2	1	2

<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>M.Tech III Sem</b>		
<b>Code: A5127</b>	<b>WIRELESS SENSOR NETWORKS (Professional Elective-V)</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: 3</b>		<b>3</b>	<b>-</b>	<b>-</b>

**Prerequisites:** Computer Networks

**Course objectives:**

This course makes to understand and gain a broad coverage of challenges and latest concepts results related to the design and management of wireless sensor networks, design models, network architectures, node discovery and localization, analyze deployment strategies, node coverage, routing protocols, the systems with power management, protocols with medium access arbitration, fault-tolerance, network security, IoT and applications

**Module I: Applications and Design Model [10 Periods]**

**Applications:** Introduction: Examples of Sensor nodes, Sample Sensor Networks Applications.

**Design Issues:** Design Challenges and Models, Contemporary network architectures, Operational and computational models Performance metrics, Software and hardware setups.

**Module II: Network Bootstrapping [10 Periods]**

**Deployment:** Sensor deployment mechanisms, Issues of coverage, Node discovery protocols

**Localization:** Localization and control: Localization schemes, Network clustering.

**Module III: Data Dissemination and Routing [9 Periods]**

**A: Data-centric and Content-based Networking**

Query models, In-network data aggregation.

**B: Routing Protocols** Robust route setup, coping with energy constraints.

**Module IV: Physical and Link layers [9 Periods]**

**Energy and Power:** Radio energy consumption model, Power management.

**Protocols:** MAC protocols: Medium access arbitration, Optimization mechanisms.

**Module V: Dependability Issues and IoT [10 Periods]**

**Security Issues:** Security and synchronization-Security challenges, Threat and attack models, Quality of service provisioning, fault tolerance.

**IoT:** History of IoT, M2M – Machine to Machine, Web of Things, IoT protocols

Applications: Remote Monitoring & Sensing, Remote Controlling, Performance Analysis The Architecture The Layering concepts, IoT Communication Pattern, IoT protocol Architecture, The6LoWPAN and Security aspects in IoT.

**TEXT BOOKS**

- Holger Karl, Andreeas Willig “**Protocols and Architectures for Wireless Sensor Networks**”, Wiley, ISBN: 0-470-09510-5, June 2005.
- Cauligi S. Raghavendra, Krishna Sivalingam, and Taieb M. Znati “**Wireless Sensor Networks**”, Springer, 2005

- Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, Dr. Ovidiu Vermesan, Dr. Peter Friess, River Publishers

### REFERENCE BOOKS

- WaltenegusDargie, Christian Poellabauer , “Fundamentals of Wireless Sensor Networks: Theory and Practice”, John Wiley & Sons 2010.
- Abbas Jamalipour Jun Zheng,” Wireless **Sensor Networks: A Networking Perspective**”, Wiley 1<sup>st</sup> Edition,2014.

### E-RESOURCES

- <http://profsite.um.ac.ir/~hyaghmae/ACN/WSNbook.pdf>
- [https://ia800207.us.archive.org/5/items/springer\\_10.1007-b117506/10.1007-b117506.pdf](https://ia800207.us.archive.org/5/items/springer_10.1007-b117506/10.1007-b117506.pdf)
- [http://www.mforum.ru/arc/iot-book\\_compressed\\_MForum.pdf](http://www.mforum.ru/arc/iot-book_compressed_MForum.pdf)
- <https://www.riverpublishers.com/pdf/ebook/RP9788793519046.pdf>
- [ceng.usc.edu/~bkrishna/teaching/SensorNetBib.html](http://ceng.usc.edu/~bkrishna/teaching/SensorNetBib.html)
- [nesl.ee.ucla.edu/](http://nesl.ee.ucla.edu/)
- [www.intel.com/content/www/us/en/research/intel-research.html](http://www.intel.com/content/www/us/en/research/intel-research.html)
- [www.libelium.com/](http://www.libelium.com/)
- <https://www.youtube.com/watch?v=e7jmXVxqS8s&t=1414s>
- <https://www.youtube.com/watch?v=ipnrZUMHfpM>

### Course Outcomes:

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

- Understand** the wireless sensor networks for various applications and design models.
- Explore** coverage of Networking, planning, nodedeployment and localization control.
- Devise** appropriate data dissemination protocols and model links cost.
- Determine** suitable medium access protocols and radio energy consumption models.
- Implement** quality of service, fault-tolerance, security and other dependability requirements in wireless sensor networks and IoT.

<b>CO- PO Mapping</b> (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
<b>COs</b>	<b>Program Outcomes (POs)</b>					
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
<b>CO1</b>	1					
<b>CO2</b>	1	1	1			
<b>CO3</b>	1	1	1		1	1
<b>CO4</b>	1		1		1	
<b>CO5</b>	1	1	1	2	2	3

<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>M.Tech III Sem</b>		
<b>Code: A5128</b>	<b>INFORMATION RETRIEVAL TECHNIQUES (Professional Elective-V)</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: 3</b>		<b>3</b>	<b>-</b>	<b>-</b>

**Prerequisites:** Data Base Management Systems

**Course Objectives:**

This course enables the students to gain knowledge in different Information Retrieval (IR), fundamental concepts, Retrieval and Information Search techniques in various application areas, apply IR and Classification methods, Machine Learning techniques, SVM, Clustering and Classification methods. These principles are used to locate relevant information large collections of data, to analyze performance of retrieval systems when dealing with unmanaged data sources, and implement retrieval systems for web search tasks.

**Module I: Information System Capabilities & Retrieval Techniques [9 Periods]**

**Retrieval Techniques-I:** Boolean Retrieval, Term Vocabulary, Postings Lists, Indexing Techniques

**Retrieval Techniques-II:** Dictionaries and tolerant retrieval, Index Construction and Compression.

**Module II: Information Search Techniques [10 Periods]**

**Score Computation:** Scoring, Term Weighting and Vector Space Model, Computing scores in Complete search system, Information System Evolution.

**Evaluation:** Evaluation in information retrieval, Relevance feedback and query expansion.

**Module III: Retrieval and classification techniques [10 Periods]**

**A: Retrieval Techniques**

XML retrieval, Probabilistic information retrieval, Language models for information retrieval.

**B: Classification Techniques**

Text classification, Vector space classification.

**Module IV: Machine Learning Retrievals [9 Periods]**

**Support Vector Machines and machine learning on documents:** Support Vector Machines, Extensions to SVM model-Issues in classification of Text documents-Machine Learning methods in Adhoc Information Retrieval, deep learning.

**Clustering Techniques:** Flat clustering, Hierarchical clustering, Matrix decompositions and latent semantic indexing.

**Module V: Web Search Linking [10 Periods]**

**Web Search Basics:** Web characteristics- Advertising as the Economic Model- Search user experience-Index size and estimation-Near-duplicates and Shingling.

**Web crawling and indexes:** Overview, Crawling, Distributing Indexes, Connectivity Servers, Link analysis, Web as a graph, Page Rank, Hubs and authorities.

### TEXT BOOKS

1. Kowalski, Gerald J. Maybury, Mark T, “**Information Storage and Retrieval systems Theory and Implementation**”, Second Edition, 2000.
2. Christopher D. Manning and Prabhakar, Raghavan and Hinrich Schütze, “**Introduction to Information Retrieval**”, Cambridge University Press, 2008.
3. Ricardo Baeza Yate, “**Modern Information Retrieval**”, Pearson Education, 2007.

### REFERENCE BOOKS

1. David A Grossman and Ophir Frider, “**Information Retrieval: Algorithms and Heuristics**”, 2<sup>nd</sup> Edition, Springer.
2. Robert Korfhage, “**Information Storage & Retrieval**”, John Wiley & Sons.

### E-RESOURCES

1. [www.unistmo.edu.mx/~daniel.garcia/.../Librorecuperacioninformacion.pdf](http://www.unistmo.edu.mx/~daniel.garcia/.../Librorecuperacioninformacion.pdf)
2. <https://nlp.stanford.edu/IR-book/pdf/irbookonlinereading.pdf>
3. [www.sciencedirect.com/science/article/pii/S1877050916000739](http://www.sciencedirect.com/science/article/pii/S1877050916000739)
4. [http://ndl.iitkgp.ac.in/document/yVCWqd6u7wgye1qWH9xY71DYMut02wjKcXilXOeS46dDWYndV38tDO50i\\_mnMwZjXcF6XgqkVglL9ordVB7VBQ](http://ndl.iitkgp.ac.in/document/yVCWqd6u7wgye1qWH9xY71DYMut02wjKcXilXOeS46dDWYndV38tDO50i_mnMwZjXcF6XgqkVglL9ordVB7VBQ)

### Course Outcomes:

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

1. **Understand the** Information retrieval techniques.
2. **Explore and Analyze** Information search techniques like Vector Space Model, and Probabilistic Model, system evaluation methods.
3. **Identify and Apply** Classification Methods and classification techniques used various applications
4. **Describe and apply** Machine learning retrieval methods like SVM and clustering techniques.
5. **Illustrate** web search technique in Information Retrieval system used in web search, crawling and indexes.

<b>CO- PO Mapping</b> (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
<b>COs</b>	<b>Program Outcomes (POs)</b>					
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
<b>CO1</b>	1	1	1			
<b>CO2</b>	2	1	1	1	2	2
<b>CO3</b>	2	1	1	1	2	2
<b>CO4</b>	3	1	1	1	2	3
<b>CO5</b>	3	1	1	1	2	3

<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>M.Tech III Sem</b>		
<b>Code:A5129</b>	<b>BUSINESS ANALYTICS</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: 3</b>	<b>(Open Elective)</b>	<b>3</b>	<b>-</b>	<b>-</b>

**Prerequisites:** Nil

**Course Objectives:**

This course provides the students to learn and understand the role of business analytics within an organization, Analyze data using statistical and data mining techniques Also to gain an understanding of how managers use business analytics to formulate and solve, business problems.

**Module I: Business analytics and Statistical Tools [9 Periods]**

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business, Analytics Process and organization, competitive advantages of Business Analytics.

Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modeling, sampling and estimation methods overview.

**Module II: Trendiness and Regression Analysis [9 Periods]**

Modeling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

**Module III: Organization Structures and Analytics [10 Periods]**

A: Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes.

B: Descriptive Analytics, predictive analytics, predicative Modeling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modeling, nonlinear Optimization.

**Module IV: Forecasting Techniques [10 Periods]**

Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models.

Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

**Module V: Decision Analysis [10 Periods]**

Formulating Decision Problems, Decision Strategies with the without outcome Probabilities, Decision Trees, Value of Information, Utility and Decision Making. Recent Trends in Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

**TEXT BOOKS**



1. Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, “**Business analytics Principles, Concepts, and Applications**”, Pearson FT Press.
2. James Evans, “**Business Analytics**”, Persons Education.

#### REFERENCE BOOKS

1. James Cadle, Donald Yeates, James Cadle, Malcolm Eva, Keith Hindle, Debra Paul, Craig Rollason, Paul Turner, Donald Yeates Debra Paul, “**Business Analysis**”, BCS, The Chartered Institute for IT; Revised edition, 2014.
2. Erik Larson and, Clifford Gray, “**Project Management: The Managerial Process**”, McGraw Hill Education; Sixth Edition, 2017.

#### Course Outcomes:

**At the end of the course, students will be able to:**

1. **Understand** the knowledge and need for data analytics.
2. **Demonstrate** the ability of think critically in making decisions based on data and deep analytics.
3. **Explore** the technical skills in predicative and prescriptive modeling to support business decision-making.
4. **Acquire** the ability to translate data into clear, actionable insights.
5. **Analyze** the problems and use various decision strategies.

<b>CO- PO Mapping</b> (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
<b>Cos</b>	<b>Program Outcomes (POs)</b>					
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
<b>CO1</b>	1	1	1			
<b>CO2</b>	2			1	2	2
<b>CO3</b>	2	1	1			2
<b>CO4</b>	1	1	1	1	1	3
<b>CO5</b>	1	1	1		2	3

<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>M.Tech. III Semester</b>		
<b>Code: A0B22</b>	<b>ADVANCED OPTIMIZATION TECHNIQUES (Open Elective)</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: 3</b>		<b>3</b>	<b>-</b>	<b>-</b>

**Pre-requisite:** Nil

**Course Objectives:**

To understand extremely important topics under the broad umbrella of optimization, this is synonymous with efficiency which is the underlying prime rationale for all scientific and technological advances and progress.

**ModuleI: Linear Programming**

**[10 Periods]**

Introduction and formulation of models; convexity; graphical & simplex method; Big-M Method, Two phase method; degeneracy, non-existent and unbounded solutions; duality in L.P. Dual simplex method, sensitivity analysis for cost and requirement vector; Revised simplex method; Transportation and Assignment problems.

**ModuleII: Integer Linear Programming**

**[10 Periods]**

Gomory's cutting plane method; branch and bound algorithm; traveling salesman problem; knapsack problem; linear C-1 problem.

**ModuleIII: Dynamic Programming, CPM & PERT**

**[9 Periods]**

**A:** Belman's Principle of optimality; recursive relations; Solution of L.P. Problem; simple examples.

**B:** CPM & PERT

**Module IV: Non-Linear Programming**

**[9 Periods]**

Classical optimization methods; equality and inequality constraints; Lagrange multipliers; Kuhn-tucker conditions; quadratic forms; quadratic programming and Beale's methods.

**Module V: Search Methods**

**[10 Period]**

One dimensional optimization; Fibonacci search; multi dimensional search methods; uni-variate search; gradient methods; steepest descent/ascent methods; conjugate gradient method; Fletcher- reeves method; penalty function approach.

**TEXT BOOKS**

1. J.K. Sharma, "**Operations Reserach Theory & Applications**", 4<sup>th</sup> Edition, Mc.Millan Publications
2. S.S.Rao, "**Engineering Optimization theory and Practice**", 4<sup>th</sup> Edition, J Wiley & Sons, Newjersey

**REFERENCE BOOKS**

1. K.V.Mital, "**Optimization methods in operations research and system analysis**", 3<sup>rd</sup> Edition, Newage International (P) Ltd., publishers.
2. H.A Taha "**Operations Research: An Introduction**" Prentice Hall Edition, 2016

Reprint.

3. Raul Poler et.al “Operations Research Problems Statement and Solutions” Springer, 2014.

### E-RESOURCES

1. <http://www.mhhe.com/engcs/industrial/hillier/etext/PDF/chap03.pdf> (LPP)
2. <http://ocw.nctu.edu.tw/upload/classbfs121001503719748.pdf> (Transportation Problems)
3. [http://shodhganga.inflibnet.ac.in/bitstream/10603/19544/12/7\\_chapter%201.pdf](http://shodhganga.inflibnet.ac.in/bitstream/10603/19544/12/7_chapter%201.pdf) (Replacement Models)
4. <https://www.math.ucla.edu/~tom/GameTheory/mat.pdf> (Game Theory)
5. <http://www.ime.unicamp.br/~andreani/MS515/capitulo12.pdf> (Inventory Models)

### Course Outcomes

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

1. Find feasible solution to LPP by various methods.
2. Minimize the cost and time by using Travelling salesmen Problem.
3. Understand various methods Dynamic programming.
4. Understand the various concepts on Non-Linear programming.
5. Understand the various concepts of Search methods.

<b>CO- PO Mapping</b> (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	Program Outcomes (POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1			3		
CO2		1		2		
CO3	2			3		
CO4	3		1			
CO5			1			

<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>M.Tech III Sem</b>		
<b>Code: A5130</b>	<b>BLOCK CHAIN TECHNOLOGY AND ITS APPLICATIONS (Open Elective)</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: 3</b>		<b>3</b>	<b>-</b>	<b>-</b>

**Prerequisites:** Nil

**Course Objectives:**

The blockchain technology course allows the students to explore the driving force behind the cryptocurrency Bitcoin. Along with the Decentralization, Cryptography, Bitcoins with its alternative coins, Smart contracts and outside of currencies.

**Module I: Introduction to Blockchain [9 Periods]**

Distributed systems, History of blockchain, Introduction to blockchain, Types of blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain.

**Module II: Decentralization and Cryptography [10 Periods]**

Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Decentralized organizations.

Cryptography and Technical Foundations: Cryptographic primitives, Asymmetric cryptography, Public and private keys

**Module III: Bitcoin and Alternative Coins [10 Periods]**

**A: Bitcoin**

Transactions, Blockchain, Bitcoin payments

**B: Alternative Coins**

Theoretical foundations, Bitcoin limitations, Namecoin, Litecoin, Primecoin, Zcash

**MODULE IV: Smart Contracts [10 Periods]**

Definition, Ricardian contracts: Smart contract templates, Deploying smart contracts on a blockchain.

**MODULE V: Blockchain-Outside of Currencies [9 Periods]**

Internet of Things, Government, Health, Finance, Media

**TEXT BOOKS**

1. Imran Bashir, “**Mastering Blockchain - Distributed ledgers, decentralization and smart contracts explained**”, Packt Publishing Ltd., Second Edition, ISBN 978-1-78712-544-5, 2017.

**REFERENCE BOOKS**

1. Daniel Drescher, “**Blockchain Basics: A Non-Technical Introduction in 25 Steps**”, Apress, First Edition, 2017.
2. Andreas M. Antonopoulos, “**Mastering Bitcoin: Unlocking Digital Cryptocurrencies**”, O'Reilly Media, First Edition, 2014.

**E-RESOURCES**

1. <http://nptel.ac.in/courses/106106168/27>

2. <https://www.edx.org/learn/blockchain-cryptography>
3. <https://www.class-central.com/tag/blockchain>
4. <https://cognitiveclass.ai/courses/blockchain-course/>
5. <https://www.skillshare.com/browse/blockchain>

**Course Outcomes:**

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

1. **Understand** the types, benefits and limitation of blockchain.
2. **Explore** the blockchain decentralization and cryptography concepts.
3. **Enumerate** the Bitcoin features and its alternative options.
4. **Describe** and deploy the smart contracts
5. **Summarize** the blockchain features outside of currencies.

<b>CO- PO Mapping</b> (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
<b>COs</b>	<b>Program Outcomes (POs)</b>					
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
<b>CO1</b>	1		1			
<b>CO2</b>	1	1	1	1	2	1
<b>CO3</b>	1	1	1	1	2	2
<b>CO4</b>	2	1	1	1	2	3
<b>CO5</b>	2		1	1	2	2

<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>M.Tech III Sem</b>		
<b>Code: A5131</b>	<b>SEMINAR</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: 2</b>		<b>-</b>	<b>-</b>	<b>4</b>

**Course Objectives:** To promote deeper understanding the basic concepts, physical mechanism behind the processes, participate in scientific analysis and comprehensive of scientific writing of verbal presentation. This course is to introduce post graduate student to ideas, methods and techniques that can improve the content and presentation of scientific seminars.

**Course Outcomes:**

At the end of the course, students should be able to

1. Write technical documents to the standards
2. Give oral presentation on technical and general topics
3. Express ideas clearly with examples
4. Identify the research opportunities related to their area.
5. Communicate effectively.

<b>CO- PO Mapping</b>						
<b>(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak</b>						
<b>COs</b>	<b>Programme Outcomes(POs)</b>					
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
<b>CO1</b>	<b>1</b>					<b>1</b>
<b>CO2</b>					<b>2</b>	
<b>CO3</b>			<b>2</b>			
<b>CO4</b>	<b>2</b>					<b>1</b>
<b>CO5</b>			<b>1</b>		<b>2</b>	

<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>M.Tech III Sem</b>		
<b>Code: A5132</b>	<b>PROJECT / DISSERTATION PHASE - I</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: 8</b>		<b>-</b>	<b>-</b>	<b>16</b>

**Course Objectives:** To utilize basic knowledge and advance techniques to make product/process using experimentation and/or simulation and expose to others as document and oral presentation.

**Course Outcomes:**

At the end of the course, students should be able to

1. Summarize the work completed in the form of technical documents
2. Specify the techniques implemented or to be implemented
3. Explain the results obtained in Project Phase I
4. Summarize the ultimate finding of the project
5. Detailed presentation of work carried out.

<b>CO- PO Mapping</b>						
<b>(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak</b>						
<b>COs</b>	<b>Programme Outcomes (POs)</b>					
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
<b>CO1</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	
<b>CO2</b>					<b>2</b>	<b>1</b>
<b>CO3</b>		<b>2</b>	<b>3</b>	<b>3</b>		
<b>CO4</b>	<b>2</b>					<b>1</b>
<b>CO5</b>			<b>2</b>		<b>2</b>	

<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>M.Tech IV Sem</b>		
<b>Code: A5133</b>	<b>PROJECT / DISSERTATION PHASE - II</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: 16</b>		<b>-</b>	<b>-</b>	<b>32</b>

**Course Objectives:** To utilize science and engineering to make product/process using innovative techniques, predict the results and prepare technical documents.

**Course Outcomes:**

At the end of the course, students should be able to

1. Identify project goals, constraints, deliverables, performance criteria, control needs and requirements.
2. Implement concepts, tools and techniques to do quality projects.
3. Adapt projects in response to issues that arise internally and externally.
4. Interact with team and stakeholders in a professional manner, respecting differences, to ensure a collaborative project environment.
5. Utilize technology tools for communication, collaboration, information management, and decision support.

<b>CO- PO Mapping</b>						
<b>(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak</b>						
<b>COs</b>	<b>Programme Outcomes (POs)</b>					
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
<b>CO1</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	
<b>CO2</b>					<b>2</b>	<b>1</b>
<b>CO3</b>		<b>2</b>	<b>3</b>	<b>3</b>		
<b>CO4</b>	<b>2</b>					<b>1</b>
<b>CO5</b>			<b>2</b>		<b>2</b>	