

**GEETHANJALI COLLEGE OF ENGINEERING AND TECHNOLOGY HYDERABAD**  
**(Autonomous)**  
**Cheeryal (V), Keesara (M), R. R. Dist., -501 301**

**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**

**M.Tech. Program in Computer Science and Engineering**

**VISION**

To produce globally competent and socially responsible computer science engineers contributing to the advancement of engineering and technology which involves creativity and innovation by providing excellent learning environment with world class facilities.

**MISSION**

1. To be a center of excellence in instruction, innovation in research and scholarship and service to the stake holders, the profession, and the public.
2. To prepare graduates to enter rapidly changing field as a competent computer science engineer.
3. To prepare graduates capable in all phases of software development, possess a firm understanding of hardware technologies, have the strong mathematical background necessary for scientific computing, be sufficiently well versed in general theory and practice to allow growth within the discipline as it advances.
4. To prepare graduates to assume leadership roles by possessing good communication skills, ability to work effectively as team members, appreciation for their social and ethical responsibility in a global setting.

**PROGRAM EDUCATION OBJECTIVES (PEOs)**

**PEO-I:** Perform with dominance in scholastics, business, design and development in computing technology, or exploration in a specific area of Computer Science and Engineering to pursue research and an appreciation for lifelong learning.

**PEO-II:** Demonstrate methodically scientific concepts and problem solving skills by applying research principles for effective decision making in handling real life problems within realistic constraints.

**PEO-III:** Ability to convey the scientific exploration or express inventive thoughts in a powerful way with familiarity, social and economic obligation with the support of domain expertise.

**PROGRAM OUTCOMES (POs)**

Students would be able to:

<b>PO 1</b>	Apply knowledge of recent computing technologies, skills and current tools of computer science and engineering.
<b>PO 2</b>	Design and conduct experiments, as well as to analyze and interpret data.
<b>PO 3</b>	Apply knowledge of contemporary research issues in the different areas of computer science & engineering
<b>PO 4</b>	Explore research gaps, analyze and carry out research in the specialized/emerging areas of computer science and engineering.
<b>PO 5</b>	Design software systems, components, or processes to meet identified needs within economic, environmental and social constraints.
<b>PO 6</b>	Express/present ideas in an impressive and professional manner.
<b>PO 7</b>	Recognize the need to engage in lifelong learning through continuing education and research.
<b>PO 8</b>	Work in multidisciplinary and multicultural environment.
<b>PO 9</b>	Become entrepreneur based upon societal needs.
<b>PO 10</b>	Exhibit professional, social and ethical responsibilities.

**ACADEMIC REGULATIONS 2016 for CBCS Based M.Tech. (Regular) Programmes**

(Effective for the students admitted into I year from the Academic Year 2016-17 onwards)

**1.0 Post-Graduate Degree (M. Tech) Programmes in Engineering**

GCET offers 2 Year (4 Semesters) full-time Master of Technology (M.Tech.) Degree programmes, under Choice Based Credit System (CBCS) at GCET Hyderabad with effect from the Academic Year 2016 - 17 onwards in the different branches of Engineering with different specializations.

**2.0 Eligibility for Admission:**

2.1 Admission to the M. Tech programme shall be made either on the basis of the Rank/Percentile earned by the candidate in the relevant qualifying GATE Examination / the Merit Rank obtained by the qualifying candidate at an Entrance Test conducted by the Telangana State Government (PGE CET) for M.Tech. Programmes / an Entrance Test conducted by the Jawaharlal Nehru Technological University Hyderabad / on the basis of any other order of merit approved by the University, subject to reservations as prescribed by the Government from time to time.

2.2 The medium of instructions for all M. Tech programmes shall be ENGLISH only.

**3.0 M.Tech. Programme Structure:**

3.1 The M.Tech. Programmes of GCET are of Semester Pattern, with 4 Semesters constituting 2 Academic Years, each Academic Year having TWO Semesters (First/Odd and Second/Even Semesters). Each Semester shall be of 21 Weeks duration (inclusive of Examinations), with a minimum of 90 Instructional Days per Semester.

3.2 UGC/ AICTE specified Definitions/ Descriptions are adopted appropriately for various terms and abbreviations used in these M. Tech Programmes - Academic Regulations.

**3.2.1 Semester Scheme:**

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

**3.2.2 Credit Courses:**

All Subjects (or Courses) are to be registered by a student in a Semester to earn Credits. Credits shall be assigned to each Subject/ Course in a L: T: P: C (Lecture Periods: Tutorial Periods: Practicals Periods : Credits) Structure, based on the following general pattern ...

- One hour/ Week/ Semester for Theory/ Lecture (L) Courses; and,
- Two hours/ Week/ Semester for Laboratory/ Practical (P) Courses or Tutorials (T).

Other student activities like Study Tour, Guest Lecture, Conference/ Workshop Participations, Technical Paper Presentations etc., and identified Mandatory Courses if any, will not carry Credits.

**3.2.3 Subject/ Course Classification:**

All Subjects/ Courses offered for the M. TECH are broadly classified as : (a) Core Courses (CoC), and (b) Elective Courses (ElC).

- Core Courses (CoC) and Elective Courses (ElC) are categorized as PS (Professional Subjects), which are further subdivided as – (i) PC (Professional/ Departmental Core) Subjects, (ii) PE (Professional/ Departmental Electives) , (iii) Seminar, (iv) Comprehensive Viva, and (v) Project Work (PW).

**3.2.4 Course Nomenclature:**

The Curriculum Nomenclature or Course-Structure Grouping for the M.Tech. Degree Programmes is as listed below ...

<i>S.No</i>	<i>Broad Course Classification</i>	<i>Course Group/ Category</i>	<i>Courses Description</i>	<i>Credits</i>
1	Core courses (CoC)	PC-Professional core	Includes core subjects related to the Parent Discipline/ Department/ Branch of Engg..	20
2	Elective Courses (ElC)	PE– Professional Electives	Includes Elective subjects related to the Parent Discipline/ Department/ Branch of Engg.	32
3	Core Courses (CC)	Project Work	M.Tech. Project or PG Project or PG Major Project	30
		Seminar	Seminar/ Colloquium based on core contents related to Parent Discipline/ Department/ Branch of Engg.	2
		Comprehensive Viva-voce	Viva-voce covering all the PG Subjects and related aspects	4
4		Communication Skills/ Soft Skills	Lab oriented	2
<b>Total Credits</b>				<b>90</b>

**4.0 Course Work:**

- 4.1 A Student, after securing admission, shall pursue and complete the M.Tech. M. TECH in a minimum period of 2 Academic Years (4 Semesters), and within a maximum period of 4 Academic Years (starting from the Date of Commencement of I Year).
- 4.2 Each student shall Register for and Secure the specified number of Credits required for the completion of the M. Tech programme and Award of the M.Tech. Degree in respective Branch of Engineering with the chosen Specialization.

4.3 I Year is structured to provide typically 28 Credits (28 C) in each of the I and II Semesters, and II Year comprises of 34 Credits (34 C), totaling to 90 Credits (90 C) for the entire M.Tech. Programme.

**5.0 Course Registration:**

5.1 A 'Faculty Advisor' shall be assigned to each M.Tech. Programme with respective Specialization, who will advise the Students about the M.Tech. Programme Specialization, its Course Structure and Curriculum, Choice/ Option for Subjects/ Courses, based on his competence, progress, pre-requisites and interest.

5.2 A Student may be permitted to Register for Subjects/ Courses of 'his CHOICE' with a typical total of 28 Credits per Semester in I Year (Minimum being 24 C and Maximum being 32 C, permitted deviation being  $\pm 15\%$ ), and 16 Credits (inclusive of Project) per III Semester in II Year (Minimum being 16 C and Maximum being 32 C), 18 credits (inclusive of Project) per IV Semester in II Year (minimum being 18 C and maximum 32 C), based on his interest, competence, progress, and 'PRE-REQUISITES' as indicated for various Subjects/ Courses, in the Department Course Structure (for the relevant Specialization) and Syllabus contents for various Subjects/ Courses.

5.3 Choice for 'additional Subjects/ Courses' in any Semester (above the typical 28/16/18 Credit norm, and within the Maximum Permissible Limit of 32/32 Credits, during I/ II Years as applicable) must be clearly indicated in the Registration, which needs the specific approval and signature of the Faculty Advisor/ Counselor on hard-copy.

5.4 Dropping of Subjects/ Courses in any Semester of I Year may be permitted, ONLY AFTER obtaining prior approval and signature from the Faculty Advisor (subject to retaining a minimum of 24 Credits), 'within 15 Days of Time' from the beginning of the current Semester.

**6.0 Attendance Requirements:**

6.1 A Student shall be eligible to appear for the End Semester Examination (SEE) of any Subject, if he acquires a minimum of 75% of attendance in that Subject for that Semester.

6.2 A Student's Seminar Report and Seminar Presentation shall be eligible for evaluation, only if he ensures a minimum of 75% of his attendance in Seminar Presentation Classes during that Semester.

6.3 Condoning of shortage of attendance up to 10% (65% and above, and below 75%) in each Subject or Seminar of a Semester may be granted by the College Academic Council on genuine and valid grounds, based on the Student's representation with supporting evidence.

6.4 A stipulated fee per Subject/Seminar shall be payable towards condoning of shortage of attendance.

6.5 Shortage of Attendance below 65% in any Subject/Seminar shall in NO case be condoned.

6.6 A Student, whose shortage of attendance is not condoned in any Subject(s) or Seminar in any Semester, is considered as 'Detained in that Subject(s)/Seminar', and is not eligible to take End Examination(s) of such Subject(s) (and in case of Seminars, his Seminar Report or Presentation are not eligible for evaluation) in that Semester; and he has to seek Re-

registration for those Subject(s)/Seminar in subsequent Semesters, and attend the same as and when offered.

**7.0 Academic Requirements:**

The following Academic Requirements have to be satisfied, in addition to the Attendance Requirements mentioned in Item No. 6.

7.1 A Student shall be deemed to have satisfied the Academic Requirements and earned the Credits allotted to each Subject/ Course, if he secures not less than 40% Marks (28 out of 70 Marks) in the End Semester Examination, and a minimum of 50% of Marks in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of Letter Grades, this implies securing B Grade or above in that Subject.

7.2 A Student shall be deemed to have satisfied the Academic Requirements and earned the Credits allotted to - Seminar, and Comprehensive Viva-voce, if he secures not less than 50% of the total marks to be awarded for each. The Student would be treated as failed, if he - (i) does not attend the

Comprehensive Viva-voce as per the schedule given, or (ii) does not present the Seminar as required, or (ii) secures less than 50% of Marks ( $< 50$  Marks) in Seminar/ Comprehensive Viva-voce evaluations. He may reappear for comprehensive viva where it is scheduled again; For seminar, he has to reappear in the next subsequent Semesters, as and when scheduled.

7.3 A Student shall - register for all Subjects covering 90 Credits as specified and listed in the Course Structure for the chosen M. TECH Specialization, put up all the Attendance and Academic requirements for securing 90 Credits obtaining a minimum of B Grade or above in each Subject, and 'earn all 90 Credits securing  $SGPA \geq 5.0$  ( in each Semester) and final CGPA (ie., CGPA at the end of M. TECH)  $\geq 5.0$ , to successfully complete the M. TECH.

7.4 Marks and Letter Grades obtained in all those Subjects covering the above specified 90 Credits alone shall be considered for the calculation of final CGPA, which shall be indicated in the Grade Card of II Year II Semester.

7.5 If a student registers for some more 'extra Subjects' (in the parent Department or other Departments/Branches of Engg.) other than those listed Subjects totaling to 90 Credits as specified in the Course Structure, the performances in those 'extra Subjects' (although evaluated and graded using the same procedure as that of the required 90 Credits) will not be taken into account while calculating the SGPA and CGPA. For such 'extra Subjects' registered, % marks and Letter Grade alone will be indicated in the Grade Card, as a performance measure, subject to completion of the Attendance and Academic Requirements as stated in Items 6 and 7.1 – 7.4 above.

7.6 Students who fail to earn 90 Credits as per the specified Course Structure, and as indicated above, within 4 Academic Years from the Date of Commencement of their I Year, shall forfeit their seats in M.Tech. Programme and their admissions shall stand cancelled.

7.7 When a Student is detained due to shortage of attendance in any Subject(s)/Seminar in any Semester, no Grade Allotment will be done for such Subject(s)/Seminar, and SGPA/ CGPA calculations of that Semester will not include the performance evaluations of such

Subject(s)/Seminar in which he got detained. However, he becomes eligible for re-registration of such Subject(s)/Seminar (in which he got detained) in the subsequent Semester(s), as and when next offered, with the Academic Regulations of the Batch into which he gets readmitted, by paying the stipulated fees per Subject. In all these re-registration cases, the Student shall have to secure a fresh set of Internal Marks (CIE) and End Semester Examination Marks (SEE) for

performance evaluation in such Subject(s), and subsequent SGPA/ CGPA calculations.

7.8 A Student eligible to appear in the End Semester Examination in any Subject, but absent at it or failed (failing to secure B Grade or above), may reappear for that Subject at the supplementary examination (SEE) as and when conducted. In such cases, his Internal Marks (CIE) assessed earlier for that Subject/ Course will be carried over, and added to the marks to be obtained in the supplementary examination (SEE), for evaluating his performance in that Subject.

### **8.0 Evaluation - Distribution and Weightage of Marks:**

8.1 The performance of a Student in each Semester shall be evaluated Subject-wise (irrespective of Credits assigned) with a maximum of 100 Marks for Theory or Practicals or Seminar or Drawing/Design or Comprehensive Viva-voce etc;

however, the M.Tech. Project Work (Major Project) will be evaluated for 200 Marks.

8.2 a) For Theory Subjects, CIE Marks shall comprise of - Mid-Term Examination Marks (for 25 Marks), and Assignment Marks (for 5 Marks).

b) During the Semester, there shall be 2 Mid-Term examinations. Each Mid-Term examination shall be for 25 Marks (with 120 minutes duration). The AVERAGE performance out of these two Mid-Term Examinations shall be considered for the award of 25 Marks.

8.3 For Practical Subjects, there shall be a Continuous Internal Evaluation (CIE) during the Semester for 30 Internal Marks, and 70 Marks are assigned for Lab./Practicals End Semester Examination (SEE). Out of the 30 Marks for Internals, day-to-day work assessment in the laboratory shall be evaluated for 20 Marks; and the performance in an internal Lab./Practical Test shall be evaluated for 10 marks. The SEE for Lab./ Practicals shall be conducted at the end of the Semester by the concerned Lab. Teacher and another faculty member of the same Department as assigned by the Head of the Department.

8.4 There shall be a Seminar Presentation in I Year I Semester or II Semester.

For the Seminar, the Student shall collect the information on a specialized topic, prepare a Technical Report and submit to the Department at the time of Seminar Presentation. The Seminar Presentation (along with the Technical Report) shall be evaluated by Two Faculty Members assigned by Head of the Department, for 100 Marks. There shall be no SEE or External Examination for Seminar.

8.5 Each Student shall appear for a Comprehensive Viva-Voce at the end of the III Semester (II Year I Semester). The Comprehensive Viva-Voce shall be conducted by a Committee, consisting of three senior faculty members of Department nominated by the Head of the

Department, and the performance evaluation shall be for 100 Marks. There are no Internal Marks for the Comprehensive Viva-voce.

- 8.6 a) Every Student shall be required to execute his M.Tech. Project, under the guidance of the Supervisor assigned to him by the Head of Department. The Project shall start immediately after the completion of the I Year II Semester, and shall continue through II Year I and II Semesters. The Student shall carry out the literature survey, select an appropriate topic and submit a Project Proposal within 6 weeks (immediately after his I Year II Semester End Examinations), for approval by the Project Review Committee (PRC). The PRC shall be constituted by the Head of Department, and shall consist of the Head of Department, Project Supervisor, and a Senior Faculty Member of the Department. The Student shall present his Project Work Proposal to the PRC (PRC-I Presentation), on whose approval he can 'REGISTER for the PG Project'. Every Student must compulsorily register for his M.Tech. Project Work, within the 6 weeks of time-frame as specified above. After Registration, the Student shall carry out his work, and continually submit 'a fortnightly progress report' to his Supervisor throughout the Project period. The PRC will monitor the progress of the Project Work and review, through PRC-II and PRC-III Presentations – one at the end of the II Year I Semester, and one before the submission of M.Tech. Project Work Report/ Dissertation.
- b) After PRC-III presentation, the PRC shall evaluate the entire performance of the Student and declare the Project Report as 'Satisfactory' or 'Unsatisfactory'. Every Project Work Report/ Dissertation (that has been declared 'satisfactory') shall undergo 'Plagiarism Check' as per the University/ College norms to ensure content plagiarism below a specified level of 30%, and to become acceptable for submission. In case of unacceptable plagiarism levels, the student shall resubmit the Project Work Report, after carrying out the necessary modifications/ additions to his Project Work/ Report as per his Supervisor's advice, within the specified time, as suggested by the PRC.
- c) If any Student could not be present for PRC-II at the scheduled time (after approval and registration of his Project Work at PRC-I), his submission and presentation at the PRC-III time (or at any other PRC specified dates) may be treated as PRC-II performance evaluation, and delayed PRC-III dates for him may be considered as per PRC recommendations. Any Student is allowed to submit his M.Tech. Project Dissertation 'only after completion of 40 weeks from the date of approval/registration' of his Project, and after obtaining all approvals from the PRC.
- d) A total of 200 Marks are allotted for the M.Tech. Project Work, ( out of which 100 Marks are allotted for internal evaluation and 100 Marks for external evaluation). For internal Evaluation of 100 marks, Project Supervisor shall evaluate for 60 marks based on the continuous Internal Evaluation(CIE) of the student's performance and combined PRC-I, II & III performance evaluation will be for 40 marks (to be awarded by PRC, as SEE).
- 8.7 a) The Student shall be allowed to submit his Project Dissertation, only on the successful completion of all the prescribed PG Subjects (Theory and Labs.), Seminar, Comprehensive Viva-voce etc. (securing B Grade or above), and after obtaining all approvals from PRC. In



such cases, the M.Tech. Dissertations will be sent to an External Examiner nominated by the Principal of the College, on whose 'approval', the Student can appear for the M.Tech. Project Viva-voce Examination, which shall be conducted by a Board, consisting of the PG Project Supervisor, Head of the Department, and the External Examiner who adjudicated the M.Tech. Project Work and Dissertation. The Board shall jointly declare the Project Work Performance as 'satisfactory', or 'unsatisfactory'; and in successful cases, the External Examiner shall evaluate the Student's Project Work presentation and performance for 100 Marks (SEE).

- b) If the adjudication report of the External Examiner is 'not favourable', then the Student shall revise and resubmit his Dissertation after one Semester, or as per the time specified by the External Examiner and/ or the PRC. If the resubmitted report is again evaluated by the External Examiner as 'not favourable', then that Dissertation will be summarily rejected. Subsequent actions for such Dissertations may be considered, only on the specific recommendations of the External Examiner and/ or PRC.
- c) In cases, where the Board declared the Project Work Performance as 'unsatisfactory', the Student is deemed to have failed in the Project Viva-voce Examination, and he has to reappear for the Viva-voce Examination as per the Board recommendations. If he fails in the second Viva-voce Examination also, he will not be considered eligible for the Award of the Degree, unless he is asked to revise and resubmit his Project Work by the Board within a specified time period (within 4 years from the date of commencement of his I Year I Semester).

## **9.0 Re-Admission / Re-Registration:**

### **9.1 Re-Admission for Discontinued Students:**

Students, who have discontinued the M.Tech. Degree Programme due to any reasons what so ever, may be considered for 'Readmission' into the same Degree Programme (with same specialization) with the Academic Regulations of the Batch into which he gets readmitted, with prior permission from the concerned authorities, subject to Item 4.1.

### **9.2 Re-Registration for Detained Students:**

When any Student is detained in a Subject (s)/ Seminar due to shortage of attendance in any Semester, he may be permitted to re-register for the same Subject in the 'same category' (Core or Elective Group) or equivalent Subject if the same Subject is not available, as suggested by the Board of Studies of that Department, as when offered in the sub-sequent Semester(s), with the Academic Regulations of the Batch into which he seeks re-registration, with prior permission from the concerned authorities, subject to Item 4.1.

## **10.0 Grading Procedure:**

10.1 Marks 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.

10.2 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:

<i>% of Marks Secured (Class Intervals)</i> 80% and above ( ≥ 80% , ≤ 100% )	<i>Letter Grade (UGC Guidelines)</i> O (Outstanding)	<i>Grade Points</i> 10
Below 80% but not less than 70% ( ≥ 70% , < 80% )	A <sup>+</sup> (Excellent)	9
Below 70% but not less than 60% ( ≥ 60% , < 70% )	A (Very Good)	8
Below 60% but not less than 55% ( ≥ 55% , < 60% )	B <sup>+</sup> (Good)	7
Below 55% but not less than 50% ( ≥ 50% , < 55% )	B (above Average)	6
Below 50% ( < 50% )	F (Fail)	0
Absent	Ab	0

10.3 A student obtaining F Grade in any Subject shall be considered ‘failed’ and is be required to reappear as ‘Supplementary Candidate’ in the Semester End Examination (SEE), as and when offered. In such cases, his Internal Marks (CIEMarks) in those Subjects will remain the same as those he obtained earlier.

10.4 A Letter Grade does not imply any specific % of Marks.

10.5 A student earns Grade Point (GP) in each Subject/ Course, on the basis of the Letter Grade obtained by him in that Subject/ Course (excluding Mandatory non-credit Courses). Then the corresponding ‘Credit Points’ (CP) are computed by multiplying the Grade Point with Credits for that particular Subject/ Course.

$$\text{Credit Points (CP)} = \text{Grade Point (GP)} \times \text{Credits} \dots \text{For a Course}$$

10.6 The Semester Grade Point Average (SGPA) is calculated by dividing the Sum of Credit Points ( $\Sigma$ 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

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

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), is the no. of Credits allotted to the ith Subject, and represents the Grade Points (GP) corresponding to the Letter Grade awarded for that ith Subject.

10.7 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 I Year second Semester onwards, at the end of each Semester, as per the formula

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

(ie., upto and inclusive of S Semesters,  $S \geq 1$  ),

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 1st 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), is the no. of Credits allotted to the jth Subject, and represents the Grade Points (GP) corresponding to the Letter Grade awarded for that jth Subject. After registration and completion of I Year I Semester however, the SGPA of that Semester itself may be taken as the CGPA, as there are no cumulative effects.

10.8 For Merit Ranking or Comparison Purposes or any other listing, ONLY the 'ROUNDED OFF' values of the CGPAs will be used.

10.9 For Calculations listed in Item 10.5 – 10.8, 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. However, Mandatory Courses will not be taken into consideration.

10.10 A student shall be declared successful or 'passed' in a Semester, only when he gets a SGPA  $\geq 5.00$  (at the end of that particular Semester); and a student shall be declared successful or 'passed' in the entire M. TECH, only when gets a CGPA  $\geq 5.00$ ; subject to the condition that he secures a GP  $\geq 6$  (B Grade or above) in every registered Subject/ Course in each Semester (during the entire M. TECH) for the Degree Award, as required.

10.11 After the completion of each Semester, a Grade Card or Grade Sheet (or Transcript) shall be issued to all the Registered Students of that Semester, indicating the Letter Grades and Credits earned. It will show the details of the Courses Registered (Course Code, Title, No. of Credits, Grade Earned etc.), Credits earned, SGPA, and CGPA.

**10.12 Passing Standards :**

10.12.1 A Student shall be declared successful or 'passed' in a Semester, only when he gets a SGPA  $\geq 5.00$  (at the end of that particular Semester); and a Student shall be declared successful or 'passed' in the entire M. TECH, only when gets a CGPA  $\geq 5.00$ ; subject to the condition that he secures a GP  $\geq 6$  (B Grade or above) in every registered Subject/ Course in each Semester (during the entire M. TECH), for the Award of the Degree, as required.

10.12.2 After the completion of each Semester, a Grade Card or Grade Sheet (or Transcript) shall be issued to all the Registered Students of that Semester, indicating the Letter Grades and Credits earned. It will show the details of the Courses Registered (Course Code, Title, No. Of Credits, Grade Earned), Credits earned, SGPA, and CGPA etc.

**11.0 Declaration of Results:**

11.1 Computation of SGPA and CGPA are done using the procedure listed in 10.5 – 10.8.

11.2 For Final % of Marks equivalent to the computed CGPA, the following formula may be used ..

$$\% \text{ of Marks} = (\text{CGPA} - 0.5) \times 10$$

**12.0 Award of Degree and Class:**

12.1 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 (M. TECH), and secures the required number of **90** Credits (with  $GP \geq 6.0$ ), 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.

**12.2 Award of Class**

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

<b>Class Awarded</b>	<b>CGPA</b>
1st Class with Distinction	$\geq 7.75$
1st Class	$6.75 \leq \text{CGPA} < 7.75$
2nd Class	$5.75 \leq \text{CGPA} < 6.75$
3rd Class	$5.0 \leq \text{CGPA} < 5.75$

12.3 A student with final CGPA (at the end of the M. TECH)  $< 5.00$  will not be eligible for the Award of Degree.

**13.0 Withholding of Results:**

13.1 If a Student has not paid fees to University/ College at any stage, or has pending dues against his name due to any reason whatsoever, or if any case of indiscipline is pending against him, the result of the Student may be withheld, and he will not be allowed to go into the next higher Semester. The Award or issue of the Degree may also be withheld in such cases.

**14.0 Transitory Regulations:**

14.1 A Student - who has discontinued for any reason, or who has been detained for want of attendance as specified, or who has failed after having undergone M. TECH, may be considered eligible for readmission to the same M. TECH with same set of Subjects/ Courses (or equivalent Subjects/ Courses as the case may be), and same Professional Electives (or from same set/category of Electives or equivalents as suggested), as and when they are offered (within the timeframe of 4 years from the Date of Commencement of his I Year I Semester).

**15.0 Student Transfers:**

15.1 There shall be no Branch/ Specialization transfers after the completion of Admission Process.

**16.0 Scope:**

- i) Where the words “he”, “him”, “his”, occur in the write-up of regulations, they include “she”, “her”, “hers”.
- ii) Where the words “Subject” or “Subjects”, occur in these regulations, they also imply “Course” or “Courses”.
- iii) The Academic Regulations should be read as a whole, for the purpose of any interpretation.
- iv) In case of any doubt or ambiguity in the interpretation of the above regulations, the decision of the Vice-Chancellor/ Principal is final.
- v) The College may change or amend the Academic Regulations, and/ or Course Structure, and/ or Syllabi at any time, and the changes or amendments made shall be applicable to all Students with effect from the dates as notified by the University/ College

	<b>Nature of Malpractices If the candidate:</b>	<b>Punishment</b>
1 (a)	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 subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
1 (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.	Expulsion from the examination hall and cancellation of the performance in that subject 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.
2	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear

	practical) in which the candidate is appearing.	for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled.
3	Impersonates any other candidate connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. 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 subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course 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 subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course 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 subject.
6	Refuses to obey the orders of the	In case of students of the college, they

	<p>Chief Superintendent / Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a 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.</p>	<p>shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.</p>
7	<p>Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.</p>	<p>Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.</p>
8	<p>Possess any lethal weapon or firearm in the examination hall.</p>	<p>Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the</p>

		<p>candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.</p> <p>The candidate is also debarred and forfeits the seat.</p>
9	<p>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.</p>	<p>Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.</p>
10	<p>Comes in a drunken condition to the examination hall.</p>	<p>Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.</p>
11	<p>Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.</p>	<p>Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester / year examinations.</p>
12	<p>If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further Action to award suitable punishment.</p>	



**18. GENERAL:**

- **Credit:** A unit 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.
- **Credit Point:** It is the product of grade point and number of credits for a course.
  - The Academic Regulations should be read as a whole for the purpose of any interpretation.
  - The University/College reserves the right of altering the Academic Regulations and/or Syllabus/Course Structure, as and when necessary. The modifications or amendments may be applicable to all the candidates on rolls, as specified by the University/College.
  - Wherever the words 'he' or 'him' or 'his' occur in the above regulations, they will also include 'she' or 'her' or 'hers'.
  - Wherever the word 'Subject' occurs in the above regulations, it implies the 'Theory Subject', 'Practical Subject' or 'Lab.' and 'Seminar'.
  - In case of any ambiguity or doubt in the interpretations of the above regulations, the decision of the Principal shall be final.

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**GEETHANJALI COLLEGE OF ENGINEERING AND TECHNOLOGY**  
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**SCHEME OF INSTRUCTION AND EXAMINATION**

**M.Tech. COMPUTER SCIENCE AND ENGINEERING**

Academic Regulations: AR-16

Academic Year 2016-17

**PROGRAM STRUCTURE**

**SEMESTER - I**

S.No.	Course Code	Course	No. of Periods per Week			Scheme of Examination with Maximum Marks			No. of Credits
			L	T	P	CIE	SEE	Tot	
1	16MCS101	Advanced Database Engineering	4	-	-	30	70	100	4
2	16MCS102	Advanced Data Structures and Algorithms	4	-	-	30	70	100	4
3	<b>Elective – I</b>		4	-	-	30	70	100	4
	16MCS103	Mobile Computing							
	16MCS104	Social Media and Web Mining							
	16MCS105	Operating System Design							
4	<b>Elective – II</b>		4	-	-	30	70	100	4
	16MCS106	Cloud Computing							
	16MCS107	Information Retrieval System							
	16MCS108	Embedded Systems							
5	<b>Elective – III</b>		4	-	-	30	70	100	4
	16MCS109	Computer Forensics							
	16MCS110	Scripting Languages							
	16MCS111	Natural Language Processing							
6	<b>Elective – IV</b>		4	-	-	30	70	100	4
	16MCS112	Software Architecture and Design Pattern							
	16MCS113	Pattern Recognition							
	16MCS114	Mobile Application Development							
7	16MCS1L1	Computing Laboratory-I	-	-	4	30	70	100	2
8	16MCS1S1	Seminar	-	-	4	100	-	100	2
<b>Total</b>			<b>24</b>	<b>0</b>	<b>8</b>	<b>310</b>	<b>490</b>	<b>800</b>	<b>28</b>
<b>Total Periods Per Week</b>			<b>32</b>						

## SEMESTER - II

S.No.	Course Code	Course	No. of Periods per Week			Scheme of Examination with Maximum Marks			No. of Credits
			L	T	P	CIE	SEE	Tot	
1	16MCS201	Advanced Computer Networks	4	-	-	30	70	100	4
2	16MCS202	Web Service and Service Oriented Architecture	4	-	-	30	70	100	4
3	<b>Elective – V</b>		4	-	-	30	70	100	4
	16MCS203	Information Security							
	16MCS204	Software Testing Methodologies							
	16MCS205	Software Project Management							
4	<b>Elective – VI</b>		4	-	-	30	70	100	4
	16MCS206	Research Methodologies							
	16MCS207	Software Design and Engineering							
	16MCS208	Speech Processing							
5	<b>Elective – VII</b>		4	-	-	30	70	100	4
	16MCS209	High Performance Computing							
	16MCS210	Ad hoc Sensor Networks							
	16MCS211	Advanced Algorithm							
6	<b>Elective – VIII</b>		4	-	-	30	70	100	4
	16MCS212	Cryptanalysis							
	16MCS213	Robotics							
	16MCS214	Bio Informatics							
	16MCS215	Big Data and Analytics							
7	16MCS2L1	Computing Laboratory-II	-	-	4	30	70	100	2
8	16MCS2S1	Soft Skills			4	100	-	100	2
<b>Total</b>			<b>24</b>	<b>0</b>	<b>08</b>	<b>310</b>	<b>490</b>	<b>800</b>	<b>28</b>
<b>Total Periods Per Week</b>			<b>32</b>						

**SEMESTER - III**

S.No.	Course Code	Course	No. of Periods per Week			Scheme of Examination with Maximum Marks			No. of Credits
			L	T	P	CIE	SEE	Tot	
1	16MCS3C1	Comprehensive Viva Voce	-	-	-	-	100	100	4
2	16MCS3P1	Project Phase -I	-	-	-	-	-	-	12*
<b>Total</b>			-	-	-	-	<b>100</b>	<b>100</b>	<b>16</b>

**SEMESTER - IV**

S.No.	Course Code	Course	No. of Periods per Week			Scheme of Examination with Maximum Marks			No. of Credits
			L	T	P	CIE	SEE	Tot	
1	16MCS4P1	Project Phase-II and Dissertation	-	-	-	100	100	200	18*
<b>Total</b>			-	-	-	<b>100</b>	<b>100</b>	<b>200</b>	<b>18</b>

\*Credits will be awarded only at the end of Semester End Examination (SEE). Marks Memo for project shall be generated only after successful completion of the project.

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**16MCS101 - ADVANCED DATABASE ENGINEERING**

**I Year. M.Tech. (CSE) – I Sem**  
**Prerequisite(s): None**

L	T	P	C
4	-	-	4

**Course Objectives**

**Enable the students to**

1. Understand the significance of integrity constraints
2. Improve the query performance
3. Gain knowledge about advanced databases and applications.

**Course Outcomes**

**At the end of the course, student would be able to**

- CO1. Design a database for an organization.
- CO2. Construct and execute optimized queries
- CO3. Apply proper security policies to data
- CO4. Handle E-Commerce transactions
- CO5. Apply object oriented features to DBMS

**UNIT- I Relational Model**

Constraints, update operations, transactions, and dealing with constraint violations. Relational database design algorithms, MVDs and 4NF, JD and 5NF, inclusion dependencies, other dependencies and normal forms.

**UNIT- II Query Processing & Optimization**

Measures of Query Cost, Selection Operation, Sorting, Join Operation, Other Operations, Evaluation of Expressions

Transformation of Relational Expressions, Estimating Statistics of Expression Results, Choice of Evaluation Plans, Materialized Views, Advanced Topics in Query Optimization.

**UNIT- III Object & Object-Relational Databases**

Concepts of Object databases, Object database standards, languages and design. Object-relational and Extended-Relational Systems.

**UNIT – IV Security, Advanced Modelling**

Database Security

Enhanced data models for advanced applications – active databases, temporal databases, spatial and multimedia databases, deductive databases.

**UNIT- V**

Advanced Transaction Processing - Transaction-Processing Monitors, Transactional Workflows, E-Commerce, Main-Memory Databases , Real-Time Transaction Systems ,Long-Duration Transactions.

Case studies: PostgreSQL, IBM DB2, Oracle, Microsoft SQL server.

**TEXT BOOK(S)**

1. Fundamentals of Database Systems, Elmasri Navate Pearson Education, V edition.
2. Data base System Concepts, Silberschatz, Korth, McGraw hill, VI edition.

**REFERENCE BOOK(S)**

1. Data base Systems design, Implementation, and Management, Peter Rob & Carlos Coronel 7th Edition.
2. Introduction to Database Systems, C.J.Date Pearson Education
3. Oracle for Professionals,The X Team,S.Shah and V.Shah,SPD.
4. Database Systems Using Oracle:A Simplified guide to SQL and PL/SQL,Shah,PHI.
5. Fundamentals of Database Management Systems,M.L.Gillenson,Wiley Student Edition.

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**16MCS102-ADVANCED DATA STRUCTURES AND ALGORITHMS**  
I Year. M.Tech. (CSE) – I Sem

**Prerequisite(s):**

- A course on “Computer Programming & Data Structures”
- A course on “ Design & Analysis of Algorithms”

L	T	P	C
4	-	-	4

**Course Objectives**

1. Introduces the notations for analysis of the complexities of algorithms
2. Introduces the amortized analysis
3. Introduces the heap data structures such as leftist trees, binomial heaps, fibonacci and min-max heaps
4. Introduces the randomized, approximation and non deterministic algorithms
5. Introduces a variety of data structures such as disjoint sets, hash tables, search structures and digital search structures

**Course Outcomes**

- CO1. Ability to analyze the performance of algorithms
- CO2. Ability to select the data structures that efficiently model the information in a problem
- CO3. Ability to understand how the choice of data structures impact the performance of programs
- CO4. Can Design programs using a variety of data structures, including hash tables, search structures and digital search structures

**UNIT-I**

Algorithm analysis: Asymptotic notations, Recurrence analysis, Masters Theorem, Amortized analysis, Disjoint sets.

Randomized Algorithms –Introduction, n-queens problem, quick sort.

**UNIT-II**

Heap Structures- Min-Max Heaps, Leftist trees, Binomial Heaps, Fibonacci heaps. Hashing.

**UNIT-III**

Search Structures- OBST, AVL trees, Red-Black trees, Splay trees, B-trees.

**UNIT-IV**

Digital Search Structures - Digital Search trees, Binary tries and Patricia, Multiway Tries, Suffix trees.

Approximation Algorithms: Planar graph colouring, Job Scheduling, TSP.

**UNIT-V**

NP-Hard and NP-complete: Non-deterministic algorithms – Searching, Sorting, Knapsack decision problem, Satisfiability problem, NP - Complete Problems- clique problem, Vertex cover problem, TSP.

**TEXT BOOK(S)**

1. Fundamentals of Data structures in C++ Sahni, Horowitz, Mehatha, Universities Press.
2. Introduction to Algorithms, TH Cormen, PHI.

**REFERENCE BOOK(S)**

1. Design methods and analysis of Algorithms, SK Basu, PHI.
2. Data Structures & Algorithm Analysis in C++, Mark Allen Weiss, Pearson Education.
3. Fundamentals of Computer Algorithms, 2<sup>nd</sup> Edition, Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, Universities Press.



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**16MCS103-MOBILE COMPUTING**  
Elective-I

L	T	P	C
4	-	-	4

**I Year. M.Tech. (CSE) – I Sem**

**Prerequisite(s):**

- Computer Networks
- Distributed Systems / Distributed Operating Systems

**Course Objectives:**

1. To make the student understand the concept of mobile computing paradigm, its novel applications and limitations.
2. To understand the typical mobile networking infrastructure through a popular GSM protocol
3. To understand the issues and solutions of various layers of mobile networks, namely MAC layer, Network Layer & Transport Layer
4. To understand the database issues in mobile environments & data delivery models.
5. To understand the ad hoc networks and related concepts.
6. To understand the platforms and protocols used in mobile environment.

**Course Outcomes:**

1. Able to think and develop new mobile applications
2. Able to develop new ad hoc network applications and/or algorithms.
3. Able to understand & develop any existing or new protocol related to mobile environment

**UNIT I Introduction**

Mobile Communications, Mobile Computing – Paradigm, Promises/Novel Applications and Impediments and Architecture; Mobile and Handheld Devices, Limitations of Mobile and Handheld Devices.

GSM – Services, System Architecture, Radio Interfaces, Protocols, Localization, Calling, Handover, Security, New Data Services, GPRS, CSHSD, DECT.

**UNIT –II(Wireless) Medium Access Control (MAC)**

Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), SDMA, FDMA, TDMA, CDMA, Wireless LAN/(IEEE 802.11)

**Mobile Network Layer**

IP and Mobile IP Network Layers, Packet Delivery and Handover Management, Location Management, Registration, Tunneling and Encapsulation, Route Optimization, DHCP.

**UNIT –III**

**Mobile Transport Layer**

Conventional TCP/IP Protocols, Indirect TCP, Snooping TCP, Mobile TCP, Other Transport Layer Protocols for Mobile Networks.

**Database Issues**

Database Hoarding & Caching Techniques, Client-Server Computing & Adaptation, Transactional Models, Query processing, Data Recovery Process & QoS Issues.

**UNIT IV Data Dissemination and Synchronization**

Communications Asymmetry, Classification of Data Delivery Mechanisms, Data Dissemination, Broadcast Models, Selective Tuning and Indexing Methods, Data Synchronization – Introduction, Software, and Protocols

**UNIT V Mobile Ad hoc Networks (MANETs)**

Introduction, Applications & Challenges of a MANET, Routing, Classification of Routing Algorithms, Algorithms such as DSR, AODV, DSDV, Mobile Agents, Service Discovery.

**Protocols and Platforms for Mobile Computing**

WAP, Bluetooth, XML, J2ME, JavaCard, PalmOS, Windows CE, SymbianOS, Linux for Mobile Devices, Android.

**TEXT BOOK(S)**

1. Jochen Schiller, “Mobile Communications”, Addison-Wesley, Second Edition, 2009.
2. Raj Kamal, “Mobile Computing”, Oxford University Press, 2007, ISBN: 0195686772.

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**16MCS104-SOCIAL MEDIA AND WEB MINING**  
Elective- I

**I Year. M.Tech. (CSE) – I Sem**

L	T	P	C
4	-	-	4

**Prerequisite(s):**

- Web Mining

**Course Objectives:**

1. The purpose of this course is to provide the students with knowledge of social media & web mining principles and techniques.
2. This course is also designed to give an exposure of the frontiers of social media web mining (Face book, twitter)
3. To introduce new technology for data analytics

**Course Outcomes:**

- CO1. Ability to understand social media and its data.
- CO2. Ability to apply mining technologies on twitter, facebook, LinkedIn and Googlet.
- CO3. Ability to apply web mining technologies, NLP concepts to summarize, mine data on webpage, blogs.
- CO4. Ability to Program using “R“ and the tool Twitter ‘R’

**UNIT-1:**

Social media mining, Fundamentals, new challenges, key concepts, Good Data vs Bad Data, understanding sentiments, Sentiment Analysis, Classification, supervised social media mining, unsupervised social media mining, human sensors under honest signals.

**UNIT-2:**

Recommendation in Social Media, Challenges, Classical Recommendation Algorithms, Recommendation Using Social Context, Evaluating Recommendations.

**UNIT-3:**

Mining Twitter: Exploring Trending Topics, Discovering What People Are Talking About, Mining Face book: Analyzing Fan Pages, Examining Friendships, Mining LinkedIn: Faceting Job Titles, Clustering Colleagues, Mining Google+: Computing Document Similarity, Extracting Collocations.

**UNIT-4:**

Mining Web Pages: web content mining, web structure mining, web usage mining, Natural Language Processing to Understand Human Language, Summarize Blog Posts, Mining Mailboxes, Mining GitHub, Inspecting Software Collaboration Habits, Building Interest Graphs, Mining the Semantically Marked-Up Web: Extracting Micro formats, Inference over RDF.

**UNIT-5:**

Getting started with R:Why R?, Quick start, The basics-Assignment and Arithmetic, Functions, Arguments and help vectors, sequences and combining vectors, creating data frames and importing files, Visualization in Rstyle and workflow, Mining Twitter with R:why Twitter data? Obtaining Twitter data, preliminary analyses.

**TEXT BOOK(S)**

1. Mining the Social Web, 2nd Edition Data Mining Face book, Twitter, LinkedIn, Google+, GitHub, and More By Matthew A. Russell Publisher: O'Reilly Media.
2. Social Media Mining with R [Kindle Edition] NATHAN DANNEMAN RICHARD HEIMANN

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**16MCS105-OPERATING SYSTEM DESIGN**  
**Elective- I**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>	<b>-</b>	<b>-</b>	<b>4</b>

**I Year. M.Tech. (CSE) – I Sem**

**Prerequisite(s)**

- A course on “Operating Systems”
- A course on “Computer Programming and Data Structures”
- A course on “Computer Organization and Architecture”

**Course Objectives**

1. Provide an introduction to operating system concepts (i.e., processes, threads, scheduling, synchronization, deadlocks, memory management, file and I/O subsystems and protection)
2. Introduce the issues to be considered in the design and development of operating system
3. Introduce inter process communication and I/O Devices.

**Course Outcomes**

- CO1. Will be able to control access to a computer and the files that may be shared
- CO2. Demonstrate the knowledge of the components of computer and their respective roles in computing.
- CO3. Ability to recognize and resolve user problems with standard operating environments.
- CO4. Gain practical knowledge of how programming languages, operating systems, and architectures interact and how to use each effectively.
- CO5. Understanding Resource Management and Security.
- CO6. Getting knowledge about Device drivers.

**UNIT - I: PROCESSES AND SCHEDULING**

Process States and System Call Interface; Life Cycle of a Process; Process Dynamics; Scheduler: working and implementation; Linux Process States and System Calls; Process Groups, Sessions,Foreground and Background Processes.

**UNIT - II: INTERPROCESS COMMUNICATION AND SYNCHRONISATION**

Signals, Pipes and Named Pipes (FIFOs); Threads and pthread library; Mutexes and Condition Variables; Semaphores; Producer-Consumer Problem and Solutions using mutexes, condition variables and semaphores.

**UNIT - III: FILES AND FILE SYSTEMS**

File and File Meta-data; File Naming Systems; File System Operations; File System Implementation; File System Structures; Booting an OS; File System Optimisation.

**UNIT - IV: DEVICES AND DEVICE DRIVERS**

Devices and Types of Devices; Terminal, Disk, SCSI, Tape and CD devices; Unification of Files

and Devices; Device Drivers: Concepts and Implementation Details.

**UNIT - V: RESOURCE MANAGEMENT AND SECURITY**

Resource Management Issues; Types of Resources; Integrated Resource Scheduling; Queuing Models of Scheduling; Protection of Resources – hardware, software, and attacks; Security Policies.

**TEXT BOOK(S)**

1. Charles Crowley. *Operating Systems: A Design-Oriented Approach*, Tata McGraw-Hill (2001 or later)
2. Richard Stevens, Stephen Rago. *Advanced Programming in the Unix Environment*, Addison-Wesley (2013).

**REFERENCE BOOK(S)**

1. Maekawa, M. and Arthur E. Oldehoeft and Oldehoeft, R.R. *Operating Systems: Advanced Concepts*, Benjamin Cummings (1987). Available through Google Books.
2. David A. Rusling. *The Linux Kernel*, <http://www.tldp.org/LDP/tlk/tlk.html>

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**16MCS106-CLOUD COMPUTING**  
**Elective – II**

**I Year. M.Tech. (CSE) – I Sem**

L	T	P	C
4	-	-	4

**Prerequisite(s)**

- A course on “Computer Networks”
- A course on “Operating Systems”

**Course Objectives**

1. This course provides an insight into cloud computing
2. Topics covered include- distributed system models, different cloud service models, service oriented architectures, cloud programming and software environments, resource management.

**Course Outcomes**

- CO1. Ability to understand various service delivery models of a cloud computing architecture.
- CO2. Ability to understand the ways in which the cloud can be programmed and deployed.
- CO3. Understanding cloud service providers.

**UNIT I:**

**Computing Paradigms,** High-Performance Computing, Parallel Computing. Distributed Computing. Cluster Computing. Grid Computing, Cloud Computing. Bio computing, Mobile Computing. Quantum Computing, Optical Computing. Nano computing.

**UNIT II:**

**Cloud Computing Fundamentals:** Motivation for Cloud Computing, The Need for Cloud Computing, Defining Cloud Computing, Definition of Cloud computing, Cloud Computing Is a Service, Cloud Computing Is a Platform, Principles of Cloud computing, Five Essential Characteristics...Four Cloud Deployment Models

**UNIT III:**

**Cloud Computing Architecture and Management:** Cloud architecture, Layer, Anatomy of the Cloud, Network Connectivity in Cloud Computing, Applications, on the Cloud, Managing the Cloud, Managing the Cloud Infrastructure Managing the Cloud application, Migrating Application to Cloud, Phases of Cloud Migration Approaches for Cloud Migration.

**UNIT IV:**

**Cloud Service Models:** Infrastructure as a Service, Characteristics of IaaS. Suitability of IaaS, Pros and Cons of IaaS, Summary of IaaS Providers, Platform as a Service, Characteristics of PaaS, Suitability of PaaS, Pros and Cons of PaaS, Summary of PaaS Providers, Software as a Service, Characteristics of SaaS, Suitability of SaaS, Pros and Cons of SaaS, Summary of SaaS Providers. Other Cloud Service Models

**UNIT V:**

**Cloud Service Providers:** EMC, EMC IT, Captiva Cloud Toolkit, Google, Cloud Platform, Cloud Storage, Google Cloud Connect, Google Cloud Print, Google App Engine, Amazon Web Services, Amazon Elastic Compute Cloud, Amazon Simple Storage Service, Amazon Simple Queue ,service, Microsoft, Windows Azure, Microsoft Assessment and Planning Toolkit, SharePoint, IBM, Cloud Models, IBM Smart Cloud, SAP Labs, SAP HANA Cloud Platform, Virtualization Services Provided by SAP, Sales force, Sales Cloud, Service Cloud: Knowledge as a Service, Rack space, VMware, Manjra soft, Aneka Platform

**TEXT BOOK(S)**

1. Essentials of cloud Computing : K.Chandrasekhran , CRC press, 2014

**REFERENCE BOOK(S)**

1. Cloud Computing: Principles and Paradigms by Rajkumar Buyya, James Broberg and Andrzej M. Goscinski, Wiley, 2011.
2. Distributed and Cloud Computing , Kai Hwang, Geoffery C.Fox, Jack J.Dongarra, Elsevier, 2012.
3. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, Subra Kumaraswamy, Shahed Latif, O'Reilly, SPD, rp2011.



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**16MCS107-INFORMATION RETRIEVAL SYSTEMS**  
Elective- II

I Year. M.Tech. (CSE) – I Sem

L	T	P	C
4	-	-	4

**Prerequisite(s):**

- Data Structures

**Course Objectives:**

1. To learn the important concepts and algorithms in IRS
2. To understand the data/file structures that are necessary to design, and implement information retrieval (IR) systems.

**Course Outcomes:**

- CO1. Ability to apply IR principles to locate relevant information large collections of data
- CO2. Ability to design different document clustering algorithms
- CO3. Implement retrieval systems for web search tasks.
- CO4. Design an Information Retrieval System for web search tasks.

**UNIT I**

**Introduction:** Motivation, Basic Concepts, Past-Present and Future, the Retrieval Process  
**Modeling:** Introduction, A Taxonomy of Information retrieval Models, Retrieval: Ad hoc and Filtering, A Formal Characteristics of IR Models, Classic Information Retrieval, Alternative Set Theory Models, Alternative Probabilistic Models, Structured Text Retrieval Models, Model for Browsing

**UNIT II**

**Retrieval Evaluation:** Introduction, retrieval Performance Evaluation, Reference Collections  
**Query languages:** Introduction, Keyword-Based Querying, Pattern Matching, Structural Queries, Query Protocols  
**Query Operations:** Introduction, User Relevance Feedback, Automatic Local Analysis, Automatic global Analysis  
**Text Operations:** Introduction, Document Preprocessing, Document Clustering, Text Compression, Comparing text Compression Techniques

**UNIT III**

**Indexing and Searching:** Introduction, Inverted Files, Other Indices for Text, Boolean queries, Sequential Searching, pattern Matching, Structural Queries, Compression  
Searching the Web: Introduction, Challenges, Characterizing the Web, Search Engines, Browsing, Metasearches, Finding the Needle in the Haystack, Searching using Hyperlinks

**UNIT IV**

**User Interfaces and Visualization:** Introduction, human-Computer Interaction, The Information Access Process, Starting Points, Query Specification, Context, User Relevance Judgments, Interface Support for the Search Process

**UNIT V**

**Multimedia IR: Models and Languages,** Introduction, Data Modeling, Query Languages  
**Multimedia IR: Indexing and Searching,** Introduction, Background-Spatial Access Methods, A Generic Multimedia Indexing Approach, One Dimensional Time Series, two dimensional Color Images, Automatic Feature Extraction.

**TEXT BOOK(S)**

1. Modern Information Retrieval By Yates and Neto Pearson Education.

**REFERENCE BOOK(S)**

1. Kowalski, Gerald, Mark T Maybury: Information Retrieval Systems: Theory and Implementation, Kluwer Academic Press, 1997.
2. Frakes, W.B., Ricardo Baeza-Yates: Information Retrieval Data Structures and Algorithms, Prentice Hall, 1992.
3. Information Storage & Retrieval By Robert Korfhage – John Wiley & Sons.

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**16MCS108-EMBEDDED SYSTEMS**  
Elective -II

L	T	P	C
4	-	-	4

**I Year. M.Tech. (CSE) – I Sem**

**Prerequisite(s)**

- Assembly language and C programming language.
- Sequential Logic Concepts
- Basic Computer Organization

**Course Objectives**

1. To introduce the students to the modern embedded systems and to show how to understand and program such systems using a concrete platform built around.
2. To introduce RTOS and its application.

**Course Outcomes**

Students would be able to

- CO1. Describe the differences between the general computing system and the embedded system, also recognize the classification of embedded systems..
- CO2. Design the real time embedded systems using the concepts of RTOS.
- CO3. Analyze various examples of embedded systems
- CO4. Programs in C/C++ for embedded systems.

**UNIT - 1 : INTRODUCTION TO EMBEDDED SYSTEMS**

Definition and Classification - Overview of Processors and hardware units in an embedded system - Software embedded into the system - Exemplary Embedded Systems - Embedded Systems on a Chip (SoC) and the use of VLSI designed circuits.

**UNIT - 2 : DEVICES AND BUSES FOR DEVICES NETWORK**

I/O Devices - Device I/O Types and Examples - Synchronous - Iso-synchronous and Asynchronous Communications from Serial Devices - Examples of Internal Serial-Communication Devices - UART and HDLC - Parallel Port Devices - Sophisticated interfacing features in Devices/Ports- Timer and Counting Devices - '12C', 'USB', 'CAN' and advanced I/O Serial high speed buses- ISA, PCI, PCI-X, cPCI and advanced buses.

**UNIT-3:PROGRAMMING CONCEPTS AND EMBEDDED PROGRAMMING IN C, C++**

Programming in assembly language (ALP) vs. High Level Language - C Program Elements, Macros and functions -Use of Pointers - NULL Pointers - Use of Function Calls - Multiple function calls in a Cyclic Order in the Main Function Pointers - Function Queues and Interrupt Service Routines Queues Pointers - Concepts of EMBEDDED PROGRAMMING in C++ - Objected Oriented Programming - Embedded Programming in C++, 'C' Program compilers - Cross compiler - Optimization of memory codes.

**UNIT - 4 : REAL TIME OPERATING SYSTEMS - PART - 1**

Definitions of process, tasks and threads - Clear cut distinction between functions - ISRs and tasks by their characteristics - Operating System Services- Goals - Structures- Kernel - Process Management - Memory Management - Device Management - File System Organisation and Implementation - I/O Subsystems - Interrupt Routines Handling in RTOS, REAL TIME OPERATING SYSTEMS : RTOS Task scheduling models - Handling of task scheduling and latency and deadlines as performance metrics - Co-operative Round Robin Scheduling - Cyclic Scheduling with Time Slicing (Rate Monotonics Co-operative Scheduling) - Preemptive Scheduling Model strategy by a Scheduler - Critical Section Service by a Preemptive Scheduler - Fixed (Static) Real time scheduling of tasks - INTER PROCESS COMMUNICATION AND SYNCHRONISATION - Shared data problem - Use of Semaphore(s) - Priority Inversion Problem and Deadlock Situations - Inter Process Communications using Signals - Semaphore Flag or mutex as Resource key - Message Queues - Mailboxes - Pipes - Virtual (Logical) Sockets - Remote Procedure Calls (RPCs).

**UNIT - 5 : REAL TIME OPERATING SYSTEMS - PART - 2**

Study of Micro C/OS-II or Vx Works or Any other popular RTOS - RTOS System Level Functions - Task Service Functions - Time Delay Functions - Memory Allocation Related Functions - Semaphore Related Functions - Mailbox Related Functions - Queue Related Functions - Case Studies of Programming with RTOS - Understanding Case Definition - Multiple Tasks and their functions - Creating a list of tasks - Functions and IPCs - Exemplary Coding Steps.

**TEXT BOOK(S)**

1. Rajkamal, Embedded Systems Architecture, Programming and Design, TATA McGraw-Hill, First reprint Oct. 2003

**REFERENCE BOOK(S)**

2. Steve Heath, Embedded Systems Design, Second Edition-2003
3. David E.Simon, An Embedded Software Primer, Pearson Education Asia, First Indian Reprint 2000.
4. Wayne Wolf, Computers as Components; Principles of Embedded Computing System Design - Harcourt India, Morgan Kaufman Publishers, First Indian Reprint 2001
5. Frank Vahid and Tony Givargis, Embedded Systems Design - A nified Hardware Software Introduction, John Wiley, 2002.

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**16MCS109-COMPUTER FORENSICS**  
**Elective – III**

**I Year. M.Tech. (CSE) – I Sem**

L	T	P	C
4	-	-	4

**Prerequisite(s): None**

**Course Objectives:**

1. To understand the cyberspace
2. To gain knowledge on fundamentals of computer forensics
3. To understand the evidence capturing process
4. To understand the preservation of digital evidence

**Course Outcomes:**

- CO1. Ability to understand the computer forensics evidence, capture and data recovery
- CO2. Ability to understand the current computer forensics tools
- CO3. Ability to apply forensics tools in the event of cyber crime.

**UNIT I : Computer Forensics Fundamentals:** Introduction to Computer Forensics, **HYPERLINK** "<https://www.safaribooksonline.com/library/view/computer-forensics-computer/9781584503897/ch01.html#ch01lev1sec2>" **Use of Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources/Employment Proceedings, Computer Forensics Services, Benefits of Professional Forensics Methodology, Steps Taken by Computer Forensics Specialists, Who Can Use Computer Forensic Evidence?.**

**Types of Computer Forensics Technology :** Types of Military Computer Forensic Technology, Types of Law Enforcement Computer Forensic Technology, Types of Business Computer Forensics Technology.

**UNIT II : Computer Forensics Evidence and Capture: Data Recovery:** Data Recovery Defined, Data Backup and Recovery, The Role of Backup in Data Recovery, The Data-Recovery Solution, Case Histories. **Evidence Collection and Data Seizure:** Why Collect Evidence?, Collection Options, Obstacles, Types of Evidence, The Rules of Evidence, Volatile Evidence, General Procedure, Collecting and Archiving, Methods of Collection, Artifacts, Collection Steps, Controlling Contamination: The Chain of Custody.

**UNIT III: Duplication and Preservation of Digital Evidence:** Preserving the Digital Crime Scene, Computer Evidence Processing Steps, Legal Aspects of Collecting And Preserving Computer Forensic Evidence. **Computer Image Verification and Authentication :** Special Needs of Evidential Authentication, Practical Considerations, Practical Implementation.

**UNIT IV: Computer Forensics Analysis: Discovery of Electronic Evidence:** Electronic Document Discovery: A Powerful New Litigation Tool, **Identification of Data:** Timekeeping,

Time Matters, Forensic Identification and Analysis of Technical Surveillance Devices. **Reconstructing Past Events:** How to Become a Digital Detective, **Usable File Formats,** Unusable File Formats, Converting Files. **Networks:** Network Forensics Scenario, A Technical Approach, Destruction of Email, Damaging Computer Evidence, International Principles Against Damaging of Computer Evidence, Tools Needed for Intrusion Response to the Destruction of Data, Incident Reporting and Contact Forms.

**UNIT V: Current Computer Forensics Tools:** Evaluating Computer Forensics Tool Needs, Computer Forensics Software Tools, Computer Forensics Hardware Tools, Validating and Testing Forensics Software.

**TEXT BOOK(S)**

1. “Computer Forensics : Computer Crime Scene Investigation”, JOHN R. VACCA, Firewall Media.
2. “Guide to Computer Forensics and Investigations”4e, Nelson, Phillips Enfinger, Steuart, Cengage Learning.

**REFERENCE BOOK(S)**

1. “Computer Forensics and Cyber Crime”, Marjie T Britz, Pearson Education.
2. “Computer Forensics”, David Cowen, Mc Graw Hill.

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**16MCS110-SCRIPTING LANGUAGES**  
**Elective- III**

**I Year. M.Tech. (CSE) – I Sem**

L	T	P	C
4	-	-	4

**Prerequisite(s)**

- A course on “Computer Programming and Data Structures”
- A course on “Object Oriented Programming Concepts”

**Course Objectives**

1. This course provides an introduction to the script programming paradigm
2. Introduces scripting languages such as Perl, PHP and Python.
3. Learning TCL

**Course Outcomes**

- CO1. Comprehend the differences between typical scripting languages and application programming languages. Acquire programming skills using scripting languages.
- CO2. Gain knowledge of the strengths and weakness of Perl, PHP, TCL and Python; and select an appropriate language for solving a given problem
- CO3. Ability to design web pages using advanced features of PHP.

**UNIT – I Introduction to PERL and Scripting**

Scripts and Programs, Origin of Scripting , Scripting Today, Characteristics of Scripting Languages, Uses for Scripting Languages, Web Scripting, and the universe of Scripting Languages. PERL- Names and Values, Variables, Scalar Expressions, Control Structures, arrays, list, hashes, strings, pattern and regular expressions, subroutines.

**UNIT – II Advanced perl**

Finer points of looping, pack and unpack, filesystem, eval, datastructures, packages, modules, objects, interfacing to the operating system, Creating Internet ware applications, Dirty Hands Internet Programming, security Issues.

**UNIT – III PHP Basics**

PHP Basics- Features, Embedding PHP Code in your Web pages, Outputting the data to the browser, Datatypes, Variables, Constants, expressions, string interpolation, control structures. Function, Creating a Function, Function Libraries, Arrays, strings and Regular Expressions. PHP and Web Forms, Files, PHP Authentication and Methodologies -Hard Coded, File Based, Database Based, IP Based, Login Administration, Uploading Files with PHP, Sending Email using PHP, PHP Encryption Functions, the Mcrypt package, Building Web sites for the World.

**UNIT - IV TCL**

TCL Structure, syntax, Variables and Data in TCL, Control Flow, Data Structures, input/output, procedures , strings , patterns, files, Advance TCL- eval, source, exec and uplevel commands,

Name spaces, trapping errors, event driven programs, making applications internet aware, Nuts and Bolts Internet Programming, Security Issues, C Interface.

**Tk:**Tk-Visual Tool Kits, Fundamental Concepts of Tk, Tk by example, Events and Binding , Perl-Tk.

### **UNIT – V Python**

Introduction to Python language, python-syntax, statements, functions, Built-in-functions and Methods, Modules in python,Exception Handling. Integrated Web Applications in Python – Building Small, Efficient Python Web Systems ,Web Application Framework.

### **TEXT BOOK(S)**

1. The World of Scripting Languages , David Barron,Wiley Publications.
2. Beginning PHP and MySQL , 3<sup>rd</sup> Edition , Jason Gilmore,Apress Publications (Dream tech.).
3. Python Web Programming, Steve Holden and David Beazley ,New Riders Publications.

### **REFERENCE BOOK(S)**

1. Open Source Web Development with LAMP using Linux Apache,MySQL,Perl and PHP,J.Lee and B.Ware(Addison Wesley) Pearson Education.
2. Programming Python,M.Lutz,SPD.
3. PHP 6 Fast and Easy Web Development ,Julie Meloni and Matt Telles, Cengage Learning Publications.
4. PHP 5.1,I.Bayross and S.Shah,The X Team,SPD.
5. Core Python Programming,Chun,Pearson Education.
6. Guide to Programming with Python,M.Dawson,Cengage Learning.
7. Perl by Example,E.Quigley,Pearson Education.
8. Programming Perl,Larry Wall,T.Christiansen and J.Orwant, O'Reilly, SPD.
9. Tcl and the Tk Tool kit,Ousterhout,Pearson Education.
10. PHP and MySQL by Example,E.Quigley,Prentice Hall(Pearson).
11. Perl Power,J.P.Flynt,Cengage Learning.
12. PHP Programming solutions,V.Vaswani,TMH.



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**16MCS111-NATURAL LANGUAGE PROCESSING**  
Elective- III

**I Year. M.Tech. (CSE) – I Sem**

L	T	P	C
4	-	-	4

**Prerequisite(s):**

- Data structures, finite automata and probability theory

**Course Objectives:**

1. Introduce to some of the problems and solutions of NLP and their relation to linguistics and statistics.

**Course Outcomes:**

- CO1. Show sensitivity to linguistic phenomena and an ability to model them with formal grammars.
- CO2. Understand and carry out proper experimental methodology for training and evaluating empirical NLP systems
- CO3. Able to manipulate probabilities, construct statistical models over strings and trees, and estimate parameters using supervised and unsupervised training methods.
- CO4. Able to design, implement, and analyze NLP algorithms
- CO5. Able to design different language modeling Techniques.

**UNIT I : Finding the Structure of Words**

Words and Their Components, Issues and Challenges, Morphological Models

**Finding the Structure of Documents**

Introduction, Methods, Complexity of the Approaches, Performances of the Approaches

**UNIT II: Syntax**

Parsing Natural Language, Treebanks: A Data-Driven Approach to Syntax, Representation of Syntactic Structure, Parsing Algorithms, Models for Ambiguity Resolution in Parsing, Multilingual Issues

**UNIT III: Semantic Parsing**

Introduction, Semantic Interpretation, System Paradigms, Word Sense  
Recourse, Systems, Software.

**UNIT IV**

Predicate-Argument Structure, Meaning Representation, Recourse, Systems, Software.

**UNIT V : Language Modeling**

Introduction, N-Gram Models, Language Model Evaluation, Parameter Estimation, Language Model Adaptation, Types of Language Models, Language-Specific Modeling Problems,

Multilingual and Crosslingual Language Modeling

**TEXT BOOK(S)**

1. Multilingual natural Language Processing Applications : From Theory to Practice – Daniel M. Bikel and Imed Zitouni, Pearson Publication

**REFERENCE BOOK(S)**

1. Speech and Natural Language Processing - Daniel Jurafsky & James H Martin, Pearson Publications

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**16MCS112-SOFTWARE ARCHITECTURE AND DESIGN PATTERNS**  
Elective - IV

I Year. M.Tech. (CSE) – I Sem

L	T	P	C
4	-	-	4

**Prerequisite:**

- A course On “Software Engineering”

**Course Objectives:**

1. To understand the concept of patterns and the Catalog.
2. To discuss the Presentation tier design patterns and their affect on: sessions, client access, validation and consistency.
3. To understand the variety of implemented bad practices related to the Business and Integration tiers.
4. To highlight the evolution of patterns.

**Course Outcomes:**

- CO1. Ability to add functionality to designs while minimizing complexity
- CO2. Understand what design patterns really are, and are not
- CO3. Learn specific design patterns.
- CO4. Able to design patterns to keep code quality high without overdesign.

**UNIT I**

**Envisioning Architecture**

The Architecture Business Cycle, What is Software Architecture, Architectural patterns, reference models, reference architectures, architectural structures and views.

**Creating an Architecture**

Quality Attributes, Achieving qualities, Architectural styles and patterns, designing the Architecture, Documenting software architectures, Reconstructing Software Architecture.

**UNIT II**

**Analyzing Architectures**

Architecture Evaluation, Architecture design decision making, ATAM, CBAM.

**UNIT III**

**Moving from one system to many**

Software Product Lines, Building systems from off the shelf components, Software architecture in future.

## **UNIT IV**

### **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.

## **UNIT V**

### **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, The World Wide Web - a case study in interoperability, Air Traffic Control – a case study in designing for high availability, Celsius Tech – a case study in product line development

### **TEXT BOOK(S)**

1. Software Architecture in Practice, second edition, Len Bass,Pau Clements&Rick Kazman, Pearson Education,2003.
2. Design Patterns, Erich Gamma, Pearson Education, 1995.

### **REFERENCE BOOK(S)**

1. Beyond Software architecture, Luke Hohmann, Addison wesley, 2003.
2. Software architecture, David M. Dikel, David Kane and James R. Wilson, Prentice Hall PTR, 2001
3. Software Design, David Budgen, second edition, Pearson education, 2003
4. Head First Design patterns, Eric Freeman & Elisabeth Freeman, O'REILLY, 2007.
5. Design Patterns in Java, Steven John Metsker & William C. Wake, Pearson education, 2006
6. J2EE Patterns, Deepak Alur, John Crupi & Dan Malks, Pearson education, 2003.
7. Design Patterns in C#, Steven John metsker, Pearson education, 2004.

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**16MCS113-PATTERN RECOGNITION**  
Elective- IV

L	T	P	C
4	-	-	4

I Year. M.Tech. (CSE) – I Sem

**Prerequisite(s)**

- Students are expected to have knowledge basic linear algebra, basic probability theory and basic programming techniques;
- A course on “Computational Mathematics”
- A course on “Computer Oriented Statistical Methods”

**Course Objectives**

1. This course introduces fundamental concepts, theories, and algorithms for pattern recognition and machine learning.
2. Topics include: Pattern Representation, Nearest Neighbor Based Classifier, Bayes Classifier, Hidden Markov Models, Decision Trees, Support Vector Machines, Clustering, and an application of hand-written digit recognition.

**Course Outcomes**

- CO1. Understand the theory, benefits, inadequacies and possible applications of various machine learning and pattern recognition algorithms
- CO2. Identify and employ suitable machine learning techniques in classification, pattern recognition, clustering and decision problems.

**UNIT-I: Introduction:** What is Pattern Recognition, Data Sets for Pattern Recognition, Different Paradigms for Pattern Recognition.

**Representation:** Data Structures for Pattern Representation, Representation of Clusters, Proximity Measures, Size of Patterns, Abstractions of the Data Set, Feature Extraction, Feature Selection, Evaluation of Classifier, Evaluation of Clustering.

**UNIT-II: Nearest Neighbor Based Classifier:** Nearest Neighbor Algorithm, Variants of the NN Algorithm use of the Nearest Neighbor Algorithm for Transaction Databases, Efficient Algorithms, Data Reduction, Prototype Selection.

**Bayes Classifier:** Bayes Theorem, Minimum Error Rate Classifier, Estimation of Probabilities, Comparison with the NNC, Naïve Bayes Classifier, Bayesian Belief Network.

**UNIT-III: Hidden Markov Models:** Markov Models for Classification, Hidden Markov Models, Classification using HMMs.

**Decision Trees:** Introduction, Decision Tree for Pattern Classification, Construction of Decision

Trees, Splitting at the Nodes, Overfitting and Pruning, Examples of Decision Tree Induction.

**UNIT-IV: Support Vector Machines:** Introduction, Learning the Linear Discriminant Functions, Neural Networks, SVM for Classification.

**Combination of Classifiers:** Introduction, Methods for Constructing Ensembles of Classifiers, Methods for Combining Classifiers.

**UNIT-V: Clustering:** Why is Clustering Important, Hierarchical Algorithms, Partitional Clustering, Clustering Large Data Sets.

**An Application-Hand Written Digit Recognition:** Description of the Digit Data, Pre-processing of Data, Classification Algorithms, Selection of Representative Patterns, Results.

**TEXT BOOK(S)**

1. Pattern Recognition: An Algorithmic Approach: Murty, M. Narasimha, Devi, V. Susheela, Spinger Pub, 1<sup>st</sup> Ed.

**REFERENCE BOOK(S)**

1. Machine Learning - Mc Graw Hill, Tom M. Mitchell.
2. Fundamentals Of Speech Recognition: Lawrence Rabiner and Biing- Hwang Juang. Prentice-Hall Pub.

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**16MCS114-MOBILE APPLICATION DEVELOPMENT**  
**Elective-IV**

L	T	P	C
4	-	-	4

**I Year. M.Tech. (CSE) – I Sem**

**Prerequisite(s)**

- Computer Networks
- Mobile Computing

**Course Objectives**

1. Understanding architectures of J2ME as well as Android
2. Ability to develop applications for current and emerging mobile computing devices
3. Ability to develop mobile applications using J2ME as well as Android

**Course Outcomes**

- CO1. Ability to understand the components and structure of mobile development frameworks (using J2ME and Android) and learn how and when to apply the different components to develop a working system.
- CO2. Ability to describe and work within the capabilities and limitations of mobile computing devices
- CO3. Ability to design and implement own user interfaces
- CO4. Design, implement and deploy mobile applications

**UNIT I: Introduction to Mobile Technology & J2ME Overview**

A brief history of Mobile, The Mobile Ecosystem, Why Mobile?, Types of Mobile Applications, Mobile Information Architecture, Mobile Design, Mobile 2.0, Mobile Web development.

Java 2 Micro Edition and the World of Java, Inside J2ME, J2ME and Wireless Devices. *Small Computing Technology*: Wireless Technology, Radio Data Networks, Microwave Technology, Mobile Radio Networks, Messaging, Personal Digital Assistants

**UNIT II: J2ME Architecture, Development Environment and User Interface**

J2ME Architecture, Small Computing Device Requirements, Run-Time Environment, MIDlet Programming, Java Language for J2ME, J2ME Software Development Kits, Hello World J2ME Style, Multiple MIDlets in a MIDlet Suite, J2ME Wireless Toolkit

*J2ME Best Practices and Patterns*: The Reality of Working in a J2ME World, Best Practices. J2ME User Interfaces, Display Class, The Palm OS Emulator, Command Class, Item Class, Exception Handling

*High-Level Display: Screens*: Screen Class, Alert Class, Form Class, Item Class, List Class, Text Box Class, Ticker Class

*Low-Level Display: Canvas*: The Canvas, User Interactions, Graphics, Clipping Regions,

Animation

**UNIT III: J2ME Data Management System & Networking**

*Record Management System:* Record Storage, Writing and Reading Records, Record Enumeration, Sorting Records, Searching Records, Record Listener

*JDBC Objects:* The Concept of JDBC, JDBC Driver Types, JDBC Packages, Overview of the JDBC Process, Database Connection, statement Objects, Result set, Transaction Processing, Metadata, Data Types, Exceptions

*JDBC and Embedded SQL:* Model Programs, Tables, Indexing, Inserting Data into Tables, Selecting Data from a Table, Metadata, Updating Tables, Deleting Data from a Table, Joining Tables, Calculating Data, Grouping and Ordering Data, Subqueries, VIEWS.

*Generic Connection Framework:* The Connection, Hypertext Transfer Protocol, Communication, Management Using HTTP Commands, Session Management, Transmit as a Background Process

**UNIT IV: Introduction to Android**

What is Android isn't?, Android: An open platform for Mobile development, Native Android

Applications, Android SDK features, Introducing the Development Framework, Development for Android, Developing for Mobile and Embedded Devices, Android Development Tools, Externalizing Resources, The Android Application Lifecycle, Android Activities.

**UNIT V: Android Development**

Building User Interfaces, Intents and Broadcast Receivers, Using Internet Resources, Files, Saving State and Preferences, Databases and Content providers.

**TEXT BOOK(S)**

1. J2ME: The Complete Reference, James Keogh, Tata McGrawHill.
2. Programming for Mobile and Remote Computers, G.T.Thampi, Dreamtech Press.

**REFERENCE BOOK(S)**

1. Mobile Design and Development, Brian Fling, O'Reilly, SPD, 2011.
2. Professional Android 4: Application Development, Reto Meier, Wiley India, 2012.



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**16MCS1L1-COMPUTING LABORATORY-I**

**I Year. M.Tech. (CSE) – I Sem**

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**Prerequisite(s)**

- A course on “Computer Programming & Data Structures” and “ Advanced Data Base Engineering”.

**Course Objectives**

1. Introduces the basic concepts of abstract data types (ADTs).
2. Introduces a variety of data structures such as hash tables, search trees, tries, heaps, graphs, B-trees.
3. To understand the basic concepts of relational database.
4. To master the basics of MySQL and construct queries using MySQL.
5. Topics include datamodels, database design, relational model, relational algebra, transaction control, concurrency control, storage structures and access techniques.

**Course Outcomes**

- CO1. Ability to select the data structures that efficiently model the information in a problem.  
 CO2. Ability to assess efficiency trade-offs among different data structure implementations or combinations.  
 CO3. Design programs using a variety of data structures, including binary and general tree structures, search trees, tries, heaps and B-trees.  
 CO4. Understand the fundamentals of Relational database design and normal forms  
 CO5. Master the basics of mySQL for retrieval and management of data.  
 CO6. Ability to understand the basics of transaction processing and concurrency control.  
 CO7. Ability to handle the database storage structures and access techniques

**Experiments for ADS:**

1. Write a program to implement the Randomized n-Queens problem
2. Write a program to implement the Randomized Quick sort
3. Write a program to implement the Optimal Binary Search Tree
4. Write a program to implement the operations of AVL trees
5. Write a program to implement the operations of Leftist tree
6. Write a program to implement the operations of Fibonacci Heap
7. Write a program to implement the Operations of Digital Search trees
8. Write a program to implement the Operations of Binary Tries

**Experiments for DBE:**

Lab Experiments for DBE:

1. Payroll processing system - Database design using E-R model
2. Applying Normalization techniques on Payroll processing systems.
3. Integrity constraints enforcement, High level language extension with Triggers on Payroll

processing systems

4. Implement query processing algorithms: nested loop join, merge join, hash join, hybrid hash join.
5. Implement Dynamic programming algorithm for join order optimization.
6. Image storage and retrieval in MySQL database
7. Transaction Processing activities – application program development – concurrent executions

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**16MCS1S1-SEMINAR**

**I Year. M.Tech. (CSE) – I Sem**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>	<b>-</b>	<b>-</b>	<b>4</b>

**Prerequisite(s): None**

**Course Objectives**

1. To comprehend the technical topic of the presentation
2. To deliver confidently technical work to a team of people

**Course Outcomes**

At the end of the course the student will be able to:

- CO1. Ability to analyze the selected topic, organize the content and communicate to audience in an effective manner
- CO2. Ability to practice the learning by self study

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**16MCS201-ADVANCED COMPUTER NETWORKS**

**I Year. M.Tech. (CSE) – II Sem**

L	T	P	C
4	-	-	4

**Prerequisite(s):**

- Data Communication, Basic Networking Principles

**Course Objective**

1. This course aims to provide advanced background on relevant computer networking topics to have a comprehensive and deep knowledge in computer networks.

**Course Outcomes:**

- CO1. Understanding of holistic approach to computer networking
- CO2. Ability to understand the computer networks and their application
- CO3. Ability to design simulation concepts related to packet forwarding in networks.

**Unit-I**

Review of Computer Networks, Devices and the Internet: Internet, Network edge, Network core, Access Networks and Physical media, ISPs and Internet Backbones, Delay and Loss in Packet-Switched Networks, Networking and Internet - Foundation of Networking Protocols: 5-layer TCP/IP Model, 7-Layer OSI Model, Internet Protocols and Addressing. Multiplexers, Modems and Internet Access Devices, Switching and Routing Devices, Router Structure. The Link Layer and Local Area Networks-Link Layer, Introduction and Services, Error- Detection and Error-Correction techniques, Multiple Access Protocols, Link Layer Addressing, Ethernet, Interconnections: Hubs and Switches, PPP: The Point-to-Point Protocol, Link Virtualization

**Unit-II**

Data-link protocols: Ethernet, Token Ring and Wireless (802.11). Wireless Networks and Mobile IP: Infrastructure of Wireless Networks, Wireless LAN Technologies, IEEE 802.11 Wireless Standard, Cellular Networks, Mobile IP, Wireless Mesh Networks (WMNs), Multiple access schemes

Routing and Internetworking: Network-Layer Routing, Least-Cost-Path algorithms, Non-Least-Cost-Path algorithms, Intra-domain Routing Protocols, Inter-domain Routing Protocols, Congestion Control at Network Layer.

**Unit-III**

Logical Addressing: IPv4 Addresses, IPv6 Addresses - Internet Protocol: Internetworking, IPv4, IPv6, Transition from IPv4 to IPv6 – Multicasting Techniques and Protocols: Basic Definitions and Techniques, Intra-domain Multicast Protocols, Inter-domain Multicast Protocols, Node-Level Multicast algorithms

**Unit-IV**

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

**Unit-V**

The Web and HTTP, File Transfer: FTP, Electronic Mail in the Internet, Domain Name System (DNS), P2P File Sharing, Socket Programming with TCP and UDP, Building a Simple Web Server

Creating simulated networks and passing packets through them using different routing techniques. Installing and using network monitoring tools.

**TEXT BOOK(S)**

1. Computer Networking: A Top-Down Approach, James F. Kurosu and Keith W. Ross, Pearson, 6th Edition, 2012.
2. Computer Networks and Internets, Douglas E. Comer, 6<sup>th</sup> Edition, Pearson.

**REFERENCE BOOK(S)**

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

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**16MCS202-WEB SERVICES AND SERVICE ORIENTED ARCHITECTURE**

I Year. M.Tech. (CSE) – II Sem

L	T	P	C
4	-	-	4

**Prerequisite(s)**

- The course assumes a reasonable comfort and background about Information Technology and Management Information Systems.

**Course Objectives**

- To gain understanding of the basic principles of service orientation
- To learn service oriented analysis techniques
- To learn technology underlying the service design
- To learn the concepts such as SOAP, registering and discovering services.

**Course Outcomes**

At the end of this course, student would be able to

- CO1. Get the foundations and concepts of service based computing
- CO2. Advocate the importance and means of technology alignment with business
- CO3. Understanding the basic operational model of web services,
- CO4. Gain the knowledge of key technologies in the service oriented computing arena
- CO5. Apply and practice the learning through a real or illustrative project/case study.

**UNIT- I**

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). Introduction to Web Services – The definition of web services, basic operational model of web services, tools and technologies enabling web services, benefits and challenges of using web services.

**UNIT -II**

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, basic steps of implementing web services. Describing Web Services – WSDL introduction, non functional service description, WSDL1.1 Vs WSDL 2.0, WSDL document, WSDL elements, WSDL binding, WSDL tools, WSDL port type, limitations of WSDL.

**UNIT III**

Brief Over View of XML – XML Document structure, XML namespaces, Defining structure in XML documents, Reuse of XML schemes, Document navigation and transformation. SOAP : Simple Object Access Protocol, 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, The enterprise Service Bus, SOA Development Lifecycle, SOAP HTTP binding, SOAP communication model, Error handling in SOAP.

**UNIT – IV**

Registering and Discovering Services : The role of service registries, Service discovery, Universal Description, Discovery, and Integration, 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.

**UNIT - V**

SOA and web services security considerations, Network-level security mechanisms, Application-level security topologies, XML security standards, Semantics and Web Services, The semantic interoperability problem, The role of metadata, Service metadata, Overview of .NET and J2EE, SOA and Web Service Management, Managing Distributed System, Enterprise management Framework, Standard distributed management frameworks, Web service management, Richer schema languages, WS-Metadata Exchange.

**TEXT BOOK(S)**

1. Web Services & SOA Principles and Technology, Second Edition, Michael P. Papazoglou.
2. Developing Java Web Services, R. Nagappan, R. Skoczylas, R.P. Sriganesh, Wiley India.
3. Developing Enterprise Web Services, S. Chatterjee, J. Webber, Pearson Education.

**REFERENCE BOOK(S)**

1. XML, Web Services, and the Data Revolution, F.P.Coyle, Pearson Education.
2. Building web Services with Java, 2<sup>nd</sup> Edition, S. Graham and others, Pearson Education.
3. Java Web Services, D.A. Chappell & T. Jewell, O'Reilly, SPD.
4. McGovern, et al., "Java web Services Architecture", Morgan Kaufmann Publishers, 2005.
5. J2EE Wer Services, Richard Monson-Haefel, Pearson Education.

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**16MCS203-INFORMATION SECURITY**  
Elective- V

**I Year. M.Tech. (CSE) – II Sem**

L	T	P	C
4	-	-	4

**Prerequisite(s)**

- A Course on “Computer Networks and a course on Mathematics

**Course Objectives**

1. To understand the fundamentals of Cryptography
2. To understand various key distribution and management schemes
3. To understand how to deploy encryption techniques to secure data in transit across data networks
4. To apply algorithms used for secure transactions in real world applications

**Course Outcomes**

- CO1. Demonstrate the knowledge of cryptography, network security concepts and applications.
- CO2. Ability to apply security principles in system design.
- CO3. Ability to identify and investigate vulnerabilities and security threats and mechanisms to counter them.

**UNIT I**

Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms, A model for Internetwork security.

Classical Encryption Techniques, DES, Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of operation, Blowfish, Placement of Encryption Function, Traffic Confidentiality, key Distribution, Random Number Generation.

**UNIT II**

Public key Cryptography-Principles, RSA algorithm, Key Management, Diffie-Hellman Key Exchange, Elliptic Curve Cryptography. Message authentication and Hash Functions, Authentication Requirements and Functions, Message Authentication, Hash Functions and MACs Hash and MAC Algorithms SHA-512, HMAC.

**UNIT III**

Digital Signatures, Authentication Protocols, Digital signature Standard, Authentication Applications, Kerberos, X.509 Directory Authentication Service.

Email Security: Pretty Good Privacy (PGP) and S/MIME.



**UNIT IV**

IP Security:

Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management.

Web Security: Web Security Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET).

**UNIT V**

Intruders, Viruses and Worms Intruders, Viruses and related threats Firewalls: Firewall Design Principles, Trusted Systems, Intrusion Detection Systems.

**TEXT BOOK(S)**

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

**REFERENCE BOOK(S)**

1. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education.
2. Principles of Information Security, Whitman, Thomson.

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**16MCS204-SOFTWARE TESTING METHODOLOGIES**  
Elective-V

I Year. M.Tech. (CSE) – II Sem

L	T	P	C
4	-	-	4

**Prerequisite(s)**

- A course on “Software Engineering”

**Course Objectives**

- To provide knowledge of the concepts in software testing such as testing process, criteria, strategies, and methodologies.
- To develop skills in software test automation and management using latest tools.

**Course Outcomes**

- CO1. Ability to design and develop the best test strategies in accordance to the development models
- CO2. Acquire skills to perform dataflow testing, domain testing, logic testing.

**UNIT-I:**

**Introduction:-** Purpose of testing, Dichotomies, model for testing, consequences of bugs, taxonomy of bugs

**Flow graphs and Path testing:-** Basics concepts of path testing, predicates, path predicates and achievable paths, path sensitizing, path instrumentation, application of path testing.

**UNIT-II:**

**Transaction Flow Testing:-** transaction flows, transaction flow testing techniques.

**Dataflow testing:-** Basics of data flow testing, strategies in data flow testing, application of dataflow testing.

**Domain Testing:-** domains and paths, nice & ugly domains, domain testing, domains and interfaces’ testing, domain and interface testing, domains and testability.

**UNIT-III:**

**Paths, Path products and Regular expressions:-** path products & path expression, reduction procedure, applications, regular expressions & flow anomaly detection.

**Logic Based Testing:-** overview, decision tables, path expressions, kv charts, specifications.

**UNIT-IV:**

**State, State Graphs and Transition testing:-** state graphs, good & bad state graphs, state testing, Testability tips.

**UNIT-V:**

**Graph Matrices and Application:**-Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm, building tools. (Student should be given an exposure to a tool like JMeter or Win-runner).

**TEXT BOOK(S)**

1. Software Testing techniques - Baris Beizer, Dreamtech, second edition.
2. Software Testing Tools – Dr.K.V.K.K.Prasad, Dreamtech.

**REFERENCE BOOK(S)**

1. The craft of software testing - Brian Marick, Pearson Education.
2. Software Testing Techniques – SPD(Oreille)
3. Software Testing in the Real World – Edward Kit, Pearson.
4. Effective methods of Software Testing, Perry, John Wiley.
5. Art of Software Testing – Meyers, John Wiley.

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**16MCS205-SOFTWARE PROJECT MANAGEMENT**  
Elective-V

I Year. M.Tech. (CSE) – II Sem

L	T	P	C
4	-	-	4

**Prerequisite(s)**

- A course on “Software Engineering”

**Course Objectives**

1. To develop skills in software project management
2. The topics include-software economics; software development life cycle; artifacts of the process; workflows; checkpoints; project organization and responsibilities; project control and process instrumentation;

**Course Outcomes**

- CO1. Gain knowledge of software economics, phases in the life cycle of software development, project organization, project control and process instrumentation.
- CO2. Analyze the major and minor milestones, artifacts and metrics from management and technical perspective
- CO3. Design and develop software products using conventional and modern principles of software project management

**UNIT I**

**Conventional Software Management:** The waterfall model, conventional software Management performance.

**Evolution of Software Economics:** Software Economics, pragmatic software cost estimation.

**UNIT II**

**Improving Software Economics:** Reducing Software product size, improving software processes, improving team effectiveness, improving automation, Achieving required quality, peer inspections. **The old way and the new:** The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process.

**UNIT III**

Life cycle phases: **Engineering and production stages, inception, Elaboration, construction, transition phases.**

**Artifacts of the process:** The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts. **Model based software architectures:** A Management perspective and technical perspective. **Work Flows of the process:** Software process workflows, Iteration workflows.

#### UNIT IV

**Checkpoints of the process:** Major mile stones, Minor Milestones, Periodic status assessments. Iterative Process Planning: work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning. Project Organizations and Responsibilities: Line-of-Business Organizations, Project Organizations, evolution of Organizations. Process Automation: Automation Building blocks, The Project Environment.

#### UNIT V

**Project Control and Process instrumentation:** The seven core Metrics, Management indicators, quality indicators, life cycle expectations, pragmatic Software Metrics, Metrics automation. Tailoring the Process: Process discriminates.

**Future Software Project Management:** modern Project Profiles, Next generation Software economics, modern process transitions.

**Case Study:** The command Center Processing and Display system- Replacement (CCPDS-R).

#### TEXT BOOKS:

1. Software Project Management, Walker Royce: Pearson Education, 2005.

#### REFERENCE BOOKS:

1. Software Project Management, Bob Hughes and Mike Cotterell: Tata McGraw-Hill Edition.
2. Software Project Management, Joel Henry, Pearson Education.
3. Software Project Management in practice, Pankaj Jalote, Pearson Education.2005.

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**16MCS206-RESEARCH METHODOLOGIES**  
Elective- VI

**I Year. M.Tech. (CSE) – II Sem**

**Prerequisite(s): None**

L	T	P	C
4	-	-	4

**Course Objectives**

1. Introduces research paper writing and publication skills.

**Course Outcome**

- CO1. Ability to distinguish research methods
- CO2. Ability to write and publish a technical research paper.
- CO3. Ability to review papers effectively

**UNIT I**

Introduction, Technical Research Paper Writing and Publication

**UNIT II**

Research Paper Search

**UNIT III**

Research Ethics, Research Methods in Computer Science and Engineering and Engineering, Research Methods for Software Engineering, Research Methods (deductive methods and proofs)

**UNIT IV**

Paper Publishing and Reviewing, Measured-based research methods in Computer Engineering

**UNIT V**

Preparation & Presentation of a scientific paper

**REFERENCE BOOK(S)**

1. A Computer Scientist's Guide to Writing and Publishing Technical Articles, Paul Martin, Technical Report, CS-TR-95-4, Dept of CS, Victoria University of Wellington, New Zealand, 1995.
2. Marcia Martens Pierson, Bion L. Pierson, Beginnings and Endings: Keys to Better Engineering Technical Writing, IEEE Transactions on Professional Communication (IEEE T-PC), Vol. 40, No. 4, pp 299 - 304 December 1997

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**16MCS207-SOFTWARE DESIGN AND ENGINEERING**  
**Elective-VI**

**I Year. M.Tech. (CSE) – II Sem**

L	T	P	C
4	-	-	4

**Prerequisite(s)**

- Software Engineering

**Course Objectives**

1. To develop in students the knowledge, understanding, skills and values to solve problems through the creation of software solutions
2. To design and experiment with software prototypes
3. To elicit, analyze and specify software requirements through a productive working relationship with project stakeholders.
4. To build solutions using different technologies, architectures and life-cycle approaches.
5. The context of different organizational structures.

**Course Outcomes**

- CO1. Understanding of the historical developments that have led to current practices in software design and development, and of emerging trends and technologies in this field.
- CO2. Acquiring and applying the skills in designing and developing software solutions.
- CO3. Acquiring and using the skills required to schedule a software project.

**UNIT I**

**Introduction to Software Engineering:** The evolving role of software, Changing Nature of Software, legacy software, Software myths.

**A Generic view of process:** Software engineering- A layered technology, a process framework, The Capability Maturity Model Integration (CMMI), Process patterns, process assessment, personal and team process models.

**Process models:** The waterfall model, Incremental process models, Evolutionary process models, Specialized process models, The Unified process.

**Software Requirements:** Functional and non-functional requirements, User requirements, System requirements, Interface specification, the software requirements document.

**Requirements engineering process:** Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management.

## UNIT II Software Design

The nature of the design process, transferring design knowledge, constraints upon the design process and product, recording design decisions, designing with others, context for design, economic factors, assessing design qualities, quality attributes of the design product, assessing the design process. Representing abstract ideas, design view points, the architecture concept, design methods, design patterns, design representations, rationale for design methods.

**Design Processes and Strategies :** The role of strategy in design methods, describing the design process – The D – Matrix, design by top-down decomposition, design by composition, organizational influences upon design.

## UNIT III

### Designing with objects and components

Designing with objects : Design practices for object-oriented paradigm, Object-oriented paradigm, Object-oriented frame works, Hierarchical object oriented design process and heuristics, the fusion method, the unified process.

### Component - based design:

The component concept, designing with components, designing components, COTS.

### User Interface design

The Golden rules, Interface analysis and design models, user and task analysis, analysis of display content and work environment, applying interface design issues, design evaluation.

## UNIT IV

### Concepts Of Software Projects

**Project Management :** The management spectrum: people, product, process and project, W5HH principle, Critical practices

**Metrics for Process and Projects :** Process metrics, project metrics, size-oriented metrics, function-oriented metrics, Object-oriented and use-case metrics, metrics for software quality, integrating metrics with in software process.

## UNIT V

### Project Scheduling and Management

**Project Scheduling:** Basic concepts, project scheduling , defining a task set and task network, timeline charts, tracking the schedule, tracking the progress for an OO project, Earned value analysis.

**Risk Management:** Reactive Vs. Proactive risk strategies, software risks, risk identification, risk projection,risk refinement, risk mitigation and monitoring, the RMMM plan.



**Text Books:**

1. Software design, David Budgen, second edition, Pearson education,2003
2. Software Engineering:A practitioner's Approach, Roger S Pressman, sixth edition. McGrawHill International Edition, 2005

**REFERENCE BOOK(S)**

1. Applying domain- driven design and patterns, jimmy Nilsson, Pearson education, 2006
2. Software Engineering Foundations, Ian Sommerville, seventh edition, Pearson education,2004.
3. Software Project Managenent , Bob Hughes & Mike Cotterell, Fourth edition, Tata Mc Gr aw Engineering : A Primer, Waman S Jawadekar, Tata McGraw-Hill, 2008
4. The Art of Project Management, Scott Berkun, O'Reilly, 2005.
5. Software Engineering, Project Management , Richard H. Thayer & Edward Yourdon, second edition, Wiley india, 2004.
6. Software Engineering foundations, Yingxu Wang Auerbach publications, 2008.

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**16MCS208-SPEECH PROCESSING**  
Elective- VI

I Year. M.Tech. (CSE) – II Sem

L	T	P	C
4	-	-	4

**Prerequisite(s)**

- A course on “Computer Oriented Statistical Methods”
- Generally, a basic knowledge of linear algebra, and probability and statistics and programming experience in one high-level language is required.

**Course Objectives**

1. The aim of the course is to make the students to understand the basic characteristics of the speech signal with regard to the production and perception of speech by humans.
2. To describe the basic techniques and practical aspects of speech analysis.
3. To make the students to understand different speech processing applications such as speech recognition and speaker recognition.

**Course Outcomes**

- CO1. Ability to understand and describe the mechanisms of speech production.
- CO2. Ability to determine the speech sounds from the acoustic characteristics.
- CO3. Ability to analyze the speech signal in time and frequency domains, and in terms of the parameters of a source-filter model.
- CO4. Ability to design a simple speech processing system that recognizes a limited number of isolated words; and a simple speaker recognition system.

**UNIT I: Fundamentals of Digital Speech Processing:** Anatomy & Physiology of Speech Organs, The process of Speech Production, Acoustic Phonetics, Articulatory Phonetics, The Acoustic Theory of Speech Production- Uniform Lossless Tube Model, Effect of Losses In Vocal Tract, Effect of Radiation at Lips, Digital Models for Speech Signals.

**UNIT II: Time Domain Models for Speech Processing:** Introduction, Window Considerations, Short-Time-Energy and Average Magnitude Short Time Average Zero Crossing Rate, Speech Vs Silence Discrimination Using Energy and Zero Crossing, Pitch Period Estimation using a Parallel Processing Approach, The Short Time Autocorrelation Function, The Short Time Average Magnitude Difference Function, Pitch Period Estimation using The Autocorrelation Function.

**UNIT III: Linear Predictive Coding (LPC) Analysis:** Basic Principles of Linear Predictive Analysis, The Autocorrelation Method, The Covariance Method, Solution of LPC Equations:

Cholesky Decomposition Solution for Covariance Method, Durbin’s Recursive Solution For the Autocorrelation Equations, Comparison between the Methods of Solution of the LPC Analysis Equations, Applications of LPC Parameters: Pitch Detection Using LPC Parameters, Formant

Analysis Using LPC Parameters.

**UNIT IV: Automatic Speech & Speaker Recognition:** Basic Pattern Recognition Approaches, Parametric Representation of Speech, Evaluating the Similarity of Speech Patterns, Isolated Digit Recognition System, Continuous Digit Recognition System

**Hidden Markov Model (HMM) For Speech:** Hidden Markov Model (HMM) for Speech Recognition, Viterbi algorithm, Training and Testing using HMMS.

**UNIT V:**

**Speaker Recognition:** Recognition techniques, Features that Distinguish Speakers, Speaker Recognition Systems: Speaker Verification System, Speaker Identification System. Overview of speech enhancement , speech synthesis.

**TEXT BOOK(S)**

1. Digital Processing of Speech Signals: **L.R Rabinar and R W Jhaung**, 1978, Pearson Education.
2. Digital Processing of Speech Signals: **L.R. Rabiner and S. W. Schafer**, Pearson Education.
3. Speech Communications: **Human & Machine - Douglas O'Shaughnessy**, 2<sup>nd</sup> Ed., Wiley India, 2000.

**REFERENCE BOOK(S)**

1. Discrete Time Speech Signal Processing: Principles and Practice - **Thomas F. Quateri**, 1<sup>st</sup> Ed., PE.
2. Speech & Audio Signal Processing: **Ben Gold & Nelson Morgan**, 1<sup>st</sup> Ed., Wiley.

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**16MCS209-HIGH PERFORMANCE COMPUTING**  
Elective- VII

**I Year. M.Tech. (CSE) – II Sem**

L	T	P	C
4	-	-	4

**Prerequisite(s)**

- Computer Organization & Architecture
- Operating System Programming

**Course Objectives**

1. To Improve the system performance
2. To learn various distributed and parallel computing architecture
3. To learn different computing technologies

**Course Outcomes**

- CO1. Understanding the concepts in grid computing
- CO2. Ability to set up cluster and run parallel applications
- CO3. Ability to understand the cluster projects and cluster OS
- CO4. Understanding the concepts of pervasive computing & quantum computing.

**Unit I**

Grid Computing: Data & Computational Grids, Grid Architectures And Its Relations To Various Distributed Technologies. Autonomic Computing, Examples Of The Grid Computing Efforts (Ibm).

**Unit II**

Cluster Setup & Its Advantages, Performance Models & Simulations; Networking Protocols & I/O, Messaging Systems. Process Scheduling, Load Sharing And Balancing; Distributed Shared Memory, Parallel I/O.

**Unit III**

Example Cluster System – Beowlf; Cluster Operating Systems: Compas And Nanos Pervasive Computing Concepts & Scenarios; Hardware & Software; Human – Machine Interface.

**Unit IV**

Device Connectivity; Java For Pervasive Devices; Application Examples.

**Unit V**

Classical Vs Quantum Logic Gates; One, Two & Three Qubit Quantum Gates; Fredkin & Toffoli Gates; Quantum Circuits; Quantum Algorithms.

**TEXT BOOK(S)**

1. “Selected Topics In Advanced Computing” Edited By Dr. P. Padmanabham And Dr. M.B. Srinivas, 2005 Pearson Education.

**REFERENCE BOOK(S)**

1. J. Joseph & C. Fellenstien: ‘Grid Computing ‘, Pearson Education
2. J. Burkhardt et.al: ‘pervasive computing’ Pearson Education
3. Marivesar:’ Approaching quantum computing’, pearson Education.
4. Raj kumar Buyya:’High performance cluster computing’, pearson Education.
5. Neilsen & Chung L:’Quantum computing and Quantum Information’, Cambridge

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**16MCS210-ADHOC & SENSOR NETWORKS**  
**Elective-VII**

**I Year. M.Tech. (CSE) – II Sem**

L	T	P	C
4	-	-	4

**Prerequisite(s)**

- Computer Networks
- Distributed Systems / Distributed Operating Systems / Advanced Operating Systems
- Mobile Computing

**Course Objectives**

1. To understand the concepts of sensor networks
2. To understand the MAC and transport protocols for adhoc networks
3. To understand the security of sensor networks
4. To understand the applications of adhoc and sensor networks

**Course Outcomes**

- CO1. Understanding the state of the art research in emerging subject of ad hoc and wireless sensor networks (ASN)
- CO2. Ability to solve the issues in real-time application development based on ASN
- CO3. Ability to conduct further research in the ASN domain

**UNIT I**

**Introduction to Ad Hoc Networks** - Characteristics of MANETs, Applications of MANETs and Challenges of MANETs.

**Routing in MANETs** - Criteria for classification, Taxonomy of MANET routing algorithms, *Topology-based* routing algorithms-**Proactive**: DSDV, WRP; **Reactive**: DSR, AODV, TORA; Hybrid: ZRP; *Position-based* routing algorithms-**Location Services**-DREAM, Quorum-based, GLS; **Forwarding Strategies**: Greedy Packet, Restricted Directional Flooding-DREAM, LAR; **Other routing algorithms**-QoS Routing, CEDAR.

**UNIT II**

**Data Transmission** - Broadcast Storm Problem, **Rebroadcasting Schemes**-Simple-flooding, Probability-based Methods, Area-based Methods, Neighbour Knowledge-based: SBA, Multipoint Relaying, AHBP. **Multicasting**: **Tree-based**: AMRIS, MAODV; **Mesh-based**: ODMRP, CAMP; **Hybrid**: AMRoute, MCEDAR and **Geocasting**: Data-transmission Oriented-LBM; Route Creation Oriented-GeoTORA, MGR.

**UNIT III**

TCP over Ad Hoc TCP protocol overview, TCP and MANETs, Solutions for TCP over Ad hoc **Basics of Wireless, Sensors and Applications**

Applications, Classification of sensor networks, Architecture of sensor network, Physical layer, MAC layer, Link layer.

**UNIT IV**

**Data Retrieval in Sensor Networks**

Routing layer, Transport layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs, Sensor Networks and mobile robots.

**UNIT V**

Security - Security in Ad Hoc networks, Key management, Secure routing, Cooperation in MANETs, Intrusion Detection systems.

**TEXT BOOK(S)**

1. Ad Hoc and Sensor Networks – Theory and Applications, *Carlos Corderio Dharma P. Aggarwal*, World Scientific Publications, March 2006, ISBN – 981-256-681-3
2. Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, Leonidas Guibas, Elsevier Science, ISBN – 978-1-55860-914-3 ( Morgan Kauffman)

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**16MCS211-ADVANCED ALGORITHMS**  
**Elective-VII**

**I Year. M.Tech. (CSE) – II Sem**

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**Prerequisite(s)**

- A course on “Computer Programming & Data Structures”
- A course on “Advanced Data Structures & Algorithms”

**Course Objectives**

1. Introduces the recurrence relations for analyzing the algorithms
2. Introduces the graphs and their traversals.
3. Describes major algorithmic techniques (divide-and-conquer, greedy, dynamic programming, Brute Force , Transform and Conquer approaches) and mention problems for which each technique is appropriate;
4. Describes how to evaluate and compare different algorithms using worst-case, average-case and best-case analysis.
5. Introduces string matching algorithms
6. Introduces linear programming.

**Course Outcomes**

- CO1. Ability to analyze the performance of algorithms
- CO2. Ability to choose appropriate data structures and algorithm design methods for a specified application
- CO3. Ability to understand how the choice of data structures and the algorithm design methods impact the performance of programs

**Unit- I**

Classification of algorithms, Algorithm Specifications,

Mathematical analysis of Recursive Algorithms: – Introduction to recurrence equations, formulation of recurrence equations, Techniques for solving recurrence equations, Solving recurrence equations, Solving Recurrence Equations using polynomial reduction, Divide and conquer recurrences

**Unit- II**

Graphs :- Graph representations, Graph traversals

Brute Force Approaches:- Computational Geometry Problems-Closest pair problem, Convex Hull Problem, Exhaustive Searching- Magic Squares problem, Container Loading problem, Knapsack Problem, Assignment Problem



**Unit-III**

Divide and Conquer approach:- Multiplication of long integers, Strassen's matrix multiplication, Fourier Transform

Greedy algorithms:- Coin change problem, Scheduling problems, knapsack problem, optimal storage on tapes, optimal tree problems, optimal graph problems

**Unit- IV**

Transform and Conquer approach :- Matrix operations- Gaussian Elimination method, LU decomposition, Crout's method of decomposition Dynamic Programming:- Computing binomial coefficients, Multistage graph problem, Transitive Closure and Warshall algorithm, Floyd warshall all pairs shortest path problem, TSP, Flow shop scheduling algorithm

**Unit-V**

String algorithms:- Basic string algorithms, Longest Common Subsequences, Naive String Matching algorithm, Rabin Karp, KMP, Harspool algorithm

Linear Programming, Graphical method for solving LPP, Simplex method, Minimization problems, Principle of Duality, Max Flow problem

**TEXT BOOK(S)**

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

**REFERENCE BOOK(S)**

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

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**16MCS212-CRYPTANALYSIS**  
Elective- VIII

I Year. M.Tech. (CSE) – II Sem

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**Prerequisite(s)**

- A Course on “Computer Networks, Mathematics”

**Course Objectives**

1. To understand the importance of cryptanalysis in our increasingly computer-driven world..
2. To understand the fundamentals of Cryptography
3. To understand the Lattice- based cryptanalysis and elliptic curves and pairings
4. To understand birthday- based algorithms for functions and attacks on stream ciphers
5. To apply the techniques for secure transactions in real world applications

**Course Outcomes**

- CO1. Ability to apply cryptanalysis in system design to protect it from various attacks.
- CO2. Ability to identify and investigate vulnerabilities and security threats and the mechanisms to counter them.
- CO3. Ability to analyze security of cryptographic algorithm against brute force attacks, birthday attacks.

**UNIT-I**

**A bird’s – eye view of modern Cryptography:** Preliminaries, Defining Security in Cryptography

**Monoalphabetic Ciphers:** Using Direct Standard Alphabets, The Caesar Cipher, Modular arithmetic, Direct Standard alphabets, Solution of direct standard alphabets by completing the plain component, Solving direct standard alphabets by frequency considerations, Alphabets based on decimations of the normal sequence, Solution of decimated standard alphabets, Monoalphabets based on linear transformation.

**Polyalphabetic Substitution:** Polyalphabetic ciphers, Recognition of polyalphabetic ciphers, Determination of number of alphabets, Solution of individual alphabets if standard, Polyalphabetic ciphers with a mixed plain sequences, Matching alphabets , Reduction of a polyalphabetic cipher to a monoalphabetic ciphers with mixed cipher sequences

**UNIT- II**

**Transposition :** Columnar transposition, Solution of transpositions with Completely filled rectangles ,Incompletely filled rectangles, Solution of incompletely filled rectangles – Probable word method, Incompletely filled rectangles general case, Repetitions between messages ; identical length messages.

**Sieve algorithms:** Introductory example: Eratosthenes's sieve, Sieving for smooth composites

### UNIT- III

**Brute force Cryptanalysis:** Introductory example: Dictionary attacks , Brute force and the DES Algorithm, Brute force as a security mechanism, Brute force steps in advanced cryptanalysis, Brute force and parallel computers.

**The birthday paradox: Sorting or not?:** Introductory example: Birthday attacks on modes of operation, Analysis of birthday paradox bounds, Finding collisions, Application to discrete logarithms in generic groups.

### UNIT- IV

**Birthday- based algorithms for functions:** Algorithmic aspects, Analysis of random functions, Number-theoretic applications, A direct cryptographic application in the context of blockwise Security, Collisions in hash functions.

**Attacks on stream ciphers:** LFSR- based key stream generators, Correlation attacks, Noisy LFSR model, Algebraic attacks, Extension to some non- linear shift registers, The cube attack.

### UNIT-V

**Lattice- based cryptanalysis:** Direct attacks using lattice reduction, Coppersmith's small roots attacks.

**Elliptic curves and pairings:** Introduction to elliptic curves, The Weil pairing, the elliptic curve factoring method.

### TEXT BOOK(S)

1. "Elementary Cryptanalysis A Mathematical Approach" by Abraham Sinkov, The mathematical Association of America (Inc).
2. "Algorithmic Cryptanalysis" by Antoine Joux, CRC Press'

### REFERENCE BOOK(S)

1. Algebraic Cryptanalysis, Bard Gregory, Springer, 2009
2. Cryptanalysis of Number Theoretic Ciphers, Sameul S. Wag staff, Champan & Hall/CRC
3. Cryptanalysis: A Study of Cipher and Their Solution, Helen F. Gaines,1989

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**16MCS213-ROBOTICS**  
Elective- VIII

I Year. M.Tech. (CSE) – II Sem

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**Prerequisite(s)**

- A course on object oriented programming

**Course Objectives**

1. Covers the theory of AI and robotics from the hierarchical to the hybrid deliberative/reactive paradigm for organizing intelligence.
2. Includes sensing and programming techniques for reactive behaviors, in order to permit a class to get covers, the coordination and control of teams of multi-agents.
3. Covers architectures that provide examples of how to transfer the principles of the paradigm into a coherent, reusable implementation on a single robot or teams of robots.
4. Focuses on navigation, a critical ability for a robot that claims to be mobile

**Course Outcomes**

- CO1. Enables students to embark on a serious robot project.
- CO2. Ability to integrate the sensor with robots.
- CO3. Ability to design an appropriate path palling and navigation of Robot.

**UNIT-I**

From Teleoperation To Autonomy: How Can a Machine Be Intelligent? What Can Robots Be Used For? A Brief History of Robotics, Teleoperation, The Seven Areas of AI.

The Hierarchical Paradigm: Attributes of the Hierarchical Paradigm, Closed World Assumption and the Frame Problem, Representative Architectures, Advantages and Disadvantages, Programming Considerations.

**UNIT-II**

Biological Foundations of the Reactive Paradigm :What Are Animal Behaviors? Coordination and Control of Behaviors , Perception in Behaviors , Schema Theory, Principles and Issues in Transferring Insights to Robots.

The Reactive Paradigm: Attributes of Reactive Paradigm, Subsumption Architecture, Potential Fields Methodologies, Visualizing potential fields, Evaluation of Reactive Architectures.

Designing a Reactive Implementation : Behaviors as Objects in OOP, Steps in Designing a Reactive Behavioral System, Case Study.

**UNIT-III**

Common Sensing Techniques for Reactive Robots : Logical sensors, Behavioral Sensor Fusion, Designing a Sensor Suite, Proprioceptive Sensors, Proximity Sensors, Computer Vision, Range from Vision.

The Hybrid Deliberative/Reactive Paradigm: Attributes of the Hybrid Paradigm, Architectural Aspects, Managerial Architecture, State-Hierarchy Architectures, Model-Oriented Architectures, Other Robots in the Hybrid Paradigm, Evaluation of Hybrid Architectures, Interleaving Deliberation and Reactive Control.

Multi-agents: Heterogeneity, Control, Cooperation, Goals, Emergent Social Behavior.

**UNIT-IV**

Topological Path Planning: Landmarks and Gateways, Relational Methods, Associative Methods, Case Study of Topological Navigation with a Hybrid Architecture.

Metric Path Planning, Configuration Space, Cspace Representations, Graph Based Planners, Wavefront Based Planners, Interleaving Path Planning and Reactive Execution.

**UNIT-V**

Localization and Map Making: Sonar Sensor Model, Bayesian, Dempster-Shafer Theory, HMM, Comparison of Methods, Localization, Exploration.

On the Horizon: Shape-Shifting and Legged Platforms , Applications and Expectations.

**TEXT BOOK(S)**

1. Introduction to AI Robotics, Robin R. Murphy, 2000

**REFERENCE BOOK(S)**

1. The Robotics Primer By Maja J. Mataric, MIT Press.
2. A Mathematical Introduction to Robotic Manipulation by Richard M. Murray, Zexiang Li and S. Shankar Sastry, CRC Press.

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**16MCS214-BIO-INFORMATICS**  
Elective- VIII

I Year. M.Tech. (CSE) – II Sem

L	T	P	C
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**Prerequisite(s)**

- A course on “Database Management Systems”
- A course on “Data Warehousing and Data Mining”
- A course on “Computer Programming and Data Structures”

**Course Objectives**

1. To impart the knowledge of theoretical and practical concepts of bioinformatics.
2. To develop skills in designing biological database and retrieving.
3. To apply appropriate sequence analysis methods for analyzing bio-molecular sequences.

**Course Outcomes**

- CO1. Demonstrate the knowledge on concepts of biological databases, Genomes and Proteome.
- CO2. Ability to analyze biological database management system.
- CO3. Ability to select and apply appropriate techniques and tools to manage the biological data.

**UNIT I**

**INTRODUCTION:-** Definition – Overview- Major databases in Bio Informatics- Molecular biology – Central Dogma- Data retrieval tools – Data mining of Databases – Gene Analysis – Prokaryotic and Eukaryotic Genomes – Sequence Assembly – Gene mapping – Physical maps – cloning – ORF – amino acids – DNA, RNA sequences – Genetic code.

**UNIT II**

**DNA and PROTEIN SEQUENCES:-**DNA: working with single DNA sequence : removing vector sequences- verifying restriction maps – PCR design – GC content – counting words – internal repeats – protein coding regions – ORFing – Genome scan, Protein: predicting properties – primary structure analysis – transmembrane segments – PROSITE patterns – interpreting scanprosite results- finding domains – CD server results – pfscan results.

**UNIT III**

**ALIGNMENT OF PAIR OF SEQUENCES:-** Terminology – Global and Local alignment – Dot matrix – dynamic programming – using scoring matrices –PAM matrices – BLOSUM, Working with FASTA – Algorithm – output – E-values – Histogram, Working with BLAST – algorithm – output – services – gapped BLAST- PSIBLAST – comparison of FASTA and BLAST.

#### UNIT IV

**MULTIPLE SEQUENCE ALIGNMENT:-** Criteria for Multiple sequence alignment – applications – choosing the right sequences; FASTA, ClustalW, Toffee methods – interpreting multiple sequence alignment – getting in right format – converting formats – using Jalview – preparing for publication.

#### UNIT V

**PROTEIN CLASSIFICATION & STRUCTURE PREDICTION:-** Structure of amino acids – primary structure – secondary structure – folds and motifs – alpha and beta helix –structure based protein classification – protein structure Data bases – folding problem – PROSEARCH – primary structure analysis and prediction – secondary structure analysis and prediction – motifs – profiles –patterns and fingerprints

#### TEXT BOOK(S)

1. S.C Rostogi , Mendiratta, P.Rasogi, “ *BioInformatics: methods and applications*”,second edition, PHI 2006.
2. Jean Mickel Clavere & Cadrienotredom “*Bio Informatics– A beginners guide*” Wiley DreamTech, 2003.

#### REFERENCE BOOK(S)

1. T.K. Attwood and D.J Perry Smith, “ *Introduction to Bio Informatics*”, Pearson Education, 1<sup>st</sup> Edition, 2001.
2. Dan E.Krane, Michael L.Raymer, “*fundamental concepts of BioInformatics* “, Pearson Education, 2004.

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16MCS215-BIG DATA AND ANALYTICS  
Elective- VIII

I Year. M.Tech. (CSE) – II Sem

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**Prerequisite(s)**

- Data Mining

**Course Objectives**

1. The purpose of this course is to provide the students with the knowledge of Big data Analytics principles and techniques.
2. This course is also designed to give an exposure of the frontiers of Big data Analytics

**Course Outcomes**

- CO1. Ability to explain the foundations, definitions, and challenges of Big Data and various Analytical tools.
- CO2. Ability to program using HADOOP and Map reduce, NOSQL
- CO3. Ability to understand importance of Big Data in Social Media and Mining.

**Unit I**

Big Data Analytics : What is big data, History of Data Management ; Structuring Big Data ; Elements of Big Data ; Big Data Analytics; Distributed and Parallel Computing for Big Data; Big Data Analytics:What is Big Data Analytics, What Big Data Analytics Isn’t, Why this sudden Hype Around Big Data Analytics, Classification of Analytics, Greatest Challenges that Prevent Business from Capitalizing Big Data; Top Challenges Facing Big Data; Why Big Data Analytics Important; Data Science; Data Scientist; Terminologies used in Big Data Environments; Basically Available Soft State Eventual Consistency (BASE); Open source Analytics Tools;

**Unit- II**

Understanding Analytics and Big Data: Comparing Reporting and Analysis, Types of Analytics; Points to Consider during Analysis; Developing an Analytic Team; Understanding Text Analytics; Analytical Approach and Tools to Analyze Data: Analytical Approaches; History of Analytical Tools; Introducing Popular Analytical Tools; Comparing Various Analytical Tools.

**Unit III**

Understanding MapReduce Fundamentals and HBase : The MapReduce Framework; Techniques to Optimize MapReduce Jobs; Uses of MapReduce; Role of HBase in Big Data Processing; Storing Data in Hadoop : Introduction of HDFS, Architecture, HDFS Files, File system types, commands, org.apache.hadoop.io package, HDFS High Availability; Introducing HBase, Architecture, Storing Big Data with HBase , Interacting with the Hadoop Ecosystem; HBase in Operations-Programming with HBase; Installation, Combining HBase and HDFS;



**Unit IV**

Big Data Technology Landscape and Hadoop : NoSQL, Hadoop; RDBMS versus Hadoop; Distributed Computing Challenges; History of Hadoop; Hadoop Overview; Use Case of Hadoop; Hadoop Distributors; HDFS (Hadoop Distributed File System), HDFS Daemons, read,write, Replica Processing of Data with Hadoop; Managing Resources and Applications with Hadoop YARN.

**Unit V**

Social Media Analytics and Text Mining: Introducing Social Media; Key elements of Social Media; Text mining; Understanding Text Mining Process; Sentiment Analysis, Performing Social Media Analytics and Opinion Mining on Tweets; Mobile Analytics: Introducing Mobile Analytics; Define Mobile Analytics; Mobile Analytics and Web Analytics; Types of Results from Mobile Analytics; Types of Applications for Mobile Analytics; Introducing Mobile Analytics Tools;

**TEXT BOOK(S)**

1. BIG DATA and ANALYTICS, Seema Acharya, Subhasinin Chellappan, Wiley publications.
2. BIG DATA, Black Book™ , DreamTech Press, 2015 Edition.
3. BUSINESS ANALYTICS 5e , BY Albright |Winston

**REFERENCE BOOK(S)**

1. Rajiv Sabherwal, Irma Becerra- Fernandez,” Business Intelligence – Practice, Technologies and Management”, John Wiley 2011.
2. Lariss T. Moss,ShakuAtre, “ Business Intelligence Roadmap”, Addison-Wesley It Service.
3. Yuli Vasiliev, “ Oracle Business Intelligence : The Condensed Guide to Analysis and Reporting”, SPD Shroff, 2012.

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**16MCS2L1-COMPUTING LABORATORY-II**

**I Year. M.Tech. (CSE) – II Sem**

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**Prerequisite(s)**

Data communication, Basic networking principles

**Course Objectives**

1. Understand and analyze the existing protocols
2. Understand the use of network packet capturing tools

**Course Outcomes**

CO1. Ability of acquiring the practical exposure to existing protocols

**Advanced Computer Networks Lab Experiments:**

1. Implement the IP fragmentation and reassembly algorithm.
2. Implement the IP forwarding algorithm.
3. Implement the simplest sliding window protocol of TCP.
4. Connect two systems using a switch and configure private IP addresses to the systems and ping them from each other. Using Wireshark, capture packets and analyze all the header information in the packets captured.
5. Install Telnet on one of the systems connected by a switch and telnet to it from the other system. Using Wireshark, capture the packets and analyze the TCP 3-way Handshake for connection establishment and tear down.
6. Start packet capture in wireshark application and then open your web browser and type in an URL of website of your choice. How long did it take from when the HTTP GET message was sent until the HTTP OK reply was received for the webpage you visited in your web browser.

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**16MCS2S1-SOFT SKILLS**  
**(Activity-based)**

**I Year. M.Tech. (CSE) – II Sem**

L	T	P	C
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**Course Objectives**

1. To improve the fluency of students in English
2. To facilitate learning through interaction
3. To illustrate the role of skills in real-life situations with case studies, role plays etc.
4. To train students in group dynamics, body language and various other activities which boost their confidence levels and help in their overall personality development
5. To encourage students develop behavioral skills and personal management skills
6. To impart training for empowerment, thereby preparing students to become successful professionals

**Course Outcomes**

- CO1. Developed critical acumen and creative ability besides making them industry- ready.  
 CO2. Appropriate use of English language while clearly articulating ideas.  
 CO3. Developing insights into Language and enrich the professional competence of the students.  
 CO4. Enable students to meet challenges in job and career advancement.

**INTRODUCTION**

- Definition and Introduction to Soft Skills – Hard Skills vs Soft Skills – Significance of Soft/Life/Self Skills – Self and SWOT Analysis *and*
- 1. Exercises on Productivity Development**
    - Effective/ Assertive Communication Skills (Activity based)
    - Time Management (Case Study)
    - Creativity & Critical Thinking (Case Study)
    - Decision Making and Problem Solving (Case Study)
    - Stress Management (Case Study)
  - 2. Exercises on Personality Development Skills**
    - Self-esteem (Case Study)
    - Positive Thinking (Case Study)
    - Emotional Intelligence (Case Study)
    - Team building and Leadership Skills (Case Study)
    - Conflict Management (Case Study)
  - 3. Exercises on Presentation Skills**
    - Netiquette
    - Importance of Oral Presentation – Defining Purpose- Analyzing the audience- Planning Outline and Preparing the Presentation- Individual & Group Presentation- Graphical Organizers- Tools and Multi-media Visuals

- One Minute Presentations (Warming up)
  - PPT on Project Work- Understanding the Nuances of Delivery- Body Language – Closing and Handling Questions – Rubrics for Individual Evaluation (Practice Sessions)
- 4. Exercises on Professional Etiquette and Communication**
- Role-Play and Simulation- Introducing oneself and others, Greetings, Apologies, Requests, Agreement & Disagreement....etc.
  - Telephone Etiquette
  - Active Listening
  - Group Discussions (Case study)- Group Discussion as a part of Selection Procedure- Checklist of GDs
  - Analysis of Selected Interviews (Objectives of Interview)
  - Mock-Interviews (Practice Sessions)
  - Job Application and Preparing Resume
  - Process Writing (Technical Vocabulary) – Writing a Project Report-Assignments
- 5. Exercises on Ethics and Values**
- Introduction — Types of Values - Personal, Social and Cultural Values - Importance of Values in Various Contexts
  - Significance of Modern and Professional Etiquette – Etiquette (Formal and Informal Situations with Examples)
  - Attitude, Good Manners and Work Culture (Live Examples)
  - Social Skills - Dealing with the Challenged (Live Examples)
  - Professional Responsibility – Adaptability (Live Examples)
  - Corporate Expectations
  - Note: Hand-outs are to be prepared and given to students.
  - Training plan will be integrated in the syllabus.
  - Topics mentioned in the syllabus are activity-based.

**SUGGESTED SOFTWARE:**

- The following software from ‘[train2success.com](http://train2success.com)’
- Preparing for being Interviewed
- Positive Thinking
- Interviewing Skills
- Telephone Skills
- Time Management
- Team Building
- Decision making

**SUGGESTED READING:**

1. Alex, K. 2012. Soft Skills. S. Chand Publishers
2. Management Shapers. 2011. Collection of 28 Books by different Authors. Universities Press.
3. Sherfield, Robert M. 2005. et al Cornerstone: Developing Soft Skills. Pearson
4. Suresh Kumar,E; Sreehari, P. & Savithri, J. 2011. Communication Skills and Soft Skills-

- An Integrated Approach. New Delhi: Pearson
5. The ACE of Soft Skills by Gopalaswamy Ramesh & Mahadevan Ramesh. 2013. Pearson Publishers. New Delhi.
  6. Patnaik, P. 2011. Group Discussion and Interview Skills. New Delhi: Foundation
  7. Sudhir Andrews. 2009. How to Succeed at Interviews. New Delhi: Tata McGraw Hill
  8. **Sasikumar, V & Dhamija, P.V. 1993. Spoken English - A Self-Learning Guide to Conversation Practice. New Delhi: Tata McGraw-Hill**
  9. Dixso, Richard J. Everyday Dialogues in English. Prentice Hall India Pvt Ltd
  10. Mukhopadhyay. L et al. 2012. Polyskills. New Delhi: CUP India Pvt Ltd
  11. Rizvi, M. A. 2005. Effective Technical Communication. New Delhi: Tata McGraw Hill
  12. The Hindu Speaks on Education by the Hindu Newspaper
  13. Naterop, B. Jean and Revell, Rod. 2004. Telephoning in English. Cambridge: CUP

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**16MCS3C1-COMPREHENSIVE VIVA**  
II Year. M.Tech. (CSE) – I Sem

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**16MCS3P1-PROJECT PHASE – I**  
II Year. M.Tech. (CSE) – I Sem

L	T	P	C
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**16MCS4P1-PROJECT PHASE - II AND DISSERTATION**  
II Year. M.Tech. (CSE) – II Sem

L	T	P	C
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**Course Objectives**

1. To identify a problem, analyse, design and code
2. To demonstrate with sufficient case studies

**Course Outcomes**

At the end of the course, student would be able to

- CO1. Synthesize and apply prior knowledge to designing and implementing solutions to open-ended computational problems while considering multiple realistic constraints.
- CO2. Design and develop the software with SE practices and standards
- CO3. Analyze database, network and application design methods
- CO4. Evaluate the various validation and verification methods
- CO5. Practice CASE tools for solving case studies
- CO6. Analyzing professional issues, including ethical, legal and security issues, related to computing projects.