

**ACADEMIC REGULATIONS  
COURSE STRUCTURE  
AND  
DETAILED SYLLABUS**

**EMBEDDED SYSTEMS**

*For*

**M.TECH TWO YEAR POST GRADUATE  
DEGREE COURSE**

*(Applicable for the batches admitted from 2022-2023)*



**MARRI LAXMAN REDDY  
INSTITUTE OF TECHNOLOGY AND MANAGEMENT**

(AN AUTONOMOUS INSTITUTION)

(Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad)

Accredited by NBA and NAAC with 'A' Grade & Recognized Under Section 2(f) & 12(B) of the UGC act, 1956



Established: 2009

PGECET Code: MLRS

## **Academic Regulations, Course Structure & Detailed Syllabus under Autonomous Status**

### **Master of Technology (M.Tech)** Choice Based Credit System (CBCS) **(MLRS - R22 Regulations)** **(Applicable for the batches admitted from 2022-23)**



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## PRELIMINARY DEFINITIONS AND NOMENCLATURES

**Academic Council:** The Academic Council is the highest academic body of the institute and is responsible for the maintenance of standards of instruction, education and examination within the institute. Academic Council is an authority as per UGC regulations and it has the right to take decisions on all academic matters including academic research.

**Academic Autonomy:** Means freedom to an institute in all aspects of conducting its academic programs, granted by UGC for Promoting Excellence.

**Academic Year:** It is the period necessary to complete an actual course of study within a year. It comprises two consecutive semesters i.e., Even and Odd semester.

**AICTE:** Means All India Council for Technical Education, New Delhi.

**Autonomous Institute:** Means an institute designated as autonomous by University Grants Commission (UGC), New Delhi in concurrence with affiliating University (Jawaharlal Nehru Technological University, Hyderabad) and State Government.

**Backlog Course:** A course is considered to be a backlog course if the student has obtained a failure grade (F) in that course.

**Basic Sciences:** The courses offered in the areas of Mathematics, Physics, Chemistry, Biology etc., are considered to be foundational innature.

**Betterment:** Betterment is a way that contributes towards improvement of the students' grade in any course(s). It can be done by either (a) re-appearing or (b) re-registering for the course.

**Board of Studies (BOS):** BOS is an authority as defined in UGC regulations, constituted by Head of the Organization for each of the departments separately. They are responsible for curriculum design and updation in respect of all the programs offered by a department.

**Certificate course:** It is a course that makes a student gain hands-on experience and skill required for holistic development in a specific area / field.

**Choice Based Credit System:** The credit based semester system is one which provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching along with provision of choice for the student in the course selection.

**Compulsory course:** Course required to be undertaken for the award of the degree as per the program.

**Commission:** Means University Grants Commission (UGC), New Delhi.

**Continuous Internal Examination:** It is an examination conducted towards internal assessment.

**Course:** A course is a subject offered by the University for learning in a particular semester.

**Course Outcomes:** The essential skills that need to be acquired by every student through a course.

**Credit:** A credit is a unit that gives weight to the value, level or time requirements of an academic course. The number of 'Contact Hours' in a week of a particular course determines its credit value. One credit is equivalent to one lecture hour per week.

**Credit point:** It is the product of grade point and number of credits for a course.

**Cumulative Grade Point Average (CGPA):** It is a measure of cumulative performance of a student over all the completed semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed upto two decimal places.

**Curriculum:** Curriculum incorporates the planned interaction of students with instructional content, materials, resources and processes for evaluating the attainment of Program Educational Objectives.

**Degree with Specialization:** A student who fulfills all the program requirements of her / his discipline and successfully completes a specified set of professional elective courses in a specialized area is eligible to receive a degree with specialization like Structural Engineering, Embedded Systems, CSE, etc.

**Department:** An academic entity that conducts relevant curricular and co-curricular activities, involving both teaching and non-teaching staff and other resources in the process of study for a degree.

**Detention in a course:** Student who does not obtain minimum prescribed attendance in a course shall be detained in that particular course.

**Dropping from the Semester:** A student who doesn't want to register for any semester can apply in writing in prescribed format before commencement of that semester.

**Elective Course:** A course that can be chosen from a set of courses. An elective can be Professional Elective and / or Open Elective.

**Evaluation:** Evaluation is the process of judging the academic performance of the student in her / his courses. It is done through a combination of continuous internal assessment and semester end examinations.

**Grade:** It is an index of the performance of the students in a said course. Grades are indicated by alphabets.

**Grade Point:** It is a numerical weight allotted to each letter grade on a 10 point scale.

**Institute:** Means MLRITM, Hyderabad unless indicated otherwise by the context.

**Massive Open Online Course (MOOC):** MOOC courses inculcate the habit of self learning. MOOC courses would be additional choices in all the elective group courses.

**Pre-requisite:** A course, the knowledge of which is required for registration into higher level course.

**Core:** The courses that are essential constituents of each engineering discipline are categorized as professional core courses for that discipline.

**Professional Elective:** A course that is discipline centric. An appropriate choice of minimum number of such electives as specified in the program will lead to a degree with specialization.

**Program:** Means, Master of Technology (M.Tech) degree program / UG degree program: B.Tech.

**Program Educational Objectives:** The broad career, professional and personal goals that every student will achieve through a strategic and sequential action plan.

**Project work:** It is a design or research based work to be taken up by a student during his / her second year to achieve a particular aim. It is a credit based course and is to be planned carefully by the student.

**Re-Appearing:** A student can reappear only in the semester end examination for the theory component of a course, subject to the regulations contained herein.

**Registration:** Process of enrolling into a set of courses in a semester of a Program.

**Regulations:** The regulations, common to all M.Tech programs offered by Institute are designated as - MLRS Regulations – R22 and are binding on all the stakeholders.

**Semester:** It is a period of study consisting of 15 to 18 weeks of academic work equivalent to normally 90 working days. The odd semester starts usually in July and even semester in December.

**Semester End Examinations:** It is an examination conducted for all courses offered in a semester at the end of the semester.

**S/he:** Means “she” and “he” both.

**Student Outcomes:** The essential skill sets that need to be acquired by every student during her / his program of study. These skill sets are in the areas of employability, entrepreneurial, social and behavioral.

**University:** Means the Jawaharlal Nehru Technological University Hyderabad, Hyderabad.

**Withdraw from a Course:** Withdrawing from a course means that a student can drop from a course within the first two weeks of the odd or even semester (deadlines are different for summer sessions). However s/he can choose a substitute course in place of it by exercising the option within 5 working days from the date of withdrawal.

**Words ‘he’, ‘him’, ‘his’, occur, they imply ‘she’, ‘her’, ‘hers’ also.**

## FOREWORD

The autonomy is conferred to Marri Laxman Reddy Institute of Technology and management (MLRITM), Hyderabad by University Grants Commission (UGC), New Delhi based on its performance as well as future commitment and competency to impart quality education. It is a mark of its ability to function independently in accordance with the set norms of the monitoring bodies like J N T University Hyderabad (JNTUH), Hyderabad and AICTE. It reflects the confidence of the affiliating University in the autonomous institution to uphold and maintain standards it expects to deliver on its own behalf and thus awards degrees on behalf of the college. Thus, an autonomous institution is given the freedom to have its own **curriculum, examination system and monitoring mechanism**, independent of the affiliating University but under its observance.

MLRITM is proud to win the credence of all the above bodies monitoring the quality in education and has gladly accepted the responsibility of sustaining, if not improving upon the standards and ethics for which it has been striving for more than a decade in reaching its present standing in the arena of contemporary technical education. As a follow up, statutory bodies like Academic Council and Boards of Studies are constituted with the guidance of the Governing Body of the institute and recommendations of the JNTUH to frame the regulations, course structure and syllabi under autonomous status.

The autonomous regulations, course structure and syllabi have been prepared after prolonged and detailed interaction with several expertise solicited from academics, industry and research, in accordance with the vision and mission of the institute to order to produce a quality engineering graduate to the society.

All the faculty, parents and students are requested to go through all the rules and regulations carefully. Any clarifications needed are to be sought at appropriate time and with principal of the college, without presumptions, to avoid unwanted subsequent inconveniences and embarrassments. The Cooperation of all the stake holders is sought for the successful implementation of the autonomous system in the larger interests of the college and brighter prospects of engineering graduates.

**PRINCIPAL**



**MARRI LAXMAN REDDY INSTITUTE OF TECHNOLOGY AND MANAGEMENT  
(Autonomous)**

**Academic Regulations of M.Tech (Regular / Full Time) Programmes, 2022-23 (R22)  
(CBCS)**

**(Effective for the students admitted into I year from the Academic year 2022 – 23 and onwards)**

For pursuing two year postgraduate Master Degree program of study in Engineering (M.Tech) offered by Marri Laxman Reddy Institute Of Technology and Management under Autonomous status and herein after referred to as MLRITM.

- 1.0 Post-Graduate Degree Programmes in Engineering & Technology (PGP in E & T)** Jawaharlal Nehru Technological University Hyderabad (JNTUH) offers **Two Years (Four Semesters)** full-time Master of Technology (M.Tech.) Degree programmes, under Choice Based Credit System (CBCS) at its constituent (non-autonomous) and affiliated colleges in different branches of Engineering and Technology with different specializations.
- 2.0 Eligibility for Admissions**
  - 2.1** Admission to the PGPs shall be made subject to eligibility, qualification and specializations prescribed by the University from time to time, for each specialization under each M.Tech programme.
  - 2.2** Admission to the post graduate programme shall be made on the basis of either the merit rank or Percentile obtained by the qualified student in the relevant qualifying GATE Examination / the merit rank obtained by the qualified student in an entrance test conducted by Telangana State Government (PGE CET) for M.Tech. programmes / an entrance test conducted by JNTUH / on the basis of any other exams approved by the University, subject to reservations as laid down by the Govt. from time to time.
  - 2.3** The medium of instructions for all PG Programmes will be **ENGLISH** only.
- 3.0 M.Tech. Programme (PGP in E & T) Structure**
  - 3.1** The M.Tech. Programs in E & T of JNTUH are of Semester pattern, with **Four** Semesters consisting of **Two** academic years, each academic year having **Two** Semesters (First / Odd and Second / Even Semesters). Each Semester shall be of 22 weeks duration (inclusive of Examinations), with a minimum of 90 instructional days per Semester.
  - 3.2** The two-year M.Tech. program consists of **68** credits and the student has to register for all **68** credits and earn all **68** credits for the award of M.Tech. degree. There is **NO** exemption of credits in any case.

**3.3** The student shall not take more than four academic years to fulfill all the academic requirements for the award of M.Tech. degree from the date of commencement of first year first semester, failing which the student shall forfeit the seat in M.Tech. programme.

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

**3.4.1 Semester Scheme**

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

**3.4.2 Credit Courses**

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

- One credit for one hour / week / semester for theory / lecture (L) courses
- One credit for 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 and mandatory courses (*Non-credit Audit Courses*) will not carry any credits.

**3.4.3 Subject Course Classification**

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

S. No.	Broad Course Classification	Course Group / Category	Course Description
1	Core Courses (CoC)	PC- Professional Core	Includes subjects related to the parent discipline / department / branch of Engineering
		Dissertation	M.Tech. Project or PG Project or Major Project
		Mini Project with Seminar	Seminar based on core contents related to Parent Discipline / Department / Branch of Engineering
2	Elective Courses (EE)	PE - Professional Electives	Includes elective subjects related to the parent discipline / department / branch of Engineering



		OE - Open Electives	Elective subjects which include inter-disciplinary subjects or subjects in an area outside the parent discipline / department / branch of Engineering
3	<b><i>Mandatory Courses</i></b>	--	<b><i>Non-Credit Audit Courses</i></b>

#### 4.0 Course Registration

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

#### 5.0 Attendance Requirements

The programmes are offered based on a unit system with each subject being considered a unit. Attendance is calculated separately for each subject.

- 5.1 Attendance in all classes (Lectures / Laboratories) is compulsory. The minimum required attendance in each theory subject (***also mandatory Audit Courses***) including the attendance of mid-term examination / Laboratory etc. is 75%. Two periods of attendance for each theory subject shall be considered, if the student appears for the mid-term examination of that subject. A student shall not be permitted to appear for the Semester End Examinations (SEE), if his attendance is less than 75%.

- 5.2 A student's Seminar report and presentation on Mini Project shall be eligible for evaluation, only if he ensures a minimum of 75% of his attendance in Seminar presentation classes on Mini Project during that Semester.
- 5.3 **Condoning of shortage of attendance** (between 65% and 75%) up to a maximum of 10% (considering the days of attendance in sports, games, NCC, NSS activities and Medical grounds) in each subject (Theory / Lab / Mini Project with Seminar) of a semester shall be granted by the College Academic Committee on genuine reasons.
- 5.4 A prescribed fee per subject shall be payable for condoning shortage of attendance after getting the approval of College Academic Committee for the same. The College Academic Committee shall maintain relevant documents along with the request from the student.
- 5.5 Shortage of Attendance below 65% in any subject shall in **no case be condoned**.
- 5.6 A Student, whose shortage of attendance is not condoned in any Subject(s) (Theory / Lab / Mini Project with Seminar) in any Semester, is considered as 'Detained in that Subject(s), and is not eligible to write Semester End Examination(s) of such Subject(s), (in case of Mini Project with Seminar, his / her Mini Project with Seminar Report or Presentation are not eligible for evaluation) in that Semester; and he / she has to seek re-registration for those Subject(s) in subsequent Semesters, and attend the same as and when offered.
- 5.7 A student fulfills the attendance requirement in the present semester, shall not be eligible for readmission into the same class.
- 5.8 a) A student shall put in a minimum required attendance in at least **three theory subjects (excluding mandatory (non-credit audit) course)** in first Year I semester for promotion to first Year II Semester.
- b) A student shall put in a minimum required attendance in at least **three theory subjects (excluding mandatory (non-credit audit) course)** in first Year II semester for promotion to second Year I Semester.

## 6.0 Academic Requirements

The following academic requirements must be satisfied, in addition to the attendance requirements mentioned in item no. 5. The performance of the candidate in each semester shall be evaluated subject-wise, with a maximum of 100 marks per subject / course (theory / practical), based on Internal Evaluation and Semester End Examination.

- 6.1 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% of Marks (24 out of 60 marks) in the Semester End Examination;
  - 40% of Marks in the internal examinations (16 out of 40 marks allotted for CIE); and
  - A minimum of 50% of marks in the sum total of CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of Letter Grades this implies securing 'B' Grade or above in a subject.

- 6.2** A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to Mini Project with seminar, if student secures not less than 50% marks (i.e. 50 out of 100 allotted marks). The student would be treated as failed, if student (i) does not submit a seminar report on Mini Project or does not make a presentation of the same before the evaluation committee as per schedule or (ii) secures less than 50% marks in Mini Project with seminar evaluation. The failed student shall reappear for the above evaluation when the notification for supplementary examination is issued.
- 6.3** A student shall register for all subjects for total of **68** credits as specified and listed in the course structure for the chosen specialization, put in the required attendance and fulfill the academic requirements for securing **68** credits obtaining a minimum of 'B' Grade or above in each subject, and all **68** credits securing Semester Grade Point Average (**SGPA**)  $\geq$  **6.0** (in each semester) and final Cumulative Grade Point Average (**CGPA**) (i.e., CGPA at the end of PGP)  $\geq$  **6.0**, and shall *pass all the mandatory Audit Courses* to complete the PGP successfully.
- Note:** (1) **The SGPA will be computed and printed on the marks memo only if the candidate passes in all the subjects offered and gets minimum B grade in all the subjects.**
- (2) **CGPA is calculated only when the candidate passes in all the subjects offered in all these semesters**
- 6.4** Marks and Letter Grades obtained in all those subjects covering the above specified **68** credits alone shall be considered for the calculation of final CGPA, which will be indicated in the Grade Card / Marks Memo of second year second semester.
- 6.5** If a student registers for extra subject(s) (in the parent department or other departments / branches of Engineering) other than those listed subjects totaling to **68** credits as specified in the course structure, the performance in extra subject(s) (although evaluated and graded using the same procedure as that of the required **68** credits) will not be considered while calculating the SGPA and CGPA. For such extra subject(s) registered, percentage of marks and Letter Grade alone will be indicated in the Grade Card / Marks Memo, as a performance measure, subject to completion of the attendance and academic requirements as stated in items 5 and 6.1 - 6.3.
- 6.6** When a student is detained due to shortage of attendance in any subject(s) in any semester, no Grade allotment will be made for such subject(s). However, he is eligible for re-registration of such subject(s) in the subsequent semester(s), as and when next offered, with the academic regulations of the batch into which he is re-registered, by paying the prescribed fees per subject. In all these re-registration cases, the student shall have to secure a fresh set of internal marks and Semester End Examination marks for performance evaluation in such subject(s), and SGPA / CGPA calculations.
- 6.7** A student eligible to appear for the Semester End Examination in any subject, but absent from it or failed (failing to secure 'B' Grade or above), may reappear for that subject at the supplementary examination as and when conducted. In such cases, his Internal Marks assessed earlier for that subject will be carried over, and added to the marks secured in the supplementary examination, for the purpose of evaluating his performance in that subject.
- 6.8** A Student who fails to earn **68** credits as per the specified course structure, and as indicated

above, within **four** academic years from the date of commencement of his first year first semester, shall forfeit his seat in M.Tech. programme and his admission **shall stand cancelled**.

## **7.0 Evaluation - Distribution and Weightage of Marks**

The performance of a student in each semester shall be evaluated subject- wise (irrespective of credits assigned) for a maximum of 100 marks.

**7.1** The performance of a student in every subject / course (including practical's and Project) will be evaluated for 100 marks each, with 40 marks allotted for CIE (Continuous Internal Evaluation) and 60 marks for SEE (Semester End-Examination). The Continuous Internal Evaluation shall be made based on the average of the marks secured in the two Mid Term Examinations conducted, first Mid-Term examinations in the middle of the Semester and second Mid-Term examinations during the last week of instruction.

**7.2** In CIE, for theory subjects, during a semester, there shall be two mid-term examinations. Each Mid- Term examination consists of two parts i) **Part – A** for 10 marks, ii) **Part – B** for 20 marks with a total duration of 2 hours as follows:

1. Mid-Term Examination for 30 marks:
  - a. Part - A: Objective / quiz paper for 10 marks.
  - b. Part – B: Descriptive paper for 20 marks.

The objective / quiz paper is set with multiple choice, fill-in the blanks and match the following type of questions for a total of 10 marks. The descriptive paper shall contain 6 full questions out of which, the student has to answer 4 questions, each carrying 5 marks. The average of two Mid Term examinations shall be taken as the final marks for Mid Term Examination (for 30 marks).

The remaining 10 marks of Continuous Internal Assessment (out of 40) are distributed as:

2. Assignment for 5 marks. (Average of 2 Assignments each for 5 marks)
  3. Subject Viva-Voce / PPT / Poster Presentation / Case Study on a topic in the concerned subject for 5 marks.
- The student has to get minimum of 40% of Marks in the internal examinations (16 out of 40 marks allotted for CIE).

While the first mid-term examination shall be conducted on 50% of the syllabus, the second mid-term examination shall be conducted on the remaining 50% of the syllabus.

Five (5) marks are allocated for assignments (as specified by the subject teacher concerned). The first assignment should be submitted before the conduct of the first mid-term examination, and the second assignment should be submitted before the conduct of the second mid-term examination. The average of the two assignments shall be taken as the final marks for assignment (for 5 marks).

Subject Viva-Voce / PPT / Poster Presentation / Case Study on a topic in the concerned subject for 5 marks before II Mid-Term Examination.

- The Student, in each subject, shall have to earn 40% of marks (i.e. 16 marks out of 40 marks) in

CIE, 40% of marks (i.e. 24 marks out of 60) in SEE and Overall 50% of marks (i.e. 50 marks out of 100 marks) both CIE and SEE marks taking together.

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

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

The details of the end semester question paper pattern are as follows:

**7.3** The Semester End Examinations (SEE), for theory subjects, will be conducted for 60 marks consisting of two parts viz. i) **Part- A** for 10 marks, ii) **Part - B** for 50 marks.

- Part-A is a compulsory question which consists of ten sub-questions from all units carrying equalmarks.
- Part-B consists of five questions (numbered from 2 to 6) carrying 10 marks each. Each of these questions is from each unit and may contain sub-questions. For each question there will be an “either” “or” choice, which means that there will be two questions from each unit and the students should answer either of the two questions.
- The duration of Semester End Examination is 3 hours.

**7.4** For practical subjects there shall be a Continuous Internal Evaluation (CIE) during the semester for 40 marks and 60 marks for semester end examination. Out of the 40 marks for internal evaluation:

1. A write-up on day-to-day experiment in the laboratory (in terms of aim, components / procedure, expected outcome) which shall be evaluated for 10 marks
2. 10 marks for viva-voce (or) tutorial (or) case study (or) application (or) poster presentation of the course concerned.
3. Internal practical examination conducted by the laboratory teacher concerned shall be evaluated for 10 marks.
4. The remaining 10 marks are for Laboratory Project, which consists of the Design (or) Software / Hardware Model Presentation (or) App Development (or) Prototype Presentation submission which shall be evaluated after completion of laboratory course and before semester end practical examination.

The Semester End Examination shall be conducted with an external examiner and the laboratory teacher. The external examiner shall be appointed from the cluster / other colleges which will be decided by the examination branch of the University.

In the Semester End Examination, held for 3 hours, total 60 marks are divided and allocated as shown below:

1. 10 marks for write-up
2. 15 for experiment / program
3. 15 for evaluation of results
4. 10 marks for presentation on another experiment / program in the same laboratory course

and

5. 10 marks for viva-voce on concerned laboratory course.

- The Student, in each subject, shall have to earn 40% of marks (i.e. 16 marks out of 40 marks) in CIE, 40% of marks (i.e. 24 marks out of 60) in SEE and Overall 50% of marks (i.e. 50 marks out of 100 marks) both CIE and SEE marks taking together.

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

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

- 7.5** For conducting laboratory end examinations of all PG Programmes, one internal examiner and one external examiner are to be appointed by the Principal of the College. The external examiner should be selected from outside the College concerned but within the cluster. No external examiner should be appointed from any other College in the same cluster / any other cluster which is run by the same Management.
- 7.6** There shall be Mini Project with Seminar during I year II semester for internal evaluation of 100 marks. The Departmental Academic Committee (DAC) will review the progress of the mini project during the seminar presentations and evaluate the same for 50 marks. Mini Project Viva Voce will be evaluated by the DAC for another 50 marks before the semester end examinations. Student shall carry out the mini project in consultation with the mini project supervisor which may include critically reviewing the literature, project implementation and submit it to the department in the form of a report and shall make an oral presentation before the DAC consisting of Head of the Department, Mini Project supervisor and two other senior faculty members of the department. The student has to secure a minimum of 50% of marks in i) seminar presentation and ii) mini project viva voce, to be declared successful. If he fails to obtain the minimum marks, he has to reappear for the same as and when scheduled.
- 7.7** Every candidate shall be required to submit a dissertation on a topic approved by the Dissertation Review Committee.
- 7.8** A Dissertation Review Committee (DRC) shall be constituted with the Head of the Department as Chairperson, Dissertation Supervisor and one senior faculty member of the Department offering the M.Tech. programme.
- 7.9** Registration of Dissertation Work: A candidate is permitted to register for the Dissertation Work after satisfying the attendance requirement in all the subjects, both theory and laboratory.
- 7.10** After satisfying 7.9, a candidate must present in ***Dissertation Work Review - I***, in consultation with his Dissertation Supervisor, the title, objective and plan of action of his Dissertation work to the Dissertation Review Committee (DRC) for approval ***within four weeks*** from the commencement of **Second year First Semester**. Only after obtaining the approval of the DRC can the student initiate the Dissertation work.
- 7.11** If a candidate wishes to change his supervisor or topic of the Dissertation, he can do so with the

approval of the DRC. However, the DRC shall examine whether or not the change of topic / supervisor leads to a major change of his initial plans of Dissertation proposal. If yes, his date of registration for the project work starts from the date of change of Supervisor or topic as the case may be.

- 7.12** A candidate shall submit his Dissertation progress report in two stages at least with a gap of **three** months between them.
- 7.13** The work on the Dissertation shall be initiated at the beginning of the II year and the duration of the Dissertation is two semesters. A candidate is permitted to submit Dissertation Thesis only after successful completion of all theory and practical courses with the approval of DRC **not earlier than 40 weeks** from the date of approval of the Dissertation work. For the approval of DRC, the candidate shall submit the draft copy of thesis to the Head of the Department and make an oral presentation before the DRC.
- 7.14** *The Dissertation Work Review - II* in II Year I Semester carries 100 internal marks. Evaluation should be done by the DRC for 50 marks and the Supervisor will evaluate the work for the other 50 marks. The Supervisor and DRC will examine the Problem Definition, Objectives, Scope of Work, Literature Survey in the same domain and progress of the Dissertation Work. A candidate has to secure a minimum of 50% of marks to be declared successful in Dissertation Work Review - II. If he fails to obtain the minimum required marks, he has to reappear for Dissertation Work Review - II as and when conducted.
- 7.15** *The Dissertation Work Review - III* in II Year II Sem. carries 100 internal marks. Evaluation should be done by the DRC for 50 marks and the Supervisor will evaluate it for the other 50 marks. The DRC will examine the overall progress of the Dissertation Work and decide whether or not the Dissertation is eligible for final submission. A candidate has to secure a minimum of 50% of marks to be declared successful in Dissertation Work Review - III. If he fails to obtain the required minimum marks, he has to reappear for Dissertation Work Review - III as and when conducted. For Dissertation Evaluation (Viva Voce) in II Year II Semester there are external marks of 100 and it is evaluated by the external examiner. The candidate has to secure a minimum of 50% marks in Dissertation Evaluation (Viva- Voce) examination.
- 7.16** Dissertation Work Reviews - II and III shall be conducted in phase I (Regular) and Phase II (Supplementary). Phase II will be conducted only for unsuccessful students in Phase I. The unsuccessful students in Dissertation Work Review - II (Phase II) shall reappear for it at the time of Dissertation Work Review - III (Phase I). These students shall reappear for Dissertation Work Review - III in the next academic year at the time of Dissertation Work Review - II only after completion of Dissertation Work Review - II, and then Dissertation Work Review - III follows. The unsuccessful students in Dissertation Work Review - III (Phase II) shall reappear for Dissertation Work Review - III in the next academic year only at the time of Dissertation Work Review - II (Phase I).
- 7.17** After approval from the DRC, a soft copy of the thesis should be submitted for ANTI-PLAGIARISM check and the plagiarism report should be submitted to the University and be included in the final thesis. The Thesis will be accepted for submission, if the similarity index is

less than **30%**. If the similarity index has more than the required percentage, the student is advised to modify accordingly and re-submit the soft copy of the thesis after one month. The maximum number of re-submissions of thesis after plagiarism check is limited to **TWO**. The candidate has to register for the Dissertation work and work for two semesters. After three attempts, the admission is liable to be cancelled. The college authorities are advised to make plagiarism check of every soft copy of theses before submissions.

**7.18** Three copies of the Dissertation Thesis certified by the supervisor shall be submitted to the College / School / Institute, after submission of a research paper related to the Dissertation work in a UGC approved journal. A copy of the submitted research paper shall be attached to thesis.

**7.19** The thesis shall be adjudicated by an external examiner selected by the University. For this, the Principal of the College / School / Institute shall submit a panel of **three** examiners from among the list of experts in the relevant specialization as submitted by the supervisor concerned and Head of the Department.

**7.20** If the report of the external examiner is unsatisfactory, the candidate shall revise and resubmit the Thesis. If the report of the examiner is unsatisfactory again, the thesis shall be summarily rejected. Subsequent actions for such dissertations may be considered, only on the specific recommendations of the external examiner and / or Dissertation Review Committee. No further correspondence in this matter will be entertained, if there is no specific recommendation for resubmission.

**7.21** If the report of the examiner is satisfactory, the Head of the Department shall coordinate and make arrangements for the conduct of Dissertation Viva-Voce examination. The Dissertation Viva-Voce examination shall be conducted by a board consisting of the Supervisor, Head of the Department and the external examiner who adjudicated the Thesis. The candidate has to secure a minimum of 50% of marks in Dissertation Evaluation (Viva-Voce) examination.

**7.22** If he fails to fulfill the requirements as specified in 7.21, he will reappear for the Dissertation Viva-Voce examination **only after three months**. In the reappeared examination also, if he fails to fulfill the requirements, he will not be eligible for the award of the degree, unless he is asked to revise and resubmit his Dissertation Work by the board within a specified time period (within **four** years from the date of commencement of his first year first semester).

**7.23** The Dissertation Viva-Voce External examination marks must be submitted to the College exam branch on the day of the examination.

**7.24** *For mandatory non-credit Audit courses, a student has to secure 40 marks out of 100 marks (i.e. 40% of the marks allotted) in the continuous internal evaluation for passing the subject / course. These marks should also be uploaded along with the internal marks of other subjects.*

**7.25** *No marks or letter grades shall be allotted for mandatory non-credit Audit Courses. Only Pass / Fail shall be indicated in Grade Card.*

## **8.0 Re-Admission / Re-Registration**

### **8.1 Re-Admission for Discontinued Student**

A student, who has discontinued the M.Tech. degree programme due to any reason whatsoever,



may be considered for '**readmission**' into the same degree programme (with the same specialization) with the academic regulations of the batch into which he gets readmitted, with prior permission from the authorities concerned, subject to item 6.6.

**8.2** If a student is detained in a subject (s) due to shortage of attendance in any semester, he may be permitted to **re-register** for the same subject(s) in the same category (core or elective group) or equivalent subject, if the same subject is not available, as suggested by the Board of Studies of that department, as and when offered in the subsequent semester(s), with the academic regulations of the batch into which he seeks re-registration, with prior permission from the authorities concerned, subject to item 3.2

**8.3** *A candidate shall be given only one-time chance to re-register and attend the classes for a maximum of two subjects in a semester*, if the internal marks secured by a candidate are less than 40% and failed in those subjects but fulfilled the attendance requirement. A candidate must re-register for failed subjects within four weeks of commencement of the class work and secure the required minimum attendance. In the event of the student taking this chance, his Continuous Internal Evaluation (internal) marks and Semester End Examination marks obtained in the previous attempt stand cancelled.

## **9.0 Examinations and Assessment - The Grading System**

**9.1** Grades will be awarded to indicate the performance of each student in each Theory Subject, or Lab / Practicals, or Mini Project with Seminar, Dissertation, etc., based on the percentage of marks obtained in CIE + SEE (Continuous Internal Evaluation + Semester End Examination, both taken together) as specified in Item 7 above, and a corresponding Letter Grade shall be given.

**9.2** As a measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades (UGC Guidelines) and corresponding percentage of marks shall be followed:

<b>% of Marks Secured in a subject / Course (Class Intervals)</b>	<b>Letter Grade (UGC Guidelines)</b>	<b>Grade Points</b>
90% and above ( $\geq 90\%$ , $\leq 100\%$ )	O (Outstanding)	10
Below 90% but not less than 80% ( $\geq 80\%$ , $< 90\%$ )	A <sup>+</sup> (Excellent)	9
Below 80% but not less than 70% ( $\geq 70\%$ , $< 80\%$ )	A (Very Good)	8
Below 70% but not less than 60% ( $\geq 60\%$ , $< 70\%$ )	B <sup>+</sup> (Good)	7
Below 60% but not less than 50% ( $\geq 50\%$ , $< 60\%$ )	B (above Average)	6
Below 50% ( $< 50\%$ )	F (FAIL)	0
<b>Absent</b>	<b>Ab</b>	<b>0</b>

**9.3** A student obtaining '**F**' Grade in any Subject is deemed to have 'failed' and is required to reappear as 'Supplementary Candidate' for the Semester End Examination (SEE), as and when conducted. In such cases, his Internal Marks (CIE Marks) in those subjects will remain as obtained earlier.

- 9.4** If a student has not appeared for the examinations, ‘Ab’ Grade will be allocated to him for any subject and shall be considered ‘failed’ and will be required to reappear as ‘Supplementary Candidate’ for the Semester End Examination (SEE), as and when conducted.
- 9.5** A Letter Grade does not imply any specific marks percentage; it is only the range of percentage of marks.
- 9.6** In general, a student shall not be permitted to repeat any Subject / Course (s) only for the sake of ‘Grade Improvement’ or ‘SGPA / CGPA Improvement’.
- 9.7** A student earns Grade Point (GP) in each Subject / Course, on the basis of the Letter Grade obtained by him in that Subject / Course. The corresponding ‘Credit Points’ (CP) are computed by multiplying the Grade Point with Credits for that particular Subject / Course.

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

- 9.8** The student passes the Subject / Course only when he gets **GP ≥ 6 (B Grade or above)**.
- 9.9** 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

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

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

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

$$\text{CGPA} = \left\{ \sum_{j=1}^M C_j G_j \right\} / \left\{ \sum_{j=1}^M C_j \right\} \dots \text{for all S Semesters registered (ie., up to and inclusive of S Semesters, } S \geq 2),$$

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

that Semester itself may be taken as the CGPA, as there are no cumulative effects.

### Illustration of calculation of SGPA

Course / Subject	Credits	Letter Grade	Grade points	Credit Points
Course 1	4	A	8	4*8 = 32
Course 2	4	O	10	4*10 = 40
Course 3	4	B	6	4*6 = 24
Course 4	3	B	6	3*6 = 18
Course 5	3	A+	9	3*9 = 27
Course 6	3	B	6	3*6 = 18
	21			159

$$SGPA = 159/21 = 7.57$$

### Illustration of calculation of CGPA

Semester	Credits	SGPA	Credits * SGPA
Semester I	24	7	24*7 = 168
Semester II	24	6	24*6 = 144
Semester III	24	6.5	24*6.5 = 156
Semester IV	24	6	24*6 = 144
	96		612

$$CGPA = 612/96 = 6.37$$

## 10.0 Award of Degree and Class

**10.1** If a student who registers for all the specified Subjects / Courses as listed in the Course Structure, satisfies all the Course Requirements, and passes the examinations prescribed in the entire PG Programme (PGP), and secures the required number of **68** Credits (with CGPA  $\geq 6.0$ ), shall be declared to have 'QUALIFIED' for the award of the M.Tech. Degree in the chosen Branch of Engineering and Technology with the specialization that he was admitted into.

## 10.2 Award of Class

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

Class Awarded	CGPA
First Class with Distinction	$\geq 7.75$
First Class	$6.75 \leq CGPA < 7.75$
Second Class	$6.00 \leq CGPA < 6.75$

A student with final CGPA (at the end of the **PGP**)  $< 6.00$  shall not be eligible for the Award of Degree.

## 11.0 Withholding of Results

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

## **12.0 General**

- 12.1 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.
- 12.2 Credit Point:** It is the product of grade point and number of credits for a course.
- 12.3** Wherever the words “he”, “him”, “his”, occur in the regulations, they shall include “she”, “her”.
- 12.4** The academic regulation should be read as a whole for the purpose of any interpretation.
- 12.5** In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the college academic council is final.

## MALPRACTICES RULES

### DISCIPLINARY ACTION FOR IMPROPER CONDUCT IN EXAMINATIONS

S. No	Nature of Malpractices / Improper conduct	Punishment
	If the candidate:	
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 to 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.
(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 to the examination (theory or practical) in which the candidate is appearing.	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 for the remaining examinations of the subjects of that Semester / year. The Hall Ticket of the candidate is to be cancelled and sent to the University.

3.	Impersonates any other candidate in 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 University 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 University 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.	<p>Refuses to obey the orders of the Chief Superintendent / Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a 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>In case of students of the college, they 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 University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.</p>

8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the 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.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	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.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the 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.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester / year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the college academic council for further action to award suitable punishment.	





# MARRI LAXMAN REDDY INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(AN AUTONOMOUS INSTITUTION)

(Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad)

Accredited by NBA and NAAC with 'A' Grade & Recognized Under Section 2(f) & 12(B) of the UGC act, 1956

## M.TECH in EMBEDDED SYSTEMS

### COURSE STRUCTURE (R22)

Applicable From 2022-23 Admitted Batch

S. No	Category	Breakup of credits (Total 68 credits)
1	Programme Core	20
2	Professional Elective	15
3	Open Elective	3
4	Mandatory Credit Course	2
5	Project Work	28
6	Audit Course	-
	<b>Total Credits</b>	<b>68</b>



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## M.TECH in EMBEDDED SYSTEMS

### COURSE STRUCTURE (R22)

Applicable From 2022-23 Admitted Batch

#### I YEAR I SEMESTER

S. No.	Course Code	Course Name	Course Area	Periods per week			Credits	Scheme of Examination Maximum Marks		
				L	T	P		Internal (CIE)	External (SEE)	Total
1	2215503	Digital System Design with FPGAs	PC	3	0	0	3	40	60	100
2	2215504	System Design with Embedded Linux	PC	3	0	0	3	40	60	100
3		Professional Elective - I	PE	3	0	0	3	40	60	100
4		Professional Elective - II	PE	3	0	0	3	40	60	100
5	2215521	Digital system Design with FPGAs Lab	PC	0	0	3	2	40	60	100
6	2215522	System Design with Embedded Linux Lab	PC	0	0	3	2	40	60	100
7	2215502	Research Methodology & IPR	MC	2	0	0	2	40	60	100
8		Audit Course - I	AC	2	0	0	0	100	-	100
<b>TOTAL</b>				<b>16</b>	<b>0</b>	<b>6</b>	<b>18</b>	<b>380</b>	<b>420</b>	<b>800</b>

#### I YEAR II SEMESTER

S. No.	Course Code	Course Name	Course Area	Periods per week			Credits	Scheme of Examination Maximum Marks		
				L	T	P		Internal (CIE)	External (SEE)	Total
1	2225505	ARM Microcontrollers	PC	3	0	0	3	40	60	100
2	2225506	Digital Control Systems	PC	3	0	0	3	40	60	100
3		Professional Elective - III	PE	3	0	0	3	40	60	100
4		Professional Elective - IV	PE	3	0	0	3	40	60	100
5	2225523	ARM Microcontrollers Lab	PC	0	0	3	2	40	60	100
6	2225524	Digital Control Systems Lab	PC	0	0	3	2	40	60	100
7	2225525	Mini Project with Seminar	PS	0	0	4	2	40	60	100
8		Audit Course - II	AC	2	0	0	0	100	-	100
<b>TOTAL</b>				<b>14</b>	<b>0</b>	<b>10</b>	<b>18</b>	<b>380</b>	<b>420</b>	<b>800</b>

**II YEAR I SEMESTER**

S. No.	Course Code	Course Name	Course Area	Periods per week			Credits	Scheme of Examination Maximum Marks		
				L	T	P		Internal (CIE)	External (SEE)	Total
1		Professional Elective - V	PE	3	0	0	3	40	60	100
2		Open Elective	OE	3	0	0	3	40	60	100
3	2235526	Dissertation Work Review-I	PS	0	0	12	6	100	0	100
<b>TOTAL</b>				<b>6</b>	<b>0</b>	<b>12</b>	<b>12</b>	<b>180</b>	<b>120</b>	<b>300</b>

**II YEAR II SEMESTER**

S. No.	Course Code	Course Name	Course Area	Periods per week			Credits	Scheme of Examination Maximum Marks		
				L	T	P		Internal (CIE)	External (SEE)	Total
1	2245527	Dissertation Work Review-II	PS	0	0	12	6	100	0	100
2	2245528	Dissertation Viva - Voce	PS	0	0	28	14	0	100	100
<b>TOTAL</b>				<b>0</b>	<b>0</b>	<b>40</b>	<b>20</b>	<b>100</b>	<b>100</b>	<b>200</b>

**Professional Elective (PE) Courses**

**Professional Elective-I**

S. No.	Course Code	Course Title
1	2215507	CMOS VLSI Design
2	2215508	Pattern Recognition and Machine Learning
3	2215509	Wireless Sensor Networks

**Professional Elective-II**

S. No.	Course Code	Course Title
1	2215510	Communications Buses & Interfaces
2	2215511	Advanced Computer Architecture
3	2215512	CMOS Analog IC Design

**Professional Elective-III**

S. No.	Course Code	Course Title
1	2225513	IoT Architectures and System Design
2	2225514	Design for Testability
3	2225515	SoC Design

**Professional Elective-IV**

S. No.	Course Code	Course Title
1	2225516	Hardware and Software Co-Design
2	2225517	Secure Networks
3	2025518	Physical Design Automation

**Professional Elective-V**

S. No.	Course Code	Course Title
1	2235519	Embedded Networks
2	2235520	CMOS Mixed Signal Design
3	2235521	Human -Machine Interface

**Audit Course – I**

S. No.	Course Code	Course
1	2210001	English for Research Paper Writing
2	2210002	Disaster Management
3	2210003	Sanskrit for Technical Knowledge
4	2210004	Value Education

**Audit Course – II**

S. No.	Course Code	Course
1	2220005	Constitution of India
2	2220006	Pedagogy Studies
3	2220007	Stress Management by Yoga
4	2220008	Personality Development Through Life Enlightenment Skills

**Open Elective (OE) Course**

S. No.	Course Code	Course Title
1	2235501	Overview of VLSI & Embedded Systems
2	2235502	Principles of Electronic Communications
3	2235503	Fundamentals of Nano Technology

**\*Open Elective** – Students should take Open Electives from List of Open Electives Offered by Other Departments/Branches Only.



**MARRI LAXMAN REDDY INSTITUTE OF TECHNOLOGY AND MANAGEMENT  
(AUTONOMOUS)**

**2215503: DIGITAL SYSTEM DESIGN WITH FPGAS**

**I Year M.Tech (ES) I – Sem.**

**L T P C**

**3 0 0 3**

**Pre-Requisite:** Switching Theory and Logic Design

**Course Objectives:**

1. To provide extended knowledge of digital logic circuits in the form of state model approach.
2. To provide an overview of system design approach using programmable logic devices.
3. To provide and understand of fault models and test methods.
4. To get exposed to the various architectural features of CPLDS and FPGAS.
5. To learn the methods and techniques of CPLD & FPGA design with EDA tools.
6. To expose software tools used for design process with the help of case studies.

**Course Outcomes:**

1. To exposes the design approaches using FPGAs.
2. To provide in depth understanding of Fault models.
3. To understands test pattern generation techniques for fault detection.
4. To design fault diagnosis in sequential circuits.
5. To provide understanding in the design of flow using case studies.

**UNIT - I**

**Programmable Logic Devices:** The concept of programmable Logic Devices, SPLDs, PAL devices, PLA devices, GAL devices, CPLD-Architecture, FPGAs-FPGA technology, architecture, virtex CLB and slice, FPGA Programming Technologies, Xilinx XC2000, XC3000, XC4000 Architectures, Actel ACT1,ACT2 and ACT3 Architectures. [TEXTBOOK-1]

**UNIT - II**

**Analysis and derivation of clocked sequential circuits with state graphs and tables:** A sequential parity checker, Analysis by signal tracing and timing charts-state tables and graphs-general models for sequential circuits, Design of a sequence detector, More Complex design problems, Guidelines for construction of state graphs, serial data conversion, Alphanumeric state graph notation. Need and Design strategies for multi-clock sequential circuits. [TEXTBOOK-2]

**UNIT - III**

**Sequential circuit Design:** Design procedure for sequential circuits-design example, Code converter, Design of Iterative circuits, Design of a comparator, Controller (FSM) — Metastability, Synchronization,FSM Issues, Pipelining resources sharing, Sequential circuit design using FPGAs, Simulation and testing of Sequential circuits, Overview of computer Aided Design. [TEXTBOOK-2]

**UNIT - IV**

**Fault Modeling and Test Pattern Generation:** Logic Fault Model, Fault detection & redundancy,



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Fault equivalence and fault location, Fault dominance, Single stuck at fault model, multiple Stuck at Fault models, Bridging Fault model. Fault diagnosis of combinational circuits by conventional methods, path sensitization techniques, Boolean difference method, KOHAVI algorithm, Test algorithms-D algorithm, Random testing, transition count testing, signature analysis and test bridging faults. [TEXTBOOK-3 & Ref.1]

**UNIT - V**

**Fault Diagnosis in sequential circuits:** Circuit Test Approach, Transition check Approach, State identification and fault detection experiment, Machine identification, Design of fault detection experiment. [Ref.3]

**TEXT BOOKS**

1. Digital Electronics and design with VHDL- Volnei A. Pedroni, Elsevier publications.
2. Fundamentals of Logic Design-Charles H.Roth, Jr. -5<sup>th</sup> Ed., Cengage Learning.
3. Digital Circuits and Logic Design-Samuel C. LEE, PHI, 2008.

**REFERENCE BOOKS**

1. Logic Design Theory-N.N. Biswas, PHI.
2. Digital System Design using programmable logic devices- Parag K. Lala, BS publications.
3. Switching and Finite Automata Theory - Zvi Kohavi & Niraj K. Jha, 3<sup>rd</sup> Edition, Cambridge, 2010.



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**2215504: SYSTEM DESIGN WITH EMBEDDED LINUX**

**I Year M.Tech (ES) I – Sem.**

**L T P C**

**3 0 0 3**

**Course Objectives:**

1. To know the difference between Embedded Linux and Desktop Linux
2. To understand the kernel concepts of Embedded Linux
3. To learn the debugging, writing, profile applications and drivers in embedded Linux.

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

1. Familiarity of the embedded Linux development model.
2. Write, debug, and profile applications and drivers in embedded Linux.
3. Create Linux BSP for a hardware platform

**UNIT- I**

Introduction to Real Time Operating Systems: Characteristics of RTOS, Tasks Specifications and types, Real-Time Scheduling Algorithms, Concurrency, Inter-process Communication and Synchronization mechanisms, Priority Inversion, Inheritance and Ceiling. Embedded Linux Vs Desktop Linux, Embedded Linux Distributions, System calls, Static and dynamic libraries, Cross toolchains

**UNIT- II**

Embedded Linux Architecture, Kernel Architecture – HAL, Memory manager, Scheduler, File System, I/O and Networking subsystem, IPC, User space, Start-up sequence

**UNIT- III**

Board Support Package Embedded Storage: MTD, Architecture, Drivers, Embedded File System Embedded Device Drivers: Communication between user space and kernel space drivers, Character and Block Device Drivers, Interrupt handling, Kernel modules Embedded Drivers: Serial, Ethernet, I2 C, USB, Timer, Kernel Modules

**UNIT- IV**

Porting Applications Real-Time Linux: Linux and Real time, Programming, Hard Real-time Linux

**UNIT- V**

Building and Debugging: Bootloaders, Kernel, Root file system, Device Tree

**TEXT BOOKS:**

1. Chris Simmonds, “Mastering Embedded Linux Programming” - Second Edition, PACKTPublications Limited.
2. Karim Yaghmour, “Building Embedded Linux Systems”, O’Reilly & Associates
3. P Raghvan, Amol Lad, Sriram Neelakandan, “Embedded Linux System Design andDevelopment”, Auerbach Publications

**REFERENCE BOOKS:**

1. Christopher Hallinan, “Embedded Linux Primer: A Practical Real-World Approach”, PrenticeHall, 2nd Edition, 2010.



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2. Derek Molloy, "Exploring Beagle Bone: Tools and Techniques for Building with EmbeddedLinux", Wiley, 1st Edition, 2014





**MARRI LAXMAN REDDY INSTITUTE OF TECHNOLOGY AND MANAGEMENT  
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**2215507: CMOS VLSI DESIGN  
(Professional Elective – I)**

**I Year M.Tech (ES) I – Sem.**

**L T P C  
3 0 0 3**

**Course Objectives:**

1. To understand the concepts of MOS Design and transient response
2. To know the design of combinational MOS logic circuits
3. To know the design of sequential MOS logic circuits
4. To understand the dynamic logic and also memory designing

**Course Outcomes:** Students will be able to:

1. Design of combinational MOS logic and sequential MOS logic circuits
2. Design of different Memories using MOS transistors
3. Design a circuits based on dynamic logic
4. Use CMOS transmission gates in various applications

**UNIT - I**

**MOS Design**

Pseudo NMOS logic- Inverter, Inverter threshold voltage, output high voltage, Output low voltage, gain at gate threshold voltage, transient response, rise time, fall time, pseudo NMOS logic gates, transistor equivalency, CMOS inverter logic.

**UNIT - II**

**Combinational MOS logic circuits**

MOS logic circuits with NMOS loads, Primitive CMOS logic gates- NOR and NAND gates, Complex logic circuits design- realizing Boolean expressions using NMOS gates and CMOS gates, AOI and OIA gates, CMOS full-adder, CMOS transmission gates, designing with transmission gates.

**UNIT - III**

Sequential MOS logic circuits: Behavior of bistable elements, SR Latch, Clocked Latch and Flip-flop circuits, CMOS D Latch and edge triggered flip-flop.

**UNIT - IV**

Dynamic Logic Circuits: Basic principle, Voltage Bootstrapping, Synchronous dynamic pass transistor circuits, Dynamic CMOS transmission gate logic, high performance dynamic CMOS circuits.

**UNIT - V**

Semiconductor Memories: Types, RAM array Organization, DRAM- types, operation, leakage currents in DRAM cell and refresh operation, SRAM - operation, leakage currents in SRAM cells, Flash memory- NOR flash and NAND flash.

**TEXT BOOKS:**

1. Digital Integrated Circuit Design- Ken Martin, Oxford University Press, 2011.



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2. CMOS Digital Integrated Circuit Analysis and Design — Sung Mo Kang, YusufLeblebici, TMH, 3<sup>rd</sup> Ed., 2011.

**REFERENCE BOOKS:**

1. Introduction to VLSI Systems: A Logic, Circuit and System Perspective- Ming Bo Lin, CRC Press, 2011.
2. Digital Integrated Circuits: A Designs Perspective -Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, 2<sup>nd</sup> Ed., PHI.



**2215508: PATTERN RECOGNITION AND MACHINE LEARNING**  
(Professional Elective – I)

**I Year M.Tech (ES) I – Sem.**

**L T P C**

**3 0 0 3**

**Prerequisite:** Statistics and Linear Algebra

**Course Objectives:**

1. The student will be able to understand the mathematical formulation of patterns.
2. To study the various linear models.
3. Understand the basic classifiers.
4. Can able to distinguish different models.

**Course Outcomes:** On completion of this course student will be able to

1. Familiar the basics of pattern classes and functionality.
2. Construct the various linear models.
3. Use the different kernel methods.
4. Design the Markov and Mixed models.

**UNIT-I**

**Introduction to Pattern recognition:** Mathematical Formulation and Basic Functional Equation, Reduction of Dimensionality, Experiments in Pattern Classification, Backward Procedure for Both Feature Ordering- and Pattern Classification, Suboptimal Sequential Pattern Recognition, Nonparametric Design of Sequential Pattern Classifiers, Analysis of Optimal Performance and a Multiclass Generalization

**UNIT-II**

**Linear Models:** Linear Basis Function Models -Maximum likelihood and least squares, Geometry of least squares , Sequential learning, Regularized least squares, Multiple outputs , The Bias-Variance Decomposition, Bayesian Linear Regression -Parameter distribution, Predictive, Equivalent, Bayesian Model Comparison, Probabilistic Generative Models-Continuous inputs, Maximum likelihood solution, Discrete features, Exponential family, Probabilistic Discriminative Models -Fixed basis functions, Logistic regression, Iterative reweighted least squares, Multiclass logistic regression, Probit regression, Canonical link functions

**UNIT-III**

**Kernel Methods:** Constructing Kernels, Radial Basis Function Networks -Nadaraya-Watson model, Gaussian Processes -Linear regression revisited, Gaussian processes for regression, Learning the hyper parameters, Automatic relevance determination, Gaussian processes for classification, Laplace approximation, Connection to neural networks, Sparse Kernel Machines- Maximum Margin Classifiers, Overlapping class distributions, Relation to logistic regression, Multiclass SVMs, SVMs for regression, Computational learning theory, Relevance Vector Machines- RVM for regression, Analysis of sparsity, RVM for classification



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**UNIT-IV**

**Graphical Models:** Bayesian Networks, Example: Polynomial regression, Generative models, Discrete variables, Linear-Gaussian models, Conditional Independence- Three example graphs, D-separation, Markov Random Fields -Conditional independence properties, Factorization properties, Illustration: Image de-noising, Relation to directed graphs, Inference in Graphical Models- Inference on a chain, Trees, Factor graphs, The sum-product algorithm, The max-sum algorithm, Exact inference in general graphs, Loopy belief propagation, Learning the graph structure.

**UNIT-V**

**Mixture Models and EM algorithm:** K-means Clustering-Image segmentation and compression, Mixtures of Gaussians-Maximum likelihood, EM for Gaussian mixtures, An Alternative View of EM- Gaussian mixtures revisited, Relation to K-means, Mixtures of Bernoulli distributions, EM for Bayesian linear regression, The EM Algorithm in General, Combining Models- Tree-based Models, Conditional Mixture Models- Mixtures of linear regression models, Mixtures of logistic models, Mixtures of experts.

**TEXT BOOKS:**

1. Sequential methods in Pattern Recognition and Machine Learning-K.S.Fu, Academic Press, volume no.52.
2. Pattern Recognition and Machine Learning- C. Bishop-Springer,2006.

**REFERENCE BOOKS:**

1. Pattern Classification- Richard o. Duda, Peter E. hart, David G. Stork, John Wiley& Sons, 2<sup>nd</sup> Ed., 2001.
2. The elements of Statistical Learning- Trevor Hastie, Robert Tibshirani, Jerome H. Friedman, Springer, 2<sup>nd</sup> Ed., 2009.



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**2215509: WIRELESS SENSOR NETWORKS  
(Professional Elective – I)**

**I Year M.Tech (ES) I – Sem.**

**L T P C**

**3 0 0 3**

**Course Objectives**

1. To acquire the knowledge about various architectures and applications of Sensor Networks
2. To understand issues, challenges and emerging technologies for wireless sensor networks
3. To learn about various routing protocols and MAC Protocols
4. To understand various data gathering and data dissemination methods
5. To Study about design principals, node architectures, hardware and software required for implementation of wireless sensor networks.

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

1. Analyze and compare various architectures of Wireless Sensor Networks
2. Understand Design issues and challenges in wireless sensor networks
3. Analyze and compare various data gathering and data dissemination methods.
4. Design, Simulate and Compare the performance of various routing and MAC protocol

**UNIT -I:**

Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks

**UNIT –II**

Mobile Ad-hoc Networks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks

**UNIT –III**

Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee

**UNIT -IV**

Dissemination protocol for large sensor network. Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols.

**UNIT -V**

Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication. Single-node architecture, Hardware components & design constraints, Operating systems and execution environments, introduction to TinyOS and nesC.

**TEXT BOOKS:**

1. Ad-Hoc Wireless Sensor Networks- C. Siva Ram Murthy, B. S. Manoj, Pearson
2. Principles of Wireless Networks – Kaveh Pah Laven and P. Krishna Murthy, 2002, PE



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**REFERENCE BOOKS:**

1. Wireless Digital Communications – Kamilo Feher, 1999, PHI.
2. Wireless Communications-Andrea Goldsmith, 2005 Cambridge University Press.
3. Mobile Cellular Communication – Gottapu Sasibhushana Rao, Pearson Education, 2012.
4. Wireless Communication and Networking – William Stallings, 2003, PHI.



**2215510: COMMUNICATION BUSES AND INTERFACES**  
(Professional Elective – II)

**I Year M.Tech (ES) I – Sem.**

**L T P C**

**3 0 0 3**

**Course Objectives:**

1. To know how to select the suitable Buses for different applications
2. To know the architecture of CAN and applications
3. To understand the use of PCIe, USB etc.,
4. To know the serial communication protocol

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

1. Select a particular serial bus suitable for a particular application.
2. Develop APIs for configuration, reading and writing data onto serial bus.
3. Design and develop peripherals that can be interfaced to desired serial bus.

**UNIT - I**

Serial Busses - Physical interface, Data and Control signals, features, limitations and applications of RS232, RS485, I2C, SPI

**UNIT - II**

CAN - Architecture, Data transmission, Layers, Frame formats, applications

**UNIT - III**

PCIe - Revisions, Configuration space, Hardware protocols, applications

**UNIT - IV**

USB - Transfer types, enumeration, Descriptor types and contents, Device driver

**UNIT - V**

Data Streaming Serial Communication Protocol - Serial Front Panel Data Port (SFPDP) using fiber optic and copper cable

**TEXT BOOKS:**

1. Jan Axelson, "Serial Port Complete - COM Ports, USB Virtual Com Ports, and Ports for Embedded Systems", Lakeview Research, 2<sup>nd</sup> Edition
2. Jan Axelson, "USB Complete", Penram Publications
3. Mike Jackson, Ravi Budruk, "PCI Express Technology", Mindshare Press
4. Wilfried Voss, "A Comprehensible Guide to Controller Area Network", Copperhill Media Corporation, 2<sup>nd</sup> Edition, 2005.
5. Serial Front Panel Draft Standard VITA 17.1 –200x
6. Technical references on [www.can-cia.org](http://www.can-cia.org),  
<http://www.pcisig.com>, <http://www.usb.org>



**MARRI LAXMAN REDDY INSTITUTE OF TECHNOLOGY AND MANAGEMENT  
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**2215511: ADVANCED COMPUTER ARCHITECTURE  
(Professional Elective – II)**

**I Year M.Tech (ES) I – Sem.**

**L T P C**

**3 0 0 3**

**Course Objectives:**

1. To understand the fundamental of computer design
2. To know the pipelines and parallelism concepts
3. To know the issues in interconnect networks

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

1. Familiarize the instruction set, memory addressing of Computer
2. Handle the issues in pipelining and parallelism
3. Familiarize the practical issues in inter network

**UNIT - I**

**Fundamentals of Computer Design:** Fundamentals of Computer design, Changing faces of computing and task of computer designer, Technology trends, Cost price and their trends, measuring and reporting performance, quantitative principles of computer design, Amdahl's law. Instruction set principles and examples- Introduction, classifying instruction set- memory addressing- type and size of operands, operations in the instruction set.

**UNIT - II**

**Pipelines:** Introduction, basic RISC instruction set, Simple implementation of RISC instruction set, Classic five stage pipe line for RISC processor, Basic performance issues in pipelining, Pipeline hazards, Reducing pipeline branch penalties.

**Memory Hierarchy Design:** Introduction, review of ABC of cache, Cache performance, Reducing cache miss penalty, Virtual memory.

**UNIT - III**

**Instruction Level Parallelism the Hardware Approach:** Instruction-Level parallelism, Dynamic scheduling, Dynamic scheduling using Tomasulo's approach, Branch prediction, high performance instruction delivery- hardware based speculation.

**ILP Software Approach:** Basic compiler level techniques, static branch prediction, VLIW approach, Exploiting ILP, Parallelism at compile time, Cross cutting issues -Hardware verses Software.

**UNIT - IV**

**Multi Processors and Thread Level Parallelism:** Multi Processors and Thread level Parallelism- Introduction, Characteristics of application domain, Systematic shared memory architecture, Distributed shared – memory architecture, Synchronization.

**UNIT - V**

**Inter Connection and Networks:** Introduction, Interconnection network media, Practical issues in interconnecting networks, Examples of inter connection, Cluster, Designing of clusters.





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**Intel Architecture:** Intel IA- 64 ILP in embedded and mobile markets Fallacies and pit falls

**TEXT BOOK:**

1. John L. Hennessy, David A. Patterson, "Computer Architecture: A Quantitative Approach", 3rd Edition, Elsevier.

**REFERENCE BOOKS:**

1. John P. Shen and Miikko H. Lipasti, "Modern Processor Design: Fundamentals of Super Scalar Processors", 2002, Beta Edition, McGraw-Hill
2. Kai Hwang, Faye A. Brigs., "Computer Architecture and Parallel Processing", Mc Graw Hill.
3. Dezsó Sima, Terence Fountain, Peter Kacsuk, "Advanced Computer Architecture - A Design Space Approach", Pearson Education



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**2215512: CMOS ANALOG IC DESIGN  
(Professional Elective – II)**

**I Year M.Tech (ES) I – Sem.**

**L T P C**

**3 0 0 3**

**Pre-requisite:** Analog Electronics

**Course Objectives:** Analog circuits play a very crucial role in all electronic systems and due to continued miniaturization, many of the analog blocks are not getting realized in CMOS technology.

1. To understand most important building blocks of all CMOS analog ICs.
2. To study the basic principle of operation, the circuit choices and the tradeoffs involved in the MOS transistor level design common to all analog CMOS ICs.
3. To understand specific design issues related to single and multistage voltage, current and differential amplifiers, their output and impedance issues, bandwidth, feedback and stability.
4. To understand the design of differential amplifiers, current amplifiers and OP AMPs.

**Course Outcomes:** After studying the course, each student is expected to be able to

1. Design basic building blocks of CMOS analog ICs.
2. Carry out the design of single and two stage operational amplifiers and voltage references.
3. Determine the device dimensions of each MOSFETs involved.
4. Design various amplifiers like differential, current and operational amplifiers.

**UNIT - I**

**MOS Devices and Modeling**

The MOS Transistor, Passive Components- Capacitor & Resistor, Integrated circuit Layout, CMOS Device Modeling - Simple MOS Large-Signal Model, Other Model Parameters, Small-Signal Model for the MOS Transistor, Computer Simulation Models, Sub-threshold MOS Model.

**UNIT- II**

**Analog CMOS Sub-Circuits**

MOS Switch, MOS Diode, MOS Active Resistor, Current Sinks and Sources, Current Mirrors- Current mirror with Beta Helper, Degeneration, Cascode current Mirror and Wilson Current Mirror, Current and Voltage References, Band gap Reference.

**UNIT – III**

**CMOS Amplifiers**

Inverters, Differential Amplifiers, Cascode Amplifiers, Current Amplifiers, Output Amplifiers, High Gain Amplifiers Architectures.

**UNIT - IV**

**CMOS Operational Amplifiers**

Design of CMOS Op Amps, Compensation of Op Amps, Design of Two-Stage Op Amps, Power-



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Supply Rejection Ratio of Two-Stage Op Amps, Cascode Op Amps, Measurement Techniques of OP Amp.

**UNIT - V**

**Comparators**

Characterization of Comparator, Two-Stage, Open-Loop Comparators, Other Open-Loop Comparators, Improving the Performance of Open-Loop Comparators, Discrete-Time Comparators.

**TEXT BOOKS:**

1. CMOS Analog Circuit Design - Philip E. Allen and Douglas R. Holberg, Oxford University Press, International Second Edition/Indian Edition, 2010.
2. Analysis and Design of Analog Integrated Circuits- Paul R. Gray, Paul J. Hurst, S. Lewis and R. G. Meyer, Wiley India, Fifth Edition, 2010.

**REFERENCE BOOKS:**

1. Analog Integrated Circuit Design- David A. Johns, Ken Martin, Wiley Student Edn, 2013.
2. Design of Analog CMOS Integrated Circuits- Behzad Razavi, TMH Edition.
3. CMOS: Circuit Design, Layout and Simulation- Baker, Li and Boyce, PHI.



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**2215521: DIGITAL SYSTEM DESIGN WITH FPGAs LAB (Lab – I)**

**I Year M.Tech (ES) I – Sem.**

**L T P C**

**0 0 3 2**

Programming can be done using any compiler. Down load the programs on FPGA/CPLD boards and performance testing may be done using pattern generator (32 channels) and logic analyzer apart from verification by simulation with any of the front-end tools.

1. HDL code to realize all the logic gates
2. Design and Simulation of Full Adder, Serial Binary Adder, Multi Precision Adder, CarryLook Ahead Adder.
3. Design of Combinational circuit using Decoders.
4. Design of Combinational circuit using encoder (without and with parity).
5. Design of Combinational circuit using multiplexer.
6. Design of 4 bit binary to gray converter using MUX or Decoders.
7. Design of Multiplexer/ Demultiplexer, comparator in all 3 styles.
8. Modelling of an Edge triggered and Level triggered FFs : D, SR, JK
9. Design of 4-bit binary, BCD counters (synchronous/ asynchronous reset) or any sequencecounter
10. Design of a N- bit Register of Serial- in Serial -out, Serial in parallel out, Parallel inSerial out and Parallel in Parallel Out using different FFs.
11. Design of Sequence Detector (Finite State Machine- Mealy and Moore Machines).
12. Design of 4- Bit Multiplier, Divider.
13. Design of ALU to Perform - ADD, SUB, AND-OR, 1's and 2's Compliment,
14. Implementing the above designs on FPGA kits.



## 2215522: SYSTEM DESIGN WITH EMBEDDED LINUX LAB (Lab – II)

I Year M.Tech (ES) I – Sem.

L T P C

0 0 3 2

### List of Experiments:

1. **Functional Testing Of Devices:** Flashing the OS on to the device into a stable functional state by porting desktop environment with necessary packages.
2. **Exporting Display On To Other Systems:** Making use of available laptop/desktop displays as a display for the device using SSH client & X11 display server.
3. **GPIO Programming:** Programming of available GPIO pins of the corresponding device using native programming language. Interfacing of I/O devices like LED/Switch etc., and testing the functionality.
4. **Interfacing Chronos eZ430:** Chronos device is a programmable Texas Instruments watch which can be used for multiple purposes like PPT control, Mouse operations etc., Exploit the features of the device by interfacing with devices.
5. **ON/OFF Control Based On Light Intensity:** Using the light sensors, monitor the surrounding light intensity & automatically turn ON/OFF the high intensity LED's by taking some pre-defined threshold light intensity value.
6. **Battery Voltage Range Indicator:** Monitor the voltage level of the battery and indicating the same using multiple LED's (for ex: for 3V battery and 3 led's, turn on 3 led's for 2-3V, 2 led's for 1-2V, 1 led for 0.1-1V & turn off all for 0V)
7. **Dice Game Simulation:** Instead of using the conventional dice, generate a random value similar to dice value and display the same using a 16X2 LCD. A possible extension could be to provide the user with option of selecting single or double dice game.
8. **Displaying RSS News Feed On Display Interface:** Displaying the RSS news feed headlines on a LCD display connected to device. This can be adapted to other websites like twitter or other information websites. Python can be used to acquire data from the internet.
9. **Porting Openwrt To the Device:** Attempt to use the device while connecting to a wifi network using a USB dongle and at the same time providing a wireless access point to the dongle.
10. **Hosting a website on Board:** Building and hosting a simple website (static/dynamic) on the device and make it accessible online. There is a need to install server (eg: Apache) and thereby host the website.
11. **Webcam Server:** Interfacing the regular usb webcam with the device and turn it into fully functional IP webcam & test the functionality.
12. **FM Transmission:** Transforming the device into a regular fm transmitter capable of transmitting audio at desired frequency (generally 88-108 Mhz)

Note: Devices mentioned in the above lists include Arduino, Raspberry Pi, Beaglebone



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**2215502: RESEARCH METHODOLOGY AND IPR**

**I Year M.Tech (ES) I – Sem.**

**L T P C**

**2 0 0 2**

**Course Objectives:**

- To understand the research problem
- To know the literature studies, plagiarism and ethics
- To get the knowledge about technical writing
- To analyze the nature of intellectual property rights and new developments
- To know the patent rights

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

- Understand research problem formulation.
- Analyze research related information
- Follow research ethics
- Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
- Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasize the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
- Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

**UNIT- I:**

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

Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

**UNIT- II:**

Effective literature studies approaches, analysis, Plagiarism, Research ethics

**UNIT- III:**

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

**UNIT- IV:**

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



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**UNIT- V:**

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

**TEXT BOOKS:**

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"

**REFERENCE BOOKS:**

1. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
2. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
3. Mayall, "Industrial Design", McGraw Hill, 1992.
4. Niebel, "Product Design", McGraw Hill, 1974.
5. Asimov, "Introduction to Design", Prentice Hall, 1962.
6. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.
7. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008



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**2225505: ARM MICROCONTROLLERS**

**I Year M.Tech (ES) II – Sem.**

**L T P C**

**3 0 0 3**

**Prerequisite:** Microprocessors and Microcontrollers

**Course Objectives:**

1. Explore the architecture and instruction set of ARM processor.
2. To provide a comprehensive understanding of various programs of ARM Processors.
3. Learn the programming on ARM Cortex M.

**Course Outcomes:** After completing this course the student will be able to:

1. Explore the selection criteria of ARM processors by understanding the functional level trade off issues.
2. Explore the ARM development towards the functional capabilities.
3. Work with ASM level program using the instruction set.
4. Programming the ARM Cortex M.

**UNIT - I**

**ARM Embedded Systems:** RISC design philosophy, ARM design philosophy, Embedded system hardware, Embedded system software.

**ARM Processor Fundamentals:** Registers, Current Program Status Register, Pipeline, Exceptions, Interrupts and Vector Table, Core Extensions, Architecture Revisions, ARM Processor Families.

**Architecture of ARM Processors:** Introduction to the architecture, Programmer's model-operation modes and states, registers, special registers, floating point registers, Behaviour of the application program status register (APSR)-Integer status flags, Q status flag, GE bits, Memory system-Memory system features, memory map, stack memory, memory protection unit (MPU), Exceptions and Interrupts-what are exceptions, nested vectored interrupt controller (NVIC), vector table, Fault handling, System control block (SCB), Debug, Reset and reset sequence.

**UNIT - II**

**Introduction to the Arm Instruction Set:** Data processing instructions, branch instructions, load-store instructions, software interrupt instructions, program status register instructions, loading constants, ARMv5E extensions, Conditional execution.

**Introduction to the Thumb Instruction Set:** Thumb Register Usage, ARM-Thumb Interworking, Other Branch Instructions, Data Processing Instructions, Single-Register Load-Store Instructions, Multiple- Register Load-Store Instructions, Stack Instructions, Software Interrupt Instruction.

**UNIT - III**

Technical Details of ARM Cortex M Processors General information about Cortex-M3 and cortex M4 processors-Processor type, processor architecture, instruction set, block diagram, memory system, interrupt and exception support, Features of the cortex-M3 and Cortex-M4





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Processors- Performance, code density, low power, memory system, memory protection unit, interrupt handling, OS support and system level features, Cortex-M4 specific features, Ease of use, Debug support, Scalability, Compatibility.

**UNIT - IV**

Instruction SET of ARM Cortex M Background to the instruction set in ARM Cortex-M Processors, Comparison of the instruction set in ARM Cortex-M Processors, understanding the assembly language syntax, Use of a suffix in instructions, Unified assembly Language (UAL), Instruction set, Cortex-M4- specific instructions, Barrel shifter, Accessing special instructions and special registers in Programming.

**UNIT -V**

Floating Point Operations About Floating Point Data, Cortex-M4 Floating Point Unit (FPU)- overview, FP registers overview, CPACR register, Floating point register bank, FPSCR, FPU->FPCCR, FPU- > FPCAR, FPU->FPDSCR, FPU->MVFR0, FPU->MVFR1. ARM Cortex-M4 and DSP

Applications: DSP on a microcontroller, Dot Product example, writing optimized DSP code for the CortexM4-Biquad filter, Fast Fourier transform, FIR filter.

**TEXT BOOKS:**

1. Andrew N. SLOSS, Dominic SYMES, Chris WRIGHT- ARM System Developer's Guide Designing and Optimizing System Software, Elsevier Publications, 2004.
2. Joseph Yiu, The Definitive Guide to ARM Cortex-M3 and Cortex-M4 Processors by Elsevier Publications, 3<sup>rd</sup> Ed.,

**REFERENCE BOOKS:**

1. Steve Furber - Arm System on Chip Architectures –Edison Wesley, 2000.
2. David Seal - ARM Architecture Reference Manual, Edison Wesley, 2000.



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**2225506: DIGITAL CONTROL SYSTEMS**

**I Year M.Tech (ES) II – Sem.**

**L T P C**

**3 0 0 3**

**Prerequisite:** Control Systems

**Course Objectives:**

1. To understand the fundamentals of digital control systems representations, z-transforms
2. To understand analysis of discrete complex domain: Z-Transforms
3. To understand the concepts of state variables analysis for discrete LTIV systems.
4. To understand the concepts of controllability and observability of discrete time systems
5. To get exposed the design aspects of controllers and for discrete time systems
6. To understand the concepts of the stability for discrete LTIV systems
7. To understand the design aspects of observers for discrete time systems.

**Course Outcomes:** At the end of this course, students will demonstrate the ability to

1. Obtain discrete representation of LTI systems.
2. Find the state space analysis of discrete time systems.
3. Test and analyze the controllability and observability for discrete time systems
4. Analyze stability of discrete time systems using various methods
5. Design and analyze digital controllers.
6. Design state feedback controllers and observers.

**UNIT- I: REPRESENTATION OF DISCRETE TIME SYSTEMS**

Basics of Digital Control Systems. Discrete representation of continuous systems. Sample and hold circuit. Mathematical Modeling of sample and hold circuit. Effects of Sampling and Quantization. Choice of sampling frequency. ZOH equivalent.

Z-Transforms, Mapping from s-plane to z plane, Properties of Z-Transforms and Inverse Z Transform. Pulse Transfer function: Pulse transfer function of closed loop systems. Solution of Discrete time systems. Time response of discrete time system, Steady State errors.

**UNIT- II: DISCRETE TIME STATE SPACE ANALYSIS**

State space representation of discrete time systems, Conversion of pulse transfer function to state space models and vice-versa, Solving discrete time state space equations, State Transition Matrix, Pulse Transfer Function Matrix. Discretization of continuous time state space equations. Concept of Controllability, stabilizability, observability, reachability – Controllability and observability tests. Effect of pole zero cancellation on the controllability & observability.

**UNIT- III: STABILITY ANALYSIS OF DISCRETE TIME SYSTEM**

Concept of stability in z-domain, Stability analysis discrete time system: by Jury test, using bilinear transformation. Stability Analysis of discrete time systems using Lyapunov methods.



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**UNIT- IV: DESIGN OF DIGITAL CONTROL SYSTEM BY CONVENTIONAL METHODS**

Design and realization of digital PID Controller, Design of discrete time controllers with bilinear transformation, Design of digital control system with dead beat response, Practical issues with dead beat response design.

**UNIT-V: DESIGN STATE FEEDBACK CONTROLLERS AND OBSERVERS**

Design of discrete state feedback controllers through pole placement, Design of Discrete Observer for LTI System: Design of full order and reduced observers, Design of observer-based controllers.

**TEXT BOOKS:**

1. K. Ogata, "Digital Control Engineering", Prentice Hall, Englewood Cliffs, 1995.
2. M. Gopal, "Digital Control Engineering", Wiley Eastern, 1988.
3. V, I, George and C. P. Kurian, Digital Control Systems, CENGAGE Learning, 2012

**REFERENCE BOOKS:**

1. G. F. Franklin, J. D. Powell and M. L. Workman, "Digital Control of Dynamic Systems", Addison-Wesley, 1998.
2. B.C. Kuo, "Digital Control System", Holt, Rinehart and Winston, 1980



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**2225513: IOT ARCHITECTURES AND SYSTEM DESIGN**  
(Professional Elective – III)

I Year M.Tech (ES) II – Sem.

L T P C

3 0 0 3

**Course Objectives**

1. To Know the definition and basic concepts of IoT
2. Learn the interfacing the IoT and M2M
3. To understand the Architecture of IoT

**Course Outcomes:** Students will be able to:

1. Integrate the sensors and actuator depending on the applications
2. Interface the IoT and M2M with value chains
3. Write Python programming for Arduino, Raspberry Pi devices
4. Design IoT based systems such as Agricultural IoT, Vehicular IoT etc.,

**UNIT - I**

**IoT introduction:** Introduction and definition of IoT, Evolution of IoT, IoT growth, Application areas of IoT, Characteristics of IoT, IoT stack, Enabling technologies, IoT levels, IoT sensing and actuation, Sensing types, Actuator types.

**UNIT - II**

**IoT and M2M:** M2M to IoT — A Basic Perspective– Introduction, Differences and similarities between M2M and IoT, SDN and NFV for IoT.M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies.

**UNIT - III**

**IoT Hands-on:** Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino. Introduction to Python programming, Introduction to Raspberry Pi, Interfacing Raspberry Pi with basic peripherals, Implementation of IoT with Raspberry Pi.

**UNIT - IV**

**IoT Architecture:** IoT Architecture components, Comparing IoT architectures, A simplified IoT architecture, The core IoT functional stack, IoT data management and compute stack



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**UNIT - V**

**IoT System design:** Challenges associated with IoT, Emerging pillars of IoT, Agricultural IoT, Vehicular IoT, Healthcare IoT, Smart cities, Transportation and logistics.

**TEXT BOOKS:**

1. Sudip Misra, Anandarup Mukherjee, Arijit Roy "Introduction to IOT", Cambridge University Press.
2. David Hanes, Gonzalo salgueiro, Patrick Grossetete, Rob barton, Jerome henry "IoT Fundamentals Networking technologies, protocols, and use cases for IoT", Cisco Press

**REFERENCE BOOKS:**

1. Cuno pfister, "Getting started with the internet of things", O Reilly Media, 2011
2. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1 st Edition, Apress Publications.
3. "Internet of Things concepts and applications", Wiley
4. Arshdeep Bahga, Vijay Madisetti "Internet of Things A Hands on approach", Universities Press
5. Shriram K Vasudevan, RMD Sundaram, Abhishek S Nagarajan, "Internet of things" John Wiley and Sons. Massimo Banzi, Michael Shiloh Make: Getting Started with the Arduino, Shroff Publisher/MakerMedia Publishers.



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**2225514: DESIGN FOR TESTABILITY**  
(Professional Elective – III)

**I Year M.Tech (ES) II – Sem.**

**L T P C**

**3 0 0 3**

**Pre-Requisite:** Digital System Design

**Course Objectives:**

1. To acquire the knowledge of fundamental concepts of testing
2. To provide broad understanding the fault simulation.
3. To illustrate the framework of Built-in-self test and Boundary scan methods.

**Course Outcomes:** Students will be able to

1. Acquire verification knowledge and test evaluation
2. Design for testability rules and techniques.
3. Utilize the scan architectures for different digital circuits.
4. Acquire the knowledge of design of built-in-self test.

**UNIT - I**

**Introduction to Testing:** Testing Philosophy, Role of Testing, Digital and Analog VLSI Testing, VLSI Technology Trends affecting Testing, Types of Testing, Fault Modeling: Defects, Errors and Faults, Functional Versus Structural Testing, Levels of Fault Models, Single Stuck-at Fault.

**UNIT - II**

**Logic and Fault Simulation:** Simulation for Design Verification and Test Evaluation, Modeling Circuits for Simulation, Algorithms for True-value Simulation, Algorithms for Fault Simulation, ATPG.

**UNIT - III**

**Testability Measures:** SCOAP Controllability and Observability, High Level Testability Measures, Digital DFT and Scan Design: Ad-Hoc DFT Methods, Scan Design, Partial-Scan Design, Variations of Scan.

**UNIT - IV**

**Built-In Self-Test:** The Economic Case for BIST, Random Logic BIST: Definitions, BIST Process, Pattern Generation, Response Compaction, Built-In Logic Block Observers, Test-Per-Clock, Test-Per-Scan BIST Systems, Circular Self Test Path System, Memory BIST, Delay Fault BIST.

**UNIT - V**

**Boundary Scan Standard:** Motivation, System Configuration with Boundary Scan: TAP Controller and Port, Boundary Scan Test Instructions, Pin Constraints of the Standard, Boundary Scan Description Language: BDSL Description Components, Pin Descriptions.

**TEXT BOOK:**



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1. M.L. Bushnell, V. D. Agrawal, "Essential of Electronic Testing for Digital, Memory and MixedSignal VLSI Circuits", Kluwer Academic Publishers.

**REFERENCE BOOKS:**

1. M. Abramovici, M. A. Breuer and A.D Friedman, Digital Systems and Testable Design", JaicoPublishing House.
2. P. K. Lala, "Digital Circuits Testing and Testability", Academic Press.



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**2225515: SOC DESIGN**  
**(Professional Elective – III)**

**I Year M.Tech (ES) II – Sem.**

**L T P C**

**3 0 0 3**

**Course Objectives:**

1. To learn ASIC design concepts and strategies
2. To know the NISC applications and advantages
3. To familiar with simulation and synthesis process

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

1. Identify and formulate a given problem in the framework of SoC based design approaches
2. Design SoC based system for engineering applications
3. Realize impact of SoC on electronic design philosophy and Macro-electronics thereby inclinetowards entrepreneurship & skill development.

**UNIT - I**

**ASIC:** Overview of ASIC types, design strategies, CISC, RISC and NISC approaches for SOC architectural issues and its impact on SoC design methodologies, Application Specific Instruction Processor (ASIP)concepts.

**UNIT - II**

**NISC:** NISC Control Words methodology, NISC Applications and Advantages, Architecture Description Languages (ADL) for design and verification of Application Specific Instruction-set Processors (ASIP), No-Instruction-Set-computer (NISC)- design flow, modeling NISC architectures and systems, use of Generic Netlist Representation - A formal language for specification, compilationand synthesis of embedded processors.

**UNIT - III**

**Simulation:** Different simulation modes, behavioural, functional, static timing, gate level, switch level, transistor/circuit simulation, design of verification vectors, Low power FPGA, Reconfigurable systems, SoC related modeling of data path design and control logic, Minimization of interconnects impact, clock tree design issues.

**UNIT - IV**

**Low power SoC design / Digital system** Design synergy, Low power system perspective-power gating, clock gating, adaptive voltage scaling (AVS), Static voltage scaling, Dynamic clock frequencyand voltage scaling (DCFS), building block optimization, building block memory, power down techniques, power consumption verification.





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**UNIT - V**

**Synthesis:** Role and Concept of graph theory and its relevance to synthesizable constructs, Walks, trails paths, connectivity, components, mapping/visualization, nodal and admittance graph. Technology independent and technology dependent approaches for synthesis, optimization constraints, Synthesis report, analysis Single core and Multi core systems, dark silicon issues, HDL coding techniques for minimization of power consumption, Fault tolerant designs

**TEXT BOOKS:**

1. Hubert Kaeslin, "Digital Integrated Circuit Design: From VLSI Architectures to CMOS Fabrication", Cambridge University Press, 2008.
2. B. Al Hashimi, "System on chip-Next generation electronics", The IET, 2006

**REFERENCE BOOKS**

1. Rochit Rajsuman, "System-on- a-chip: Design and test", Advantest America R & D Center, 2000
2. P Mishra and N Dutt, "Processor Description Languages", Morgan Kaufmann, 2008
3. Michael J. Flynn and Wayne Luk, "Computer System Design: System-on-Chip". Wiley, 2011



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**2225516: HARDWARE AND SOFTWARE CO-DESIGN**  
(Professional Elective – IV)

I Year M.Tech (ES) II – Sem.

L T P C

3 0 0 3

**Course Objectives:**

1. To Know the Co-design Issues, prototype and emulation techniques
2. To learn Architecture specific techniques
3. To know the different tool for design

**Course Outcomes:** Students will be able to:

1. Acquire the knowledge on various models of Co-design.
2. Explore the interrelationship between Hardware and software in a embedded system
3. Acquire the knowledge of firmware development process and tools during Co-design.
4. Implement validation methods and adaptability.

**UNIT - I**

**Co-Design Issues:** Co- Design Models, Architectures, Languages, A Generic Co-design Methodology. **Co-Synthesis Algorithms:** Hardware software synthesis algorithms: hardware – software partitioning distributed system co-synthesis.

**UNIT - II**

**Prototyping and Emulation:** Prototyping and emulation techniques, prototyping and emulation environments, future developments in emulation and prototyping architecture specialization techniques, system communication infrastructure.

**Target Architectures:** Architecture Specialization techniques, System Communication infrastructure, Target Architecture and Application System classes, Architecture for control dominated systems (8051- Architectures for High performance control), Architecture for Data dominated systems (ADSP21060, TMS320C60), Mixed Systems.

**UNIT - III**

**Compilation Techniques and Tools for Embedded Processor Architectures:** Modern embedded architectures, embedded software development needs, compilation technologies, practical consideration in a compiler development environment.

**UNIT - IV**

**Design Specification and Verification:** Design, co-design, the co-design computational model, concurrency coordinating concurrent computations, interfacing components, design verification, implementation verification, verification tools, interface verification.



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**UNIT - V**

**Languages for System – Level Specification and Design-I:** System – level specification, design representation for system level synthesis, system level specification languages,

**Languages for System – Level Specification and Design-II:** Heterogeneous specifications and multi- language co-simulation, the cosyma system and lycos system.

**TEXT BOOKS**

1. Hardware / Software Co- Design Principles and Practice – Jorgen Staunstrup, Wayne Wolf –Springer, 2009.

**REFERENCE BOOKS**

1. Hardware / Software Co- Design - Giovanni De Micheli, Mariagiovanna Sami, Kluwer Academic Publishers, 2002.
2. A Practical Introduction to Hardware/Software Co-design -Patrick R. Schaumont, Springer,2010



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**2225517: SECURE NETWORKS**  
(Professional Elective – IV)

**I Year M.Tech (ES) II – Sem.**

**L T P C**

**3 0 0 3**

**Course Objectives:**

1. To underlying principles and techniques for network and communication security.
2. To learn practical examples of security problems and principles for countermeasures
3. To provide cryptographic methods, protocols and applications.

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

1. Identify and utilize different forms of cryptography techniques.
2. Incorporate authentication and security in the network applications.
3. Distinguish among different types of threats to the system and handle the same.

**UNIT -I:**

**Security:** Need, security services, Attacks, OSI Security Architecture, one time passwords, Model for Network security, Classical Encryption Techniques like substitution ciphers, Transposition ciphers, Cryptanalysis of Classical Encryption Techniques.

**UNIT -II**

**Number Theory:** Introduction, Fermat's and Euler's Theorem, The Chinese Remainder Theorem, Euclidean Algorithm, Extended Euclidean Algorithm, and Modular Arithmetic.

**UNIT -III**

**Private-Key (Symmetric) Cryptography:** Block Ciphers, Stream Ciphers, RC4 Stream cipher, Data Encryption Standard (DES), Advanced Encryption Standard (AES), Triple DES, RC5, IDEA, Linear and Differential Cryptanalysis.

**UNIT -IV**

**Public-Key (Asymmetric) Cryptography:** RSA, Key Distribution and Management, Diffie-Hellman Key Exchange, Elliptic Curve Cryptography, Message Authentication Code, hash functions, message digest algorithms: MD4 MD5, Secure Hash algorithm, RIPEMD-160, HMAC.

**UNIT -V**

**Authentication and System Security:** IP and Web Security Digital Signatures, Digital Signature Standards, Authentication Protocols, Kerberos, IP security Architecture, Encapsulating Security Payload, Key Management, Web Security Considerations, Secure Socket Layer, Secure Electronic Transaction Intruders, Intrusion Detection, Password Management, Worms, viruses, Trojans, Virus Countermeasures, Firewalls, Trusted Systems.



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**TEXT BOOKS:**

1. William Stallings, "Cryptography and Network Security, Principles and Practices", Pearson Education, 3<sup>rd</sup> Edition.
2. Charlie Kaufman, Radia Perlman and Mike Speciner, "Network Security, Private Communication in a Public World", Prentice Hall, 2<sup>nd</sup> Edition

**REFERENCE BOOKS:**

1. Christopher M. King, Ertem Osmanoglu, Curtis Dalton, "Security Architecture, Design Deployment and Operations", RSA Press,
2. Stephen Northcutt, Leny Zeltser, Scott Winters, Karen Kent, and Ronald W. Ritchey, "Inside Network Perimeter Security", Pearson Education, 2<sup>nd</sup> Edition
3. Richard Bejtlich, "The Practice of Network Security Monitoring: Understanding Incident Detection and Response", William Pollock Publisher, 2013.



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**2225518: PHYSICAL DESIGN AUTOMATION**  
(Professional Elective – IV)

**I Year M.Tech (ES) II – Sem.**

**L T P C**

**3 0 0 3**

**Course Objectives:**

1. To understand the concepts of Physical Design Process (partitioning, Floor planning etc.,)
2. To know the concepts of design optimization algorithms and their application
3. To understand the clock and power design concepts

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

1. Implement automation process for VLSI System design.
2. Familiarize to use various physical design CAD tools.
3. Develop and enhance the existing algorithms and computational techniques for physical design process of VLSI systems.

**UNIT - I**

Introduction to VLSI Physical Design Automation: Design Representation, VLSI Design Styles, and VLSI Physical Design automation.

**UNIT - II**

Partitioning, Floor planning, Pin Assignment, Standard cell, Performance issues in circuit layout, delay models, Layout styles.

**UNIT - III**

**Placement:** Problem formulation, classification, Simulation based placement algorithms, Partitioning based placement algorithms, Time driven and performance driven placement.

**UNIT - IV**

**Global routing:** Problem formulation, classification of global routing, Maze routing algorithms, Line- Probe algorithms, and shortest path based algorithms, Steiner Tree based algorithms, Integer programming based approach, Performance driven routing.

Detailed Routing: Problem formulation, classification, Single layer, two layer, three layer and Multi-Layer channel routing, Algorithms, Switch box routing.

**UNIT - V**

**Over the Cell Routing** - Single layer and two-layer routing: Over the cell routing, Two Layer, Three Layer and Multi-Layer OTC Routing.

Via Minimization: Constraint and Unconstrained via minimization.

**Clock and Power Routing:** Clocking schemes, design considerations for the clock, Problem formulation, Clock routing algorithms, Skew and Delay reduction by Pin Assignment, Multiple clock routing, Power and Ground Routing

**TEXT BOOKS:**

1. Algorithms for VLSI Physical Design Automation – Naveed Sherwani, 3rd Ed., 2005,



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2. Algorithms for VLSI Design Automation, S.H.Gerez, 1999, WILEY Student Edition, John wiley&Sons (Asia) Pvt. Ltd.

**REFERENCE BOOKS:**

1. Computer Aided Logical Design with Emphasis on VLSI – Hill & Peterson, 1993, Wiley.
2. Modern VLSI Design: Systems on silicon – Wayne Wolf, 2nd ed., 1998, Pearson EducationAsia



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**2225523: ARM MICROCONTROLLERS LAB**

**I Year M.Tech (ES) II – Sem.**

**L T P C**

**0 0 3 2**

**Course Outcomes:** At the end of the laboratory work, students will be able to:

1. Install, configure and utilize tool sets for developing applications based on ARM processorcore SoC.
2. Develop prototype codes using commonly available on and off chip peripherals on the CortexM3 development boards.

**List of Assignments:**

**Part A)** Experiments to be carried out on Cortex-M3 development boards and using GNU tool-chain

1. Blink an LED with software delay, delay generated using the SysTicktimer.
2. System clock real time alteration using the PLL modules.
3. Control intensity of an LED using PWM implemented in software and hardware.
4. Control an LED using switch by polling method, by interrupt method and flash the LED on every five switch presses.
5. UART Echo Test.
6. Take analog readings on rotation of rotary potentiometer connected to an ADC channel.
7. Temperature indication on an RGB LED.
8. Mimic light intensity sensed by the light sensor by varying the blinking rate of an LED.
9. Evaluate the various sleep modes by putting core in sleep and deep sleep modes.
10. System reset using watchdog timer in case something goes wrong.
11. Sample sound using a microphone and display sound levels on LEDs.





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**2225524: DIGITAL CONTROL SYSTEMS LAB (Lab – IV)**

**I Year M.Tech (ES) II – Sem.**

**L T P C**

**0 0 3 2**

Perform the following experiments in real time by interfacing with the related hardware.

**List of Experiments:**

1. PWM pulse generation
2. Three phase voltage monitoring using A/D converter.
3. Three phase current monitoring using A/D converter.
4. Speed monitoring of AC motor.
5. Sine PWM pulse generation.
6. Inverter output voltage control.
7. Control of AC motor using UFD.
8. Control of DC motor using DC drive.



**2235519: EMBEDDED NETWORKS**  
(Professional Elective – V)

II Year M.Tech (ES) I – Sem.

**L T P C**

**3 0 0 3**

**Prerequisite:** Computer Networks.

**Course Objectives:**

1. To elaborate on the conceptual frame work of physical layer and topological issues of networking in Embedded Systems.
2. To emphasis on issues related to guided and unguided media with specific reference to Embedded device level connectivity.

**Course Outcomes:** Student will be able to

1. Acquire knowledge on communication protocols of connecting Embedded Systems.
2. Master the design level parameters of USB and CAN bus protocols.
3. Design Ethernet in Embedded networks considering different issues.
4. Acquire the knowledge of wireless protocols in Embedded domain.

**UNIT –I**

**Embedded Communication Protocols:** Embedded Networking: Introduction – Serial/Parallel Communication – Serial communication protocols -RS232 standard – RS485 – Synchronous Serial Protocols -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I2C) – PC Parallel port programming - ISA/PCI Bus protocols – Firewire.

**UNIT –II**

**USB and CAN Bus:** USB bus – Introduction – Speed Identification on the bus – USB States – USB bus communication Packets –Data flow types –Enumeration –Descriptors – PIC 18 Microcontroller USB Interface – C Programs –CAN Bus – Introduction - Frames – Bit stuffing –Types of errors –Nominal Bit Timing – PIC microcontroller CAN Interface –A simple application with CAN.

**UNIT –III**

**Ethernet Basics:** Elements of a network – Inside Ethernet – Building a Network: Hardware options –Cables, Connections and network speed – Design choices: Selecting components –Ethernet Controllers –Using the internet in local and internet communications – Inside the Internet protocol.

**UNIT –IV**

**Embedded Ethernet:** Exchanging messages using UDP and TCP – Serving web pages with DynamicData – Serving web pages that respond to user Input – Email for Embedded Systems – Using FTP –Keeping Devices and Network secure.

**UNIT –V**

**Wireless Embedded Networking:** Wireless sensor networks – Introduction – Applications



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– Network Topology – Localization –Time Synchronization - Energy efficient MAC protocols –SMAC – Energy efficient and robust routing – Data Centric routing.

**TEXT BOOKS**

1. Embedded Systems Design: A Unified Hardware/Software Introduction - Frank Vahid, TonyGivargis, John & Wiley Publications, 2002
2. Parallel Port Complete: Programming, interfacing and using the PCs parallel printer port - JanAxelson, Penram Publications, 1996.

**REFERENCE BOOKS**

1. Advanced PIC microcontroller projects in C: from USB to RTOS with the PIC18F series -DoganIbrahim, Elsevier 2008.
2. Embedded Ethernet and Internet Complete - Jan Axelson, Penram publications, 2003.
3. Networking Wireless Sensors - Bhaskar Krishnamachari, Cambridge press 2005.



**2235520: CMOS MIXED SIGNAL DESIGN**  
(Professional Elective – V)

II Year M.Tech (ES) I – Sem.

L T P C

3 0 0 3

**Pre-Requisites:** Analog Electronics

**Course Objectives:** The objectives of this course are to

1. Introduce circuit design concepts for basic building blocks used in mixed-signal integrated circuit designs.
2. Provide students with the skills to design mixed-signal integrated circuits with these building blocks.
3. Understand design and operation of basic analog circuits.
4. Know mixed signal circuits like DAC, ADC, PLL etc.
5. Design and analysis of switched capacitor circuits
6. Analysis basic data conversion algorithms and circuits.

**Course Outcomes:** At the completion of this course, each student will have demonstrated proficiency in:

1. Designing CMOS analog circuits to achieve performance specifications.
2. Analyzing CMOS based switched capacitor circuits.
3. Designing data converters and know how to use these in specific applications
4. Design a mixed-signal circuits with understanding design flow.

#### UNIT - I

##### Switched Capacitor Circuits

Introduction to Switched Capacitor circuits- basic building blocks, Operation and Analysis, Non-ideal effects in switched capacitor circuits, Switched capacitor integrators first order filters, Switch sharing, biquad filters.

#### UNIT - II

##### Phased Lock Loop (PLL)

Basic PLL topology, Dynamics of simple PLL, Charge pump PLLs-Lock acquisition, Phase/Frequency detector and charge pump, Basic charge pump PLL, Non-ideal effects in PLLs-PFD/CP non-idealities, Jitter in PLLs, Delay locked loops, applications

#### UNIT - III

##### Data Converter Fundamentals

DC and dynamic specifications, Quantization noise, Nyquist rate D/A converters- Decoder based converters, Binary-Scaled converters, Thermometer-code converters, Hybrid converters.

#### UNIT - IV

##### Nyquist Rate A/D Converters

Successive approximation converters, Flash converter, Two-step A/D converters, Interpolating A/D converters, Folding A/D converters, Pipelined A/D converters, Time-



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interleaved converters.

**UNIT - V**

**Oversampling Converters**

Noise shaping modulators, Decimating filters and interpolating filters, Higher order modulators, Delta sigma modulators with multibit quantizers, Delta sigma D/A.

**TEXT BOOKS:**

1. Design of Analog CMOS Integrated Circuits- Behzad Razavi, TMH Edition, 2002.
2. CMOS Analog Circuit Design - Philip E. Allen and Douglas R. Holberg, Oxford University Press, International Second Edition/Indian Edition, 2010.
3. Analog Integrated Circuit Design- David A. Johns, Ken Martin, Wiley Student Edition, 2013.

**REFERENCE BOOKS:**

1. CMOS Integrated Analog-to- Digital and Digital-to-Analog converters-Rudy Van DePlassche, Kluwer Academic Publishers, 2003
2. Understanding Delta-Sigma Data converters-Richard Schreier, Wiley Interscience, 2005.
3. CMOS Mixed-Signal Circuit Design - R. Jacob Baker, Wiley Interscience, 2009.



**2235521: HUMAN MACHINE INTERFACE**  
(Professional Elective – V)

II Year M.Tech (ES) I – Sem.

L T P C

3 0 0 3

**Course Objectives:**

1. To learn the guidelines for user interface
2. To learn the foundations of Human Computer Interaction
3. To become familiar with the design technologies for individuals and persons with disabilities
4. To learn about different HCI models
5. To become familiar with the features of windows and interactive devices

**Course Outcomes:** Upon completion of the course, the students will be able to:

1. Design effective dialog for HCI
2. Design effective HCI for individuals and persons with disabilities
3. Assess the importance of user feedback.
4. Explain the HCI implications for designing multimedia/ e-learning Web sites
5. Develop meaningful user interface.

**UNIT - I**

**Basics of User Interface**

Importance of user interface- Definition, importance of good design, benefits of good design, brief history of human-computer interface, Graphical User Interface, Popularity of Graphics, Concept of Direct Manipulation, Graphical Systems, Characteristics of GUI, Web user interface popularity, Characteristics and Principles of user interface

**UNIT – II**

**Foundations of Human Computer Interface**

The Human: I/O channels – Memory – Reasoning and problem solving; The Computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms. - Case Studies

**UNIT – III**

**Design Process**

Interactive Design: Basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process: Software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules: principles, standards, guidelines, rules. Evaluation Techniques – Universal Design

**UNIT – IV**

**Models and Theories**

HCI Models: Cognitive models: Socio-Organizational issues and stakeholder requirements, Communication and collaboration models-Hypertext, Multimedia and WWW.

**UNIT - V**

**Windows and Interaction Devices**



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Window characteristics, Components of window, Window Presentation Style, Types of windows, Organizing window functions, Characteristics of input devices, Selection of proper input devices, Output devices

**TEXT BOOKS:**

1. Wilbert O. Galitz - The essential Guide to User Interface Design, 3<sup>rd</sup> Ed.,
2. Wiley, 2007 (Unit I & V)
3. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, —Human Computer Interaction", 3rdEd., Pearson Education, 2004 (UNIT II, III & IV)

**REFERENCE BOOKS:**

1. Daniel Newman, Olivier Blanchard — Human/Machine: The Future of our partnership with machine,
2. Paul R. Daugherty, H. James Wilson – Human+Machine: Reimagining work in the Age of AI Hardcover, Kindle Ed.,



MARRI LAXMAN REDDY INSTITUTE OF TECHNOLOGY AND MANAGEMENT  
(AUTONOMOUS)

**2210001: ENGLISH FOR RESEARCH PAPER WRITING**  
**(Audit Course-I)**

**I Year M.Tech (ES) I – Sem.**

**L T P C**  
**2 0 0 0**

**Prerequisite:** None

**Course objectives:** Students will be able to:

- Understand that how to improve your writing skills and level of readability
- Learn about what to write in each section
- Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission

**UNIT-I:**

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

**UNIT-II:**

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

**UNIT-III:**

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

**UNIT-IV:**

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

**UNIT-V:**

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

**TEXT BOOKS/ REFERENCES:**

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





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(AUTONOMOUS)**

**2210002: DISASTER MANAGEMENT  
(Audit Course-I)**

**I Year M.Tech (ES) I – Sem.**

**L T P C**

**2 0 0 0**

**Prerequisite:** None

**Course Objectives:** Students will be able to

- learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in

**UNIT-I:**

**Introduction:**

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

**Disaster Prone Areas in India:**

Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics

**UNIT-II:**

**Repercussions of Disasters and Hazards:**

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

**UNIT-III:**

**Disaster Preparedness and Management:**

Preparedness: Monitoring of Phenomena Triggering A Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.

**UNIT-IV:**

**Risk Assessment Disaster Risk:**

Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.



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(AUTONOMOUS)**

**UNIT-V:**

**Disaster Mitigation:**

Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

**TEXT BOOKS/ REFERENCES:**

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



MARRILAXMAN REDDY INSTITUTE OF TECHNOLOGY AND MANAGEMENT  
(AUTONOMOUS)

**2210003: SANSKRIT FOR TECHNICAL KNOWLEDGE**  
(Audit Course-I)

I Year M.Tech (ES) I – Sem.

L T P C

2 0 0 0

**Prerequisite:** None

**Course Objectives:**

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world
- Learning of Sanskrit to improve brain functioning
- Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power
- The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

**Course Outcomes:** Students will be able to

- Understanding basic Sanskrit language
- Ancient Sanskrit literature about science & technology can be understood
- Being a logical language will help to develop logic in students

**UNIT-I:**

Alphabets in Sanskrit,

**UNIT-II:**

Past/Present/Future Tense, Simple Sentences

**UNIT-III:**

Order, Introduction of roots,

**UNIT-IV:**

Technical information about Sanskrit Literature

**UNIT-V:**

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

**TEXT BOOKS/ REFERENCES:**

1. "Abhyasustakam" – Dr. Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.



**MARRI LAXMAN REDDY INSTITUTE OF TECHNOLOGY AND MANAGEMENT  
(AUTONOMOUS)**

**2210004: VALUE EDUCATION  
(Audit Course-I)**

**I Year M.Tech (ES) I – Sem.**

**L T P C**

**2 0 0 0**

**Prerequisite:** None

**Course Objectives:** Students will be able to

- Understand value of education and self- development
- Imbibe good values in students
- Let the should know about the importance of character

**Course outcomes:** Students will be able to

- Knowledge of self-development
- Learn the importance of Human values
- Developing the overall personality

**UNIT-I:**

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

**UNIT-II:**

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

**UNIT-III:**

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline, Punctuality, Love and Kindness.

**UNIT-IV:**

Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature

**UNIT-V:**

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

**TEXT BOOKS/ REFERENCES:**

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



**MARRI LAXMAN REDDY INSTITUTE OF TECHNOLOGY AND MANAGEMENT  
(AUTONOMOUS)**

**2220005: CONSTITUTION OF INDIA  
(Audit Course-II)**

**I Year M.Tech (ES) II – Sem.**

**L T P C**

**2 0 0 0**

**Prerequisite:** None

**Course Objectives:** Students will be able to:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

**Course Outcomes:** Students will be able to:

- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

**UNIT-I:**

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

**Philosophy of the Indian Constitution:** Preamble, Salient Features.

**UNIT-II:**

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

**UNIT-III:**

**Organs of Governance:** Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualification, Powers and Functions.

**UNIT-IV:**

**Local Administration:** District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments),



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Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

**UNIT-V:**

**Election Commission:** Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

**TEXT BOOKS/ REFERENCES:**

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.



MARRI LAXMAN REDDY INSTITUTE OF TECHNOLOGY AND MANAGEMENT  
(AUTONOMOUS)

**2220006: PEDAGOGY STUDIES**  
(Audit Course-II)

I Year M.Tech (ES) II – Sem.

**L T P C**

**2 0 0 0**

**Prerequisite:** None

**Course Objectives:** Students will be able to:

- Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.

**Course Outcomes:** Students will be able to understand:

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

**UNIT-I:**

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

**UNIT-II:**

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

**UNIT-III:**

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

**UNIT-IV:**

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



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**UNIT-V:**

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

**TEXT BOOKS/ REFERENCES:**

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, *Compare*, 31(2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, *Journal of Curriculum Studies*, 36 (3): 361-379.
3. Akyeamong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeamong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? *International Journal Educational Development*, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign. [www.pratham.org/images/resource%20working%20paper%202.pdf](http://www.pratham.org/images/resource%20working%20paper%202.pdf).





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(AUTONOMOUS)

**2220007: STRESS MANAGEMENT BY YOGA**  
**(Audit Course-II)**

**I Year M.Tech (ES) II – Sem.**

**L T P C**

**2 0 0 0**

**Prerequisite:** None

**Course Objectives:**

- To achieve overall health of body and mind
- To overcome stress

**Course Outcomes:** Students will be able to:

- Develop healthy mind in a healthy body thus improving social health also
- Improve efficiency

**UNIT-I:**

Definitions of Eight parts of yog. (Ashtanga)

**UNIT-II:**

Yam and Niyam.

**UNIT-III:**

Do`s and Don`t`s in life.

- i) Ahinsa, satya, astheya, bramhacharya and aparigraha
- ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

**UNIT-IV:**

Asan and Pranayam

**UNIT-V:**

- i) Various yog poses and their benefits for mind & body
- ii) Regularization of breathing techniques and its effects-Types of pranayam

**TEXT BOOKS/ REFERENCES:**

1. 'Yogic Asanas for Group Training-Part-I': Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama(Publication Department), Kolkata



**2220006: PERSONALITY DEVELOPMENT THROUGH LIFE  
ENLIGHTENMENT SKILLS  
(Audit Course-II)**

**I Year M.Tech (ES) II – Sem.**

**L T P C**

**2 0 0 0**

**Prerequisite:** None

**Course Objectives:**

- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students

**Course Outcomes:** Students will be able to

- Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
- The person who has studied Geeta will lead the nation and mankind to peace and prosperity
- Study of Neetishatakam will help in developing versatile personality of students

**UNIT-I:**

Neetisatakam-Holistic development of personality

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

**UNIT-II:**

Neetisatakam-Holistic development of personality

- Verses- 52,53,59 (don't's)
- Verses- 71,73,75,78 (do's)

**UNIT-III:**

Approach to day to day work and duties.

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

**UNIT-IV:**

Statements of basic knowledge.

- Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68
- Chapter 12 -Verses 13, 14, 15, 16,17, 18
- Personality of Role model. Shrimad Bhagwad Geeta:

**UNIT-V:**

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

**TEXT BOOKS/ REFERENCES:**



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1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata.
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.



**MARRI LAXMAN REDDY INSTITUTE OF TECHNOLOGY AND MANAGEMENT  
(AUTONOMOUS)**

**2235501: OVERVIEW OF VLSI & EMBEDDED SYSTEMS  
(Open Elective)**

**II Year M.Tech (ES). I – Sem.**

**L T PC**

**3 0 03**

**Course Objectives:**

- To acquire the knowledge about various architectures and applications of processors
- To understand issues, challenges implementation of VLSI chips
- To learn about synthesis of DSP architecture
- To understand various processors and component datasheets
- To be familiar with working on a team to create and apply embedded systems

**Course Outcomes:**

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

- Analyze combinational and sequential circuit design
- Analyze and develop various FSMs & ASMs for the given problems.
- Demonstrate semiconductor IC design such as PLA's, PAL, FPGA, CPLDs
- Demonstrate VHDL synthesis, simulation, design captures tools, design verification tools.
- Prototype digital Systems using FPGA

**UNIT I**

Essential features of Instruction set architectures of CISC, RISC and DSP processors and their implications for implementation as VLSI chips; CISC Instruction-set implementation and RT-Level optimization through hardware flow-charting (without/with pipelining concepts).

**Learning Outcomes:** At the end of the unit, the student will be able to

- Describe the Architecture of CISC, RISC and DSP Processors
- Summarize the operational modes of different processors
- Illustrate the various applications of DSP processor

**UNIT II**

Implementation of DSP Instruction sets, Programmable and function specific architectures; Synthesis of DSP architectures; Scheduling and resource allocation for DSP architectures.

**Learning Outcomes:** At the end of the unit, the student will be able to

- Illustrate the concepts of programmable and specific architectures
- Demonstrate various DSP Instruction sets
- Discuss the concepts of resource allocation for DSP Processors

**UNIT III**

Different abstraction levels in VLSI design, Design flow as a succession of translations among different abstraction levels, Gajski's Y-Chart; Need for manual designing to move to higher levels of abstraction with automatic translation at lower levels of abstraction.

**Learning Outcomes:** At the end of the unit, the student will be able to

- Understand the concepts of different abstraction levels
- Understand the abstraction is advantageous to implement low power techniques
- Synthesize digital circuit targeting state of the art VLSI design

**UNIT IV**



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(AUTONOMOUS)

Bus architectures, communication protocols, microcontroller and FPGA architectures and instruction sets, low-power design.

**Learning Outcomes:** At the end of the unit, the student will be able to

- Analyze the different types of FPGA architectures
- Understand the concept of communication protocols
- Identify the different types of low-power designs

**UNIT V**

Hardware, models of hardware –FSM, controller, micro-programmed etc., architecture synthesis, design space exploration.

**Learning Outcomes:** At the end of the unit, the student will be able to

- Understand the concept of FSM
- Analyze the design space exploration
- Identify different types of hardware models for FSM

**Text Books:**

1. A.M. Dewey, Analysis and Design of Digital Systems with VHDL, PWS Kent, 1996.
2. A.A. Jerraya, H. Ding and P. Kission, Behavioral Synthesis and Component Reuse with VHDL, Kluwer, 1996.

**Reference Books:**

1. K.C. Chang, Digital System Design with VHDL and Synthesis: An Integrated Approach, Wiley India Pvt. Ltd., New Delhi
2. W. Wolf, Computers as Components: Principles of Embedded Computing System Design (The Morgan Kaufmann Series in Computer Architecture and Design), Elsevier Inc. 3<sup>rd</sup> edition, 2016.
3. W.H.Wolf, "Computers as Components: Principles of Embedded Computing System Design", Elsevier, 2008.



**2235502: PRINCIPLES OF ELECTRONIC COMMUNICATIONS  
(Open Elective)**

**II Year M.Tech (ES). I – Sem.**

**L T PC**

**3 0 03**

**Course Objectives:**

- To acquire the knowledge about modulation of various analog and digital modulation schemes.
- Understanding of satellite, optical, cellular, mobile, wireless and telecom concepts.
- Acquire theoretical knowledge of each block in AM/FM transmitters and receivers
- Understand the concepts of baseband transmissions and various source & channel coding techniques
- Study of various noise sources and SNR/Figure of Merit calculations

**Course Outcomes:**

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

- List and discuss needs and types of modulations.
- Describe analog pulse modulation techniques and digital modulation technique.
- Explain and apply the concepts telecommunication switching, traffic and network fundamentals.
- To provide an in-depth illustration of different concepts used in a satellite communication system and summarize the basic elements of optical fibre transmission link.
- Discuss various wireless and cellular, mobile and telephone communication systems.

**UNIT - I**

Introduction: Need for Modulation, Frequency translation, Electromagnetic spectrum, Gain, Attenuation and decibels.

**UNIT - II**

Simple description on Modulation: Analog Modulation-AM, FM, Pulse Modulation-PAM, PWM, PCM, Digital Modulation Techniques-ASK, FSK, PSK, QPSK modulation and demodulation schemes.

**UNIT - III**

Telecommunication Systems: Telephones Telephone system, Paging systems, Internet Telephony.

Networking and Local Area Networks: Network fundamentals, LAN hardware, Ethernet LANs, Token Ring LAN.

**UNIT - IV**

Satellite Communication: Satellite Orbits, satellite communication systems, satellite subsystems, Ground Stations Satellite Applications, Global Positioning systems.

**Optical Communication:** Optical Principles, Optical Communication Systems, Fiber –Optic Cables,



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(AUTONOMOUS)

Optical Transmitters & Receivers, Wavelength Division Multiplexing.

**UNIT - V**

Cellular and Mobile Communications: Cellular telephone systems, AMPS, GSM, CDMA, WCDMA.

**Wireless Technologies:** Wireless LAN, PANs and Bluetooth, ZigBee and Mesh Wireless networks, Wimax and MANs, Infrared wireless, RFID communication, UWB.

**TEXT BOOKS**

1. Louis E. Frenzel, "Principles of Electronic Communication Systems", 3rd Ed., McGraw Hill publications, 2008.
2. Kennedy, Davis, "Electronic Communications systems", 4Ed., TMH, 1999

**REFERENCE BOOKS**

1. Tarmo Anttalainen, "Introduction to Telecommunications Network Engineering", Artech House Telecommunications Library.
2. Theodore Rappaport, "Wireless Communications-Principles and practice", Prentice Hall, 2002.
3. Roger L. Freeman, "Fundamentals of Telecommunications", 2 Ed. Wiley publications.
4. Wayne Tomasi, "Introduction to data communications and networking", Pearson Education, 2005.



**MARRI LAXMAN REDDY INSTITUTE OF TECHNOLOGY AND MANAGEMENT  
(AUTONOMOUS)**

**2235503: FUNDAMENTALS OF NANO TECHNOLOGY  
(Open Elective)**

**II Year M.Tech (ES). I – Sem.**

**L T PC**

**3 0 0 3**

**Course Objectives:**

- Imparting the basic knowledge in Nano Science and Technology.
- Discuss how nanotechnology can help in the global energy crisis
- Describe how nanoscale particles (quantum dots) can be synthesised, characterised and utilised.
- Understand and predict nanoscale devices and behaviour and communicate
- Learn independently and self-critically.

**Course Outcomes:**

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

- Analyze combinational and sequential circuit design
- To familiarize about the various properties of nanostructures.
- To bring out the differences between nano and macro structures.
- To discuss applications specific properties of nano materials.
- Will give insight into many aspects of Nanoscience, technology and their applications in the prospective of materials science.

**UNIT- I:**

**Over View of Nanotechnology:** Definition – historical development – properties, design and fabrication Nanosystems, working principle, applications and advantages of nano system. Nanomaterials –ordered oxides – Nano arrays – potential health effects

**UNIT –II:**

**Nanodefects, Nano Partiles and Nanolayers:** Nanodefects in crystals – applications – Nuclear Track nano defects. Fabrication of nano particles – LASER ablation – sol gels – precipitation of quantum dots. Nano layers – PVD, CVD, Epitaxy and ion implantation – formation of Silicon oxide-chemical composition – doping properties – optical properties

**UNIT- III:**

**Nanostructuring:** Nanophotolithography – introduction – techniques – optical – electron beam – ion beam – X-ray and Synchrotron – nanolithography for microelectronic industry – nanopolishign of Diamond – Etching of Nano structures – Nano imprinting technology – Focused ion beams - LASER interference Lithography nanoarrays –Near-Field Optics - case studies and Trends

**UNIT- IV:**

**Science and Synthesis of Nano Materials:** Classification of nano structures – Effects of nano scale dimensions on various properties – structural, thermal, chemical, magnetic, optical and electronic properties fluid dynamics –Effect of nano scale dimensions on mechanical properties - vibration, bending, fracture Nanoparticles, Sol-Gel Synthesis, Inert Gas Condensation, High energy Ball Milling, Plasma Synthesis, Electro deposition and other techniques. Synthesis of Carbon nanotubes – Solid carbon source-based production techniques – Gaseous carbon source-based production techniques –Diamond like carbon coating. Top down and bottom up processes





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(AUTONOMOUS)

**UNIT –V:**

**Characterization of Nano Materials:** Nano-processing systems – Nano measuring systems – characterization – analytical imaging techniques – microscopy techniques, electron microscopy scanning electron microscopy, confocal LASER scanning microscopy - transmission electron microscopy, transmission electron microscopy, scanning tunneling microscopy, atomic force microscopy, diffraction techniques – spectroscopy techniques – Raman spectroscopy, 3D surface analysis – Mechanical, Magnetic and thermal properties – Nano positioning systems.

**TEXT BOOKS:**

1. Tai-Ran Hsu, MEMS and Microsystems Design and Manufacture, Tata-McGraw Hill, NewDelhi, 2002.
2. Fahrner W.R., Nanotechnology and Nanoelectronics, Springer (India) Private Ltd., 2011.
3. Mark Madou, Fundamentals of Microfabrication, CRC Press, New York, 1997.
4. Norio Taniguchi, Nano Technology, Oxford University Press, New York, 2003.

**REFERENCE BOOKS:**

1. Mohamed Gad-el-Hak, MEMS Handbook, CRC press, 2006, ISBN: 8493-9138-5.
2. Waqar Ahmed and Mark J. Jackson, Emerging Nanotechnologies for Manufacturing, ElsevierInc., 2013, ISBN: 978-93-82291-39-8 29.
3. Sami Franssila, Introduction to Micro fabrication, John Wiley & sons Ltd, 2004. ISBN: 470-85106-6.
4. Charles P Poole, Frank J Owens, Introduction to Nano technology, John Wiley and Sons, 2003.
5. Julian W. Hardner Micro Sensors, Principles and Applications, CRC Press 1993.

**\*Open Elective** – Students should take Open Electives from List of Open Electives Offered by Other Departments/Branches Only.

**Ex:** - A Student of Mechanical Engineering can take Open Electives from all other departments/branches except Open Electives offered by Mechanical Engineering Dept.