# ACADEMIC REGULATIONS (R18PG)

## COURSE STRUCTURE AND DETAILED SYLLABUS

**For**

**M.Tech.- Regular Two Year Post Graduate Degree Programe**

**(Effective from 2018-19)**

# MASTER OF TECHNOLOGY
# IN
# DIGITAL ELECTRONICS AND COMMUNICATION SYSTEMS


**KANDULA SRINIVASA REDDY MEMORIAL COLLEGE OF ENGINEERING**

**(UGC-Autonomous)**

**Kadapa 516003, A.P**

**(Approved by AICTE, Affiliated to JNTUA, Ananthapuramu, Accredited by NAAC)**

**(An ISO 14001:2004 & 9001: 2015 Certified Institution)**

**E-mail:** principal@ksrmce.ac.in **Website:** www.ksrmce.ac.in

# ABOUT THE COLLEGE

The college owes its existence to the keen interest of Late Kandula Obul Reddy to develop technical education in Rayalaseema region of Andhra Pradesh. With a view to translating his noble ideal of imparting technical education into reality, a Technical Training Institute at Vempalli, Kadapa District was started in 1979 under the aegis of Sri Kandula Obul Reddy charities. It is in the year 1980 that K.S.R.M. College of Engineering was established to perpetuate the memory of Late Sri. Srinivasa Reddy, youngest son of Late Sri Obul Reddy. Sri Srinivasa Reddy, a brilliantstudent of III year Mechanical Engineering at Delhi College of Engineering, New Delhi, met with his untimely death in a scooter accident on 18th Oct, 1979. The college was formally inaugurated on 14 November 1980 by Sri T. Anjaiah, the Chief Minister of Andhra Pradesh and it started functioning from the academic year 1980-81.

The college had its modest beginnings in 1980 with an intake of 160 students with core branches "Civil, Electrical & Electronics, Electronics & Communications and Mechanical Engineering. Keeping in view the latest trends, priorities and relevance in Engineering and Technology, the Board of Management decided to start Computer Science and Engineering in 1990 commemorating the decennial year of the college. With the conserted efforts of the Management and the Successive Principals, the departments have been strengthened year after year and the intake has steadily been increased to 1080 by the year 2014. Furthering its sphere of activity, the college started post graduate programme in CAD/CAM (ME), Geo-technical Engineering (CE) in the year 2004, Power Systems (EEE) & Computer Science and Engineering (CSE) during 2010-11 and Digital Electronics and Communication Systems (ECE) in 2011-12 respectively. The branches have constantly been strengthened by increasing the intake from time to time. This reflects one aspect of the progress and development of the college.

The College campus is located 7 K.M. away from Kadapa town on Kadapa to Pulivendula Highway in a calm and salubrious area of 35 acres. The College is set in a serene environment with lush greenery and fresh air. Four multi-storeyed RCC structures measuring 26,700 sqm provide accommodation for the departments. The College has dedicated electric power feeder and 250 KVA substation. Other capital resources include transport vehicles and four hostels. Excellent Bus facilities exist from Kadapa to Hyderabad, Vijayawada, Nellore, Tirupati, Kurnool, Bangalore, Chittoor and Chennai.

# VISION

To evolve as center of repute for providing quality academic programs amalgamated with creative learning and research excellence to produce graduates with leadership qualities, ethical and human values to serve the nation.

# MISSION

**M1:** To provide high quality education with enriched curriculum blended with impactful teaching learning practices.

**M2:** To promote research, entrepreneurship and innovation through industry collaborations.

**M3:** To produce highly competent professional leaders for contributing to Socio-economic development of region and the nation.

# ABOUT THE DEPARTMENT

ECE Department was started in the year 1980 with an intake of 15. Since then the intake was gradually increased from 30 to 60 in the year 1990 then to 90 in the year 2001, to120 in the year 2007, to 180 in the year 2017. PG course with the specialization DECS was introduced in the year 2011 with an intake of 18 which was later increased to 18 in the year 2018and switched to Embedded Systems and VLSI in the year 2022.

The department has highly qualified and experienced faculty. There are Ten Doctorates in the department. The department has good infrastructural facilitates and is equipped with full-fledged laboratories. The department also has audio-visual facilities with four Digital Graphics Drawing Tablets for effective teaching. The staff members are deputed to participate in workshops, conferences, and refresher courses to keep in pace with recent developments in the field of Electronics & Communication Engineering.

The Department is accredited by AICTE-NBA twice. As part of the curriculum, Industrial visits are arranged for students of B. Tech (ECE) in III/IV year II Semesters. Students of our department actively participate in National-level Student Paper Presentation Contests being organized at various engineering colleges and universities. A few of them have been awarded in these paper presentation contests. The Department organizes the Co –Curricular and Extra Curricular activities through IEEE and IETE student chapters.

## VISION

To emerge as globally recognized department in the frontier areas of Electronics and Communication Engineering.

## MISSION

**M1:**To imbibe experiential, lifelong learning skills and problem solving capabilities through enriched curriculum and innovative teaching learning practices.

**M2:** To promote quality research by strengthening industry collaborations.

**M3:**To inculcate entrepreneurial attitude, leadership skills, human values and professional ethics.

## PROGRAM EDUCATIONAL OBJECTIVES

**PEO1**: To apply the concepts of electronics, communication and computation and pursue career in core and allied industries to solve industrial and societal problems.
**PEO2**: To pursue higher education to progress professionally in contemporary Technologies and multidisciplinary fields with an inclination towards continuous learning.
**PEO3**: To exhibit professional skills, ethical values, interpersonal skills, leadership abilities, team spirit and lifelong learning.

# PROGRAM OUTCOMES

**PO1 - Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**PO2 - Problem Analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**PO3 - Design/Development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**PO4 - Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**PO5 - Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

**PO6 - The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

**PO7 - Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

**PO8 - Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.

**PO9 - Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**PO10 - Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**PO11 - Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**PO12 - Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

# PROGRAM SPECIFIC OUTCOMES

**PSO1**: An ability to design electronic circuits for applications including signal processing, communications, computer networks, Embedded systems and in the field of VLSI

**PSO2**: Develop innovative technologies for Entrepreneurship with new cutting edge Technologies in the fields of electronic design, communication and automation.

**PSO3**: Identify and Apply Domain specific tools for Design, Analysis and Synthesis in the areas of Signal Processing, Communications, VLSI and Embedded systems.

**Regulations for PG Programs in Engineering (R18PG)**
**(Effective from 2018-19)**

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**KSRM College of Engineering, Kadapa-516003, AP**

**Regulations for PG Programs in Engineering (R18PG)**

## 1.0 Nomenclature

**1.1** *Academic Term*: Extent of time during which academic instructions are initiated and completed.

**1.2** *Academic Year*: Academic Term of, approximately, one year duration that usually starts in June/July and ends in April/May next

**1.3** *Semester*: Either of two Academic Terms that make up an Academic Year

**1.4** *Major*: A specific field of study

**1.5** *Minor*: An area outside of, or complementary to, a Major

**1.6** *Subject*: An area of knowledge that is studied as part of a Course

**1.7** *Core*: A subject that is mandatory for a Major course of study

**1.8** *Elective*: A subject that is selected for study to suit one's individual needs

**1.9** *Audit Subject*: A subject that is studied to meet certain requirements but has no credits assigned to it

**1.10** *Humanities subjects*: Subjects that describe and interpret human achievements, problems and historical changes at individual and societal levels covering the disciplines of literature, history, and philosophy

**1.11** *Social Sciences subjects*: Subjects that describe the mental and behavioral activities of individuals, groups, organizations, institutions, and nations covering the disciplines of anthropology, economics, linguistics, political science, and psychology

**1.12** *Exam*: A test to measure one's progress, knowledge, or ability in a subject

**1.13** *Credit*: A numerical weight given to a subject

**1.14** *Grade*: A numerical or alphabetic designation measuring the level ofachievement in an exam

**1.15** *Attendance*: Physical presence of oneself in a classroom/laboratory forpurpose of a scheduled academic instruction

**1.16** *Course*: A series of subjects that constitute a Major field of study

**1.17** *Branch*: Same as Course

**1.18** *Program*: Same as Course

**1.19** *Specialization*: Same as branch

**1.20** *Degree*: An academic title conferred to honour distinguished achievement

## 2.0 Short Title and Application

**2.1** These rules and regulations may be called as R18 PG and come into force from Academic Year 2018-19 and exist until superseded by new regulations

**2.2** These rules and regulations are applicable to all post graduate courses in engineering and technology leading to Master's Degree in Technology (M. Tech)

**2.3** The Specializations offered, at present, are:

2.3.1 Geotechnical Engineering

2.3.2 Power Systems

2.3.3 Renewable Energy
2.3.4 Embedded System & VLSI
2.3.5 Artificial Intelligence & Data Science

**2.4** The Institute may offer new Specializations in future to which these rules and regulations will be applicable

## 3.0 Suspension and Amendment of Rules

**3.1** Academic Council has the authority to suspend a rule temporarily

**3.2** Academic Council has the authority to amend a rule

**3.3** For affirmative action on any suspension or amendment of a rule, an affirmative vote of three-fifths of the members present and voting shall be required in Academic Council

## 4.0 Requirements for Admission

**4.1** At present, admissions into first semester of various Specializations are governed by Government and the Affiliating University. The eligibility criteria and procedure for admission are prescribed by Government and Affiliating University

**4.2** A student is not allowed change of Specialization after admission

**4.3** A student must fulfil medical standards required for admission

**4.4** The selected students are admitted into first semester after payment of the prescribed fees

## 5.0 Structure of the M. Tech course

**5.1** *Duration*: The duration of M. Tech degree course is four semesters

**5.2** *Working Days*: Calendar for any semester shall be announced at least four weeks before its commencement. Minimum number of working days is 90 per semester

**5.3** *Curriculum*: Each Specialization shall have core, elective and audit subjects. The curriculum for each Specialization shall be approved by its corresponding Board of Studies and then by the Academic Council

**5.4** *Credits*: All subjects that are assessed for marks have credits assigned to them. The credits assigned to subjects shall be given in curriculum. The total number of credits for entire course is 68 for all Specializations. The distribution of total credits semester-wise is given in Table 1

Table 1 Semester-wise Total Credits

| Semester | Total Credits |
|---|---|
| First Semester | 18 |
| Second Semester | 18 |
| Third Semester | 16 |
| Fourth Semester | 16 |
| **Total for entire course** | **68** |

**5.5** The curriculum and syllabus is given in Annexure-1 and Annexure-2 respectively

**5.6** Responsibility and Advising: It is the responsibility of the student to understand and know the regulations and requirements to earn the degree. Each student admitted in to the degree programs is assigned to a Faculty Advisor who assists the student in designing an effective program of study. Students should consult their Faculty Advisors for selection of electives and for general advice on academic program

## 6.0 Registration and Enrolment

**6.1** Prior to opening of each semester, every student shall register for all the credit-bearing and audit subjects listed in curriculum of the semester. Excepting first semester, the registration for a semester shall be done during a specified week after end examinations of previous semester. In first semester, the registration shall be done within six working days from date of opening. Recommendation of Faculty Advisor is needed for registration

**6.2** Late registration will be permitted with a fine, decided from time to time, up to six working days from the last date specified for registration

**6.3** A student will be eligible for registration for a semester if she or he i) is promoted to that semester, ii) has cleared all fees to the Institute, library and hostel of previous semester, and iii) is not disqualified for registration by a disciplinary action of the Institute

**6.4** A student will be enrolled and allowed to attend the classes on successful registration and payment of necessary fees to Institution, library, and hostel

**6.5** Registration and enrolment will be controlled by the Office of the Controller of Examinations.

## 7.0 Assessment Procedure – Internal Tests and End Examinations

**7.1** Performance of students in all subjects is assessed continuously through internal assessment tests and an End examination

**7.2** Allocation of internal assessment and End examination marks

7.2.1 For theory subjects, the allocation is 40 marks for internal assessment and 60 marks for End examination totalling 100 marks

7.2.2 For laboratory/project work subjects, the allocation is 50 marks for internal assessment and 50 marks for End examination totalling 100 marks

7.2.3 For mini-project/mini-project with seminar total 100 marks are allocated for internal assessment. There shall be no end examination for this mini-project

7.2.4 For all audit subjects the allocation is 40 marks for internal assessment and no allocation for End examination

**7.3** Internal Assessment Examinations

7.3.1 Internal assessment means performance evaluation of students by faculty members who teach the subjects

7.3.2 For theory subjects, including audit subjects, the internal assessment shall be done by midterm tests. For each subject, two midterm tests will be conducted for 40 marks each and the internal assessment mark is the better of two marks. If any student abstains for any midterm test, she or he will be awarded zero marks for that midterm test. There shall be no choice of questions in midterm tests

7.3.3 For laboratory/practical subjects, the internal assessment will be based on regular laboratory work over full semester. The assessment will be done by the faculty concerned. The students shall be informed sufficiently early of the procedure to be followed for internal assessment

7.3.4 For subjects like seminar, project-work, industrial training, and comprehensive viva-voce, the internal assessment will be done by a concerned Department Committee consisting of two senior faculty members and faculty guide of concerned student. The assessment procedure will be informed sufficiently early to the students

**7.4** End examinations

7.4.1 End examinations shall be conducted after completion of coursework in each semester

7.4.2 The question papers for theory subjects shall be set by faculty members outside of the Institute. The external faculty members for question paper setting will be selected by the Principal

7.4.3 Evaluation of answer scripts shall be done by faculty members from outside of the Institute selected by the Principal

7.4.4 For laboratory subjects, end examination shall be conducted by a committee consisting of two internal examiners. One examiner shall be recommended by Head of Department of concerned Major, and the other examiner shall be appointed by the Principal

7.4.5 For project work viva-voce, End examination shall be conducted by a committee consisting of one internal examiner, one external examiner, and the concerned guide of the student. Internal examiner shall be appointed by Head of Department of concerned Major, and the external examiner shall be appointed by the Principal

7.4.6 If a student abstains from End examination of any subject, for any reason, she or he shall be awarded zero marks in that subject

7.4.7 There is no end examination for audit subjects.

## 8.0 Method of Assigning Letter Grades and Grade Points

**8.1** For all credit-bearing subjects, performance of a student in a subject is indicated by a letter grade that corresponds to absolute marks earned in that subject. Each letter grade is assigned a numeric Grade Point that is used to compute Grade Point Average on a scale of 0 to 10

**8.2** Performance of a student in both internal assessment and End examination will be considered for awarding grades for credit bearing subjects. Total marks earned in a subject is the sum of marks obtained in internal and End examinations in that subject

**8.3** Pass grade A+ to D+ is assigned to a subject based on total marks earned in that subject provided that a student earns at least i) 40% of marks in End examination marks and ii) 50% of marks in internal and End examination marks put together; otherwise fail grade F will be assigned to that subject

**8.4** Grade I will be assigned to a subject if a disciplinary action is pending and is not resolved before publication of results. Office of Controller of Examinations shall resolve the pending disciplinary action within six working days from the date of publication of results and change the grade to any of A+ to D+ or F

**8.5** Grade X will be assigned to a subject if a student abstains for End examination of that subject

**8.6** The absolute marks and corresponding letter grade and grade points are given in Table2

Table 2 Letter Grades and Grade Points

| Absolute Marks | Letter Grade | Grade Points | Remark |
|---|---|---|---|
| 95-100 | A+ | 10.0 | Pass |
| 90-94 | A | 9.5 | Pass |
| 85-89 | A- | 9.0 | Pass |
| 80-84 | B+ | 8.5 | Pass |
| 75-79 | B | 8.0 | Pass |
| 70-74 | B- | 7.5 | Pass |
| 65-69 | C+ | 7.0 | Pass |
| 60-64 | C | 6.5 | Pass |
| 55-59 | C- | 6.0 | Pass |
| 50-54 | D+ | 5.5 | Pass |
| 0-49 | F | 0.0 | Fail |
| - | I | 0.0 | Result Withheld |
| - | X | 0.0 | Absent for End Exam |

**8.7** *SGPA*: Semester Grade Point Average indicates the performance of a student in all credit-bearing subjects of a semester. SGPA is calculated as the weighted average of Grade Points of all subjects of the semester with corresponding credits of subjects as weights. Audit subjects are not considered for SGPA calculation

**8.8** *CGPA*: Cumulative Grade Point Average indicates the performance of a student in all terms up to and including the current semester under consideration. CGPA is calculated as the weighted average of SGPAs with total credits in each semester as the weights

**8.9** *Grade Card*: All students shall be issued Grade Cards after the publication of results of a semester. Grade Card is a statement of performance of a student in a semester. It contains information about each registered subject: type of subject, allocated credits, and letter grade earned. SGPA and CGPA will alsobe indicated.

## 9.0 Requirements for Completing Subjects

**9.1** A student shall complete all credit-bearing and audit subjects successfully to be eligible for award of degree

**9.2** *Credit-bearing subjects*: A student is considered to have completed a credit-bearing subject successfully and earned credits if she or he obtains a pass grade from A+ to D+ in that subject. If a student receives fail grade F or X in any subject, she or he must register for supplementary End examination for that subject as and when opportunity arises and improve grade to pass grade

**9.3** *Audit subjects*: A student is considered to have successfully completed an audit subject if she or he earns at least 40% of marks in internal assessment marks.

Supplementary exam for audit subjects: If a student fails in audit subject, she or he shall register for supplementary examination in that subject as and when the opportunity arises and pass that subject. The supplementary exam will be conducted for 40 marks covering the entire syllabus and student is deemed to have passed in the subject if she or he earns 16 marks (40% marks) in the supplementary exam, disregard of her or his performance in internal tests.

## 10.0 Requirements for taking End Examinations

**10.1** A student is eligible to take regular End Examinations of current semester ifshe or he full fills the attendance requirement

**10.2** A student shall be promoted from current semester to succeeding semesteron satisfying the attendance requirement

**10.3** A student shall complete all credit-bearing and audit subjects successfully before taking End examination for project viva-voce

**10.4** Attendance Requirement

10.4.1 Attendance of students shall be recorded for credit-bearing and audit subjects as per the workload indicated in curriculum

10.4.2 Total class-periods conducted shall be reckoned from beginning toend of a semester as published in academic calendar

10.4.3 Aggregate Percentage of Attendance is calculated using total number of class-periods attended as numerator and total number of class- periods conducted for the concerned subject as the denominator

10.4.4 A minimum aggregate attendance of 75% is required for promotion to succeeding semester

10.4.5 A student can appeal to the Principal for condoning deficiency in aggregate attendance if she or he gets 65% or more aggregate attendance presenting a valid reason for deficiency. Such a student will be granted promotion if the Principal pardons the deficiency. Principal has the right to reject the appeal if it is not satisfied with the performance of the student or the reason cited for deficiency of the attendance

10.4.6 A student earning less than 75% aggregate attendance will be denied promotion. A student who is not promoted on basis of attendance shall be removed from the rolls and shall register for the same semester when opportunity arises. The current semester record of the student is cancelled automatically.

**10.5** A student can forgo promotion and opt to repeat the current team on written request. Recommendation of the concerned Faculty Advisor is required for cancellation of promotion. This option shall be exercised before the commencement of the End Examinations of the current term.

## 11.0 Revaluation of End Examination Scripts

**11.1** Revaluation of End Examination scripts is allowed for theory subjects only by paying requisite fee

**11.2** A Procedure for Revaluation: The script will be revaluated by an examiner appointed by the Principal. The maximum of revaluation and regular end examination marks will be awarded for that subject

**11.3** A student can apply for revaluation in a subject only once.

## 12.0 Supplementary End Examinations

**12.1** Students are eligible to take Supplementary examinations in subjects with fail grade F or X only

**12.2** Supplementary examinations for even semester subjects will be conducted with regular examinations of odd semester subjects and vice versa

**12.3** A student will be allowed to improve grade in any theory subject provided she or he has completed coursework of all semesters but before award of provisional/final degree.

## 13.0 Requirements for Award of M. Tech degree

**13.1** Time Limit for completion of requirements for award of degree is four calendar years from the date of admission. A student who could not complete all the requirements in this time limit shall forego admission and will be removed from the rolls of the Institute

**13.2** A student shall be eligible for award of degree provided she or he has:

13.2.1 Registered and successfully completed all required credit-bearing and audit subjects with a total of 68 credits

13.2.2 Secured a CGPA of 5.5 or more

13.2.3 Cleared all dues to the Institute, library and hostel

13.2.4 No disciplinary action is pending against her or him

13.2.5 Satisfied any other stipulation of the affiliating University

**13.3** Award of Class: Each student will be given class in degree based on CGPA as given in Table 3

Table 3 Class of Degree

| Class of Degree | Range of CGPA |
|---|---|
| Second Class | >= 5.5 but <6.5 |
| First Class | >= 6.5 but <7.5 |
| First Class with Distinction | >= 7.5 |

**13.4** Consolidated Grade Card and Degree will issued under the seal of affiliating University

## 14.0 Transitory Regulations

14.1 A student who initially joins the Institute in a previous Regulation and has to re-join in any semester of the present Regulations, due to any reason, shall be bound by the rules of the current Regulations. Board of Studies of the concerned Major will specify, extra or otherwise, academic coursework to be undertaken by such students who re-join the current Regulations.

# COURSE STRUCTURE

## DEPARTMENT OF ECE

## R18PG SYLLABUS

### I Semester

| S. No. | Core or Elective | Course Code | Course Name | L | T | P | IM | EM | CR |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Core 1 | 1854101 | Digital System Design | 3 | 0 | 0 | 40 | 60 | 3 |
| 2 | Core 2 | 1854102 | Digital Communication Techniques | 3 | 0 | 0 | 40 | 60 | 3 |
| 3 | PE I | 1854103<br><br>1854104<br>1854105 | 1.Analog & Digital CMOS VLSI Design<br>2.Low power VLSI<br>3.SoC Design | 3 | 0 | 0 | 40 | 60 | 3 |
| 4 | PE II | 1854106<br><br>1854107<br><br>1854108 | 1.Digital Image & Video Processing<br>2. Wireless & Mobile Communications<br>3. Advanced Communication Networks | 3 | 0 | 0 | 40 | 60 | 3 |
| 5 | | 1800109 | Research Methodology & IPR | 2 | 0 | 0 | 40 | 60 | 2 |
| 6 | Core | 1854110 | DSD Lab | 0 | 0 | 4 | 50 | 50 | 2 |
| 7 | Core | 1854111 | DCT Lab | 0 | 0 | 4 | 50 | 50 | 2 |
| 8 | Audit Course | 1870A02 | Disaster Management | 2 | 0 | 0 | 40 | 0 | 0 |
| **Total:** | | | | **16** | **0** | **8** | **300** | **400** | **18** |

**II Semester**

| S. No. | Core or Elective | Course Code | Course Name | L | T | P | IM | EM | CR |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Core 3 | 1854201 | Microcontrollers & Programmable DSP Processors | 3 | 0 | 0 | 40 | 60 | 3 |
| 2 | Core 4 | 1854202 | Advanced DSP | 3 | 0 | 0 | 40 | 60 | 3 |
| 3 | PE III | 1854203<br>1854204<br>1854205 | 1.Advanced Computer Architecture<br>2.IOT & Applications<br>3.VLSI Signal Processing | 3 | 0 | 0 | 40 | 60 | 3 |
| 4 | PE IV | 1854206<br>1854207<br>1854208 | 1.Detection & Estimation Theory<br>2.Optical Networks<br>3.Biomedical Signal Processing | 3 | 0 | 0 | 40 | 60 | 3 |
| 5 | Core | 1854209 | Mini Project with Seminar | 0 | 0 | 4 | 100 | 0 | 2 |
| 6 | Core | 1854210 | Microcontrollers and Programmable DSP Processors Lab | 0 | 0 | 4 | 50 | 50 | 2 |
| 7 | Core | 1854211 | Advanced DSP Lab | 0 | 0 | 4 | 50 | 50 | 2 |
| 8 | Audit Course | 1870A01 | English for Research paper writing. | 2 | 0 | 0 | 40 | 0 | 0 |
| **Total:** | | | | **14** | **0** | **12** | **360** | **340** | **18** |

**III Semester**

| S. No. | Core or Elective | Course Code | Course Name | L | T | P | IM | EM | CR |
|---|---|---|---|---|---|---|---|---|---|
| 1 | PE V | 1854301<br><br>1854302<br><br><br>1854303 | 1.Microcomputer System Design<br>2. Joint Time Frequency Analysis & MRA<br>3. Pattern recognition & Machine learning | 3 | 0 | 0 | 40 | 60 | 3 |
| 2 | OE | 1871304<br>1871305<br>1871306<br>1871307<br><br>1871308<br>1871309 | 1.Business Analytics<br>2.Industrial Safety<br>3.Operations Research<br>4.Cost Management of Engineering Projects<br>5.Composite Materials<br>6.Waste to Energy | 3 | 0 | 0 | 40 | 60 | 3 |
| 3 | Major Project | 1854310 | Dissertation Phase I | 0 | 0 | 20 | 100 | - | 10 |
| **Total:** | | | | **6** | **0** | **20** | **180** | **120** | **16** |

**IV Semester**

| S. No. | Core or Elective | Course Code | Course Name | L | T | P | IM | EM | CR |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Major Project | 1854401 | Dissertation Phase II | 0 | 0 | 32 | 50 | 50 | 16 |
| **Total:** | | | | **0** | **0** | **32** | **50** | **50** | **16** |

# M.TECH.-I- SEMESTER SYLLABUS

| Course Title | DIGITAL SYSTEM DESIGN (Core-1 ) | | | | M.Tech DECS I Sem | | |
|---|---|---|---|---|---|---|---|
| Course Code | Category | Hours/Week | | | Credits | Maximum Marks | | |
| 1854101 | CORE-1 | L | T | P | C | Continuous Internal Assessment | End Exams | Total |
| | | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| Mid Exam Duration: 2 Hours | | | | | End Exam Duration: 3Hrs | | | |

**Course Objectives:**

- To understand combinational and sequential logic circuits.
- To understand faults in digital systems.

**Course Outcomes:On successful completion of this course, the students will be able to**

| | |
|---|---|
| **CO 1** | To analyze and design combinational and sequential logic circuits. |
| **CO 2** | Troubleshooting faults regarding Digital Systems. |

## UNIT I

**Design of Digital Systems:** ASM charts, Hardware description language and control sequence method, design of sequential circuits using ROMs and PLAs, sequential circuit design using CPLD, FPGAs.

## UNIT II

**Fault Modeling & Test Generation :**Fault classes and models – Stuck at faults, bridging faults, transition and intermittent faults, Fault diagnosis of Combinational circuits by conventional methods- Path Sensitization technique, Boolean difference method, Kohavi algorithm.

## UNIT III

**Test Pattern Generation & Fault Diagnosis:** D – algorithm, PODEM, Random testing, Signature Analysis and testing for bridging faults, Design of fault detection.

## UNIT IV

**Programmable Logic Arrays**: Design using PLAs, PLA minimization and PLA folding

Fault models, Test generation and Testable PLA design.

## UNIT V

**Asynchronous Sequential Machine**: Fundamental mode model, flow table, state reduction, minimal closed covers, races, cycles and hazards.

**Text Books:**

1. Z. Kohavi – "Switching & finite Automata Theory" (TMH)
2. N. N. Biswas – "Logic Design Theory" (PHI)
3. NolmanBalabanian, Bradley Calson – "Digital Logic Design Principles" – Wily Student Edition 2004.

**Reference Books:**

1. Charles H. Roth Jr. – "Fundamentals of Logic Design".
2. Frederick. J. Hill & Peterson – "Computer Aided Logic Design" – Wiley 4th Edition.

<table>
<tr><td colspan="2">Course Title</td><td colspan="5">DIGITAL COMMUNICATION TECHNIQUES (Core-2 )</td><td colspan="3">M.Tech DECS I Sem</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">1854102</td><td rowspan="2">CORE-2</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exams</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 2 Hours</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives:<br>• To understand basic components of digital communication systems.<br>• To Design optimum receivers for digital modulation techniques.<br>• To analyze the error performance of digital modulation techniques.<br>• To Design digital communication systems under given power, spectral and error performance constrains.</td></tr>
<tr><td colspan="9">Course Outcomes:On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Understand the orthogonalization and characteristics of random processes</td></tr>
<tr><td>CO 2</td><td colspan="8">Analyze the receivers and equalizers</td></tr>
<tr><td>CO 3</td><td colspan="8">Analyze various Digital Modulation Schemes</td></tr>
<tr><td>CO 4</td><td colspan="8">Analyze various synchronization methods</td></tr>
<tr><td>CO 5</td><td colspan="8">Describe Multicarrier Systems</td></tr>
</table>

## UNIT I

### Deterministic and Random Signal Analysis

Bandpass and Lowpass Signal Representation , Signal Space Representation of Waveforms- Vector Space Concepts, Signal Space Concepts, Orthogonal Expansions of Signals- Gram-Schmidt Procedure,Some Useful Random Variables , Bounds on Tail Probabilities, Limit Theorems for Sums of Random Variables , Random Processes -Wide-Sense Stationary Random Processes, Cyclostationary Random Processes, Bandpass and Lowpass Random Processes.

## UNIT II

### Digital Communication Through Band-Limited Channels

Design of Band-Limited Signals for No Inter symbol Interference—The Nyquist Criterion, Design of Band-Limited Signals with Controlled ISI—Partial-Response Signals, Data Detection for Controlled ISI, Signal Design for Channels with Distortion, Optimum Receiver for Channels with ISI and AWGN - Optimum Maximum-Likelihood Receiver , Linear Equalization - Peak Distortion Criterion, Mean-Square-Error(MSE) Criterion, Performance Characteristics of the MSE Equalizer , Fractionally Spaced Equalizers, Baseband and Pass band Linear Equalizers,

Decision-Feedback Equalization -Coefficient Optimization , Performance Characteristics of DFE , Predictive Decision-Feedback Equalizer.

**UNIT III**

**Digital Modulation Schemes:**

Introduction, Geometric Representation of Signals, Conversion of the Continuous AWGN Channel into a Vector Channel, Optimum Receivers Using Coherent Detection, Probability of Error, Phase-Shift Keying Techniques Using Coherent Detection, *M*-ary Quadrature Amplitude Modulation, Frequency-Shift Keying Techniques Using Coherent Detection , Comparison of *M*-ary PSK and *M*-ary FSK from an Information-Theoretic Viewpoint, Detection of Signals with Unknown Phase, Noncoherent Orthogonal Modulation Techniques, Binary Frequency-Shift Keying Using Noncoherent Detection, Differential Phase-Shift Keying, BER Comparison of Signaling Schemes over AWGN Channels.

**UNIT IV**

**Synchronization:**

Synchronization Defined, Costs versus Benefits, Receiver Synchronization- Frequency and Phase Synchronization, Symbol Synchronization, Discrete Symbol Modulations, Synchronization with Continuous-Phase Modulations (CPM), Frame Synchronization

**UNIT V**

**Multichannel and Multicarrier Systems**

Multichannel Digital Communications in AWGN Channels- Binary Signals, M-ary Orthogonal Signals Multicarrier Communications - Single-Carrier Versus Multicarrier Modulation , Capacity of a Nonideal Linear Filter Channel , Orthogonal Frequency Division Multiplexing (OFDM), Modulation and Demodulation in an OFDM System , An FFT Algorithm Implementation of an OFDM System, Spectral Characteristics of Multicarrier Signals , Bit and Power Allocation in Multicarrier Modulation, Peak-to-Average Ratio in Multicarrier Modulation, Channel Coding Considerations in Multicarrier Modulation.

**Text Books:**

1. J.G. Proakis and MasoudSalehi, Digital Communications, McGraw Hill, 2000 (I,II,V)
2. BernerdSklar, " Digital Communications- Fundamentals & Applications, "Prentice Hall, 2001 (IV)
3. Simon S Haykin, "Digital Communications Systems", Wiley, 2013 (III)

**Reference Books:**

1. Ahmad R S Bahai ,Burton R Saltzberg ,Mustafa Ergen, "Multi-carrier Digital Communications: Theory and Applications of OFDM." Springer Publications.
2. J.S.Chitode, "Digital Communication", Technical Publications.
3. Edward. A. Lee and David. G. Messerschmitt, "Digital Communication", Allied Publishers (second edition).
4. J Marvin.K.Simon, Sami. M. Hinedi and William. C. Lindsey, "Digital Communication Techniques", PHI.
5. William Feller, "An introduction to Probability Theory and its applications", Vol 11, Wiley 2000.

| Course Title | ANALOG & DIGITAL CMOS VLSI DESIGN (PSE-1 ) | | | | M.Tech DECS I Sem | | |
|---|---|---|---|---|---|---|---|
| Course Code | Category | Hours/Week | | | Credits | Maximum Marks | |
| 1854103 | PSE-1 | L | T | P | C | Continuous Internal Assessment | End Exams | Total |
| | | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| Mid Exam Duration: 2 Hours | | | | | End Exam Duration: 3Hrs | | |

**Course Objectives:**

- To understand basic MOS structure.
- To get exposed to basic building blocks of a system.
- To learn various EDA tools to design digital systems.

**Course Outcomes:On successful completion of this course, the students will be able to**

| | |
|---|---|
| **CO 1** | Analyze, design, optimize and simulate analog and digital circuits using CMOS constrained by the design metrics |
| **CO 2** | Connect the individual gates to form the building blocks of a system |
| **CO 3** | Use EDA tools like Cadence, Mentor Graphics and other open source software tools like Ngspice. |

**Digital CMOS Design:**

**UNIT I**

Review: Basic MOS structure and its static behaviour, Dynamic Behavior, Stick diagram and Layout, Wire delay models. Inverter: Static CMOS inverter, Switching threshold and noise margin concepts and their evaluation, Power consumption.

**UNIT II**

Physical design flow: Floor planning, Placement, Routing, CTS, Power analysis.Combinational logic: Static CMOS design, Complementary CMOS, Ratioed logic, Pass transistor logic, Dynamic logic, Speed and power dissipation in dynamic logic, Cascading dynamic gates.

**UNIT III**

Sequential logic: Static latches and registers, Bi-stability principle, MUX based latches, Static SR flip-flops, Master-slave edge-triggered register, Dynamic latches and registers, Concept of pipelining, Pulse registers, Non-bistable sequential circuit.

**Analog CMOS Design:**

**UNIT IV**

Single Stage Amplifier: CS stage with resistance load, Diode connected load, Current source load, CS stage with source degeneration, Common gate stage, CG Stage With Biasing Source follower, Source Follower With Biasing.

## UNIT V

Passive and active current mirrors: Basic current mirrors, Cascode Stage, Cascode as a Current Source, Cascode as an Amplifier , Active current mirrors, Bipolar Current Mirror, MOS Current Mirror.

## Reference Books:


1. J P Rabaey, A P Chandrakasan, B Nikolic, "Digital Integrated circuits: A design
    a. perspective", Prentice Hall electronics and VLSI series, 2nd Edition.
2. Baker, Li, Boyce, "CMOS Circuit Design, Layout, and Simulation", Wiley, 2nd Edition.
3. BehzadRazavi , "Design of Analog CMOS Integrated Circuits", TMH, 2007.
4. Phillip E. Allen and Douglas R. Holberg, "CMOS Analog Circuit Design", Oxford, 3rd Edition.
5. R J Baker, "CMOS circuit Design, Layout and Simulation", IEEE Inc., 2008.
6. Kang, S. and Leblebici, Y., "CMOS Digital Integrated Circuits, Analysis and Design" TMH, 3rdEdition.
7. Pucknell, D.A. and Eshraghian, K., "Basic VLSI Design", PHI, 3rd Edition.

| Course Title | LOW POWER VLSI DESIGN (PSE-1 ) | | | | M.Tech DECS I Sem | | |
|---|---|---|---|---|---|---|---|
| Course Code | Category | Hours/Week | | | Credits | Maximum Marks | |
| 1854104 | PSE-1 | L | T | P | C | Continuous Internal Assessment | End Exams | Total |
| | | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| Mid Exam Duration: 2 Hours | | | | | End Exam Duration: 3Hrs | | |

**Course Objectives:**

- To understand the sources of power dissipation.
- To study the concept of power consumption and analysis methods.
- To get exposed to leakage sources and reduction techniques.

**Course Outcomes: On successful completion of this course, the students will be able to**

| | |
|---|---|
| **CO 1** | Identify the sources of power dissipation in digital IC systems & understand the impact of power on system performance and reliability. |
| **CO 2** | Characterize and model power consumption & understand the basic analysis methods. |
| **CO 3** | Understand leakage sources and reduction techniques. |

## UNIT I

Technology & Circuit Design Levels: Sources of power dissipation in digital ICs, degree of freedom, recurring themes in low-power, emerging low power approaches, dynamic dissipation in CMOS, effects of Vdd&Vt on speed, constraints on Vt reduction, transistor sizing & optimal gate oxide thickness, impact of technology scaling, technology innovations.

## UNIT II

Low Power Circuit Techniques: Power consumption in circuits, flip-flops & latches, high capacitance nodes, energy recovery, reversible pipelines, high performance approaches.

## UNIT III

Low Power Clock Distribution: Power dissipation in clock distribution, single driver

Versus distributed buffers, buffers & device sizing under process variations, zero skew Vs.

Tolerable skew, chip & package co-design of clock network.

## UNIT IV

Logic Synthesis for Low Power estimation techniques: Power minimization techniques, low power arithmetic components- circuit design styles, adders, multipliers.

**UNIT V**

Low Power Memory Design: Sources & reduction of power dissipation in memory subsystem, sources of power dissipation in DRAM & SRAM, low power DRAM circuits, low power SRAM circuits.

**Reference Books:**

1. P. Rashinkar, Paterson and L. Singh, "Low Power Design Methodologies", Kluwer
    a. Academic, 2002
2. Kaushik Roy, Sharat Prasad, "Low power CMOS VLSI circuit design", John Wiley sonsInc.,2000.
3. J.B.Kulo and J.H Lou, "Low voltage CMOS VLSI Circuits", Wiley, 1999.
4. A.P.Chandrasekaran and R.W.Broadersen, "Low power digital CMOS design",
    a. Kluwer,1995
5. Gary Yeap, "Practical low power digital VLSI design", Kluwer, 1998.

<table>
<tr><td>Course Title</td><td colspan="4">System on Chip Design<br>(PSE-1 )</td><td colspan="3">M.Tech DECS I Sem</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">1854105</td><td rowspan="2">PCC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exams</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 2 Hours</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives:<br>• To understand ASIC types and design strategies.<br>• To study the basic building blocks of SoC.<br>• To learn electronic design philosophy.</td></tr>
<tr><td colspan="9">Course Outcomes:On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Identify and formulate a given problem in the framework of SoC based design approaches.</td></tr>
<tr><td>CO 2</td><td colspan="8">Design SoC based system for engineering applications</td></tr>
<tr><td>CO 3</td><td colspan="8">Realize impact of SoC on electronic design philosophy and Macro-electronics thereby incline towards entrepreneurship & skill development</td></tr>
</table>

**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 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.

**UNIT III**

Simulation: Different simulation modes, behavioural, functional, static timing, gate level, switch level, transist or/circuit simulation, design of verification vectors, Low power FPGA, configurable systems, SoC related modeling of data path design and control logic, Minimization of inter connects 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 frequency and voltage scaling (DCFS),building block optimization, building block memory, power down techniques, power consumption verification.

## 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.

## Reference Books:

1. Hubert Kaeslin, "Digital Integrated Circuit Design: From VLSI Architectures to CMOS
2. Fabrication", Cambridge University Press, 2008.
3. B. Al Hashimi, "System on chip-Next generation electronics", The IET, 2006
4. RochitRajsuman, "System-on- a-chip: Design and test", Advantest America R & D Center,2000
5. P Mishra and N Dutt, "Processor Description Languages", Morgan Kaufmann, 2008
6. Michael J. Flynn and Wayne Luk, "Computer System Design: System-on-Chip". Wiley,2011

<table>
<tr><td colspan="2">Course Title</td><td colspan="5">DIGITAL IMAGE AND VIDEO PROCESSING<br>(PSE-2 )</td><td colspan="3">M.Tech DECS I Sem</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">1854106</td><td rowspan="2">PSE-2</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exams</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 2 Hours</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives:<br>• To provide an introduction to the basic concepts and techniques used in digital image and video processing.<br>• To give an understanding of the two-dimensional sampling and quantization<br>• To study Edge detection and Image Enhancement Algorithms<br>• To Understand techniques for video sampling and motion estimation<br>• To Study techniques for image and video compression and object recognition</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">To apply various transformation techniques on images.</td></tr>
<tr><td>CO 2</td><td colspan="8">To apply various filtering techniques.</td></tr>
<tr><td>CO 3</td><td colspan="8">To apply various compression techniques.</td></tr>
</table>

## UNIT I

Fundamentals of Image Processing: Digital image fundamentals, Applications of image processing, Image Sampling and Quantization, relationship between pixels.

Image Transforms: General approach for operating in the linear transform domain, 2-D DFT and Properties, Walsh transform, Hadamard Transform, Discrete cosine Transform, Haar transform, KL Transform or Hotelling transform.

## UNIT II

Image Enhancement: Spatial domain methods: Spatial domain methods: Point processing, Histogram processing, Fundamentals of spatial filtering, smoothing spatial filters, sharpening spatial filters.

Frequency domain methods: Basics of filtering in frequency domain, image smoothing, image sharpening, Homomorphic filtering, LOG filters.

Colour image processing: Colour fundamentals, colour models, Pseudo color image processing.

## UNIT III

Image Segmentation: Point, Line and Edge detection, Edge linking and boundary detection, Thresholding, Region based segmentation – Region growing, Region splitting and merging. Region Based segmentation.

Image Restoration: Degradation model, Noise models, Restoration in the presence of noise only – spatial filtering, Periodic noise reduction by frequency domain filtering, linear position-Invariant degradation, restoration using inverse filtering, Wiener filtering, Constrained Least Squares filtering.

## UNIT IV

Image Compression: Redundancies in images, Fidelity criteria, Image compression models, Error free compression – Variable length coding, Huffman coding, Arithmetic coding, LZW coding, Bit-plane coding, loss less and lossy predictive coding, Transform coding, Image Compression standards- JPEG, JPEG 2000.

## UNIT V

Video Processing: Definition of video signal, Analog and digital video, digital video applications, 3-D sampling and filtering, motion estimation and compensation signals, Transform coding, Predictive coding, Motion estimation algorithms, Search algorithms for Block Matching in motion estimation, video compression standards- MPEG-2/4, H.264, SVC.

## Text Books:

1. Digital Image Processing – Gonzaleze and Woods, 3rd Ed., Pearson.

2. Digital Image Processing – S.Jayaraman, S.Esakkirajan, T.Veera Kumar–TMH, 2009.

3. J. W. Woods, "Multidimensional Signal, Image and Video Processing and Coding",2nd

Edition, Academic Press, 2011.

## Reference Books:

1. Digital Image Processing and Analysis-Human and Computer Vision Application with CVIP Tools –
1. Scotte Umbaugh, 2nd Ed, CRC Press, 2011.
2. Digital Video Processing – M. Tekalp, Prentice Hall International
3. Ed. Al Bovik ,"Handbook of Image and Video Processing", 2nd Edition, Academic
4. Press, 2000.
5. Digital Image Processing with MATLAB and LabView – Vipula Singh, Elsevier.

| Course Title | WIRELESS AND MOBILE COMMUNICATION (PSE-2 ) | | | | M.Tech DECS I Sem | | |
|---|---|---|---|---|---|---|---|
| Course Code | Category | Hours/Week | | | Credits | Maximum Marks | |
| 1854107 | PSE-2 | L | T | P | C | Continuous Internal Assessment | End Exams | Total |
| | | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| Mid Exam Duration: 2 Hours | | | | | End Exam Duration: 3Hrs | | |

**Course Objectives:**

- To understand FDMA, TDMA, and CDMA.
- To get exposed to mobile system's performance.
- To gain knowledge on CDMA system functionality.
- To understand 3G and 4G Technologies.

**Course Outcomes: On successful completion of this course, the students will be able to**

| | |
|---|---|
| **CO 1** | Distinguish various multiple-access techniques for mobile communications e.g. FDMA, TDMA, CDMA, and their advantages and disadvantages. |
| **CO 2** | Analyze path loss and interference for wireless telephony and their influences on a mobile communication system's performance. |
| **CO 3** | Analyze and design CDMA system functioning with knowledge of forward and reverse channel details, advantages and disadvantages of using the technology. |
| **CO 4** | Understanding upcoming technologies like 3G, 4G etc |

## UNIT I

**Introduction to Wireless Communications Systems:** Evolution, Examples of Wireless Communication systems, Comparison, Second Generation Cellular Networks, WLL, Bluetooth and Personal Area Networks.

**GSM Fundamentals:** GSM architecture and interfaces, GSM architecture details, GSM subsystems, GSM Logical Channels, Data Encryption in GSM, Mobility Management, Call Flows in GSM.2.5 G Standards: High speed Circuit Switched Data (HSCSD), General Packet Radio Service (GPRS), 2.75 G Standards: EDGE

## UNIT II

**Mobile Radio Propagation:** Large Scale Path Loss, Free Space Propagation Model, Reflection, Ground Reflection (Two-Ray) Model, Diffraction, Scattering, Practical Link Budget Design using Path Loss Models, Outdoor Propagation Models, Indoor Propagation Models, Signal Penetration into Buildings. Small Scale Fading and Multipath Propagation, Impulse Response Model, Multipath Measurements, Parameters of Multipath channels, Types of Small Scale Fading: Time Delay Spread; Flat, Frequency selective, Doppler Spread; Fast and Slow fading.

## UNIT III

**Multiple access technologies:** TDMA, FDMA and CDMA, Comparison of these technologies based on their signal separation techniques, advantages, disadvantages and application areas.

**Code Division Multiple Access:** Introduction to CDMA technology, IS 95 system Architecture, Air Interface, Physical and logical channels of IS 95, Forward Link and Reverse link operation, Physical and Logical channels of IS 95 CDMA, IS 95 CDMA Call Processing, soft Handoff, Evolution of IS 95 (CDMA One) to CDMA 2000, CDMA 2000 layering structure and channels.

## UNIT IV

**Equalization and Diversity:** Equalizers in a communications receiver, Algorithms for adaptive equalization, diversity techniques, space, polarization, frequency diversity, Interleaving.

## UNIT V

**Higher Generation Cellular Standards:** 3G Standards: evolved EDGE, enhancements in 4G standard, Architecture and representative protocols, call flow for LTE, VoLTE, UMTS, introduction to 5G.

## Text Books:

1. V.K.Garg, J.E.Wilkes, "Principle and Application of GSM", Pearson Education, 5th edition, 2008.
2. V.K.Garg, "IS-95 CDMA & CDMA 2000", Pearson Education, 4th edition, 2009.
3. T.S.Rappaport, "Wireless Communications Principles and Practice", 2nd edition, PHI, 2002. William C.Y.Lee, "Mobile Cellular Telecommunications Analog and Digital Systems", 2nd edition, TMH, 1995.
4. AshaMehrotra, "A GSM system Engineering" Artech House Publishers Bosten, London, 1997.

| Course Title | ADVANCED COMMUNICATION NETWORK (PSE-2 ) | | | | M.Tech DECS I Sem | | |
|---|---|---|---|---|---|---|---|
| Course Code | Category | Hours/Week | | | Credits | Maximum Marks | |
| 1854108 | PSE-2 | L | T | P | C | Continuous Internal Assessment | End Exams | Total |
| | | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| Mid Exam Duration: 2 Hours | | | | | End Exam Duration: 3Hrs | | |

**Course Objectives:**

- To understand various communication networks.
- To learn various protocols for communication networks.
- To get exposed to quality of service.
- To know optimization in network design.

**Course Outcomes: On successful completion of this course, the students will be able to**

| | |
|---|---|
| **CO 1** | Understand advanced concepts in Communication Networking. |
| **CO 2** | Design and develop protocols for Communication Networks. |
| **CO 3** | Understand the mechanisms in Quality of Service in networking. |
| **CO 4** | Optimize the Network Design. |

## UNIT I

**Overview of Internet-Concepts, challenges and history:** Overview of -ATM. TCP/IP Congestion and Flow Control in Internet-Throughput analysis of TCP congestion control. TCP for high bandwidth delay networks. Fairness issues in TCP.

## UNIT II

**Real Time Communications over Internet. Adaptive applications:** Latency and throughput Issues, Integrated Services Model (intServ). Resource reservation in Internet. RSVP, Characterization of Traffic by Linearly Bounded Arrival Processes (LBAP). Leaky bucket algorithm and its properties.

## UNIT III

**Packet Scheduling Algorithms-requirements and choices:** Scheduling guaranteed service connections. GPS, WFQ and Rate proportional algorithms.High speed scheduler design.Theory of Latency Rate servers and delay bounds in packet switched networks for LBAP traffic, Active Queue Management - RED, WRED and Virtual clock. Control theoretic analysis of active queue management.

## UNIT IV

**IP address lookup-challenges:** Packet classification algorithms and Flow Identification-Grid of Tries, Cross producting and controlled prefix expansion algorithms.

**Admission control in Internet:** Concept of Effective bandwidth, Measurement based admission control, Differentiated Services in Internet (DiffServ), DiffServ architecture and framework.

## UNIT V

**IPV4, IPV6, IP tunnelling, IPswitching and MPLS:** Overview of IP over ATM and its evolution to IP switching, MPLS architecture and framework, MPLS Protocols, Traffic engineering issues in MPLS.

## Text Books:

1. Jean Wairand and PravinVaraiya, "High Performance Communications Networks", 2 nd edition, 2000.
2. Jean Le Boudec and Patrick Thiran, "Network Calculus A Theory of Deterministic Queueing Systems for the Internet", Springer Veriag, 2001.
3. Zhang Wang, "Internet QoS", Morgan Kaufman, 2001.
4. Anurag Kumar, D. Manjunath and Joy Kuri, "Communication Networking: An Analytical Approach" , Morgan Kaufman Publishers, 2004.
5. George Kesidis, "ATM Network Performance", Kluwer Academic, Research Papers, 2005.

<table>
<tr><td>Course Title</td><td colspan="5">RESEARCH METHODOLOGY AND IPR</td><td colspan="3">M.Tech DECS I Sem</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">1800109</td><td rowspan="2"></td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exams</td><td>Total</td></tr>
<tr><td>2</td><td>0</td><td>0</td><td>2</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 2 Hours</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives:<br>• To understand research problem formulation.<br>• To learn research related information.<br>• To understand research ethics.<br>• To understand today’s world.<br>• To understand IPR.<br>• To understand IPR protection.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Understand research problem formulation..</td></tr>
<tr><td>CO 2</td><td colspan="8">Analyze research related information.</td></tr>
<tr><td>CO 3</td><td colspan="8">Follow research ethics.</td></tr>
<tr><td>CO 4</td><td colspan="8">Understand that today’s world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity</td></tr>
<tr><td>CO 5</td><td colspan="8">Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.</td></tr>
<tr><td>CO 6</td><td colspan="8">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.</td></tr>
</table>

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

**UNIT V**

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

**UNIT VI**

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

**Reference Books:**

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition , "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Mayall , "Industrial Design", McGraw Hill, 1992.
6. Niebel , "Product Design", McGraw Hill, 1974.
7. Asimov , "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

| Course Title | DIGITAL SYSTEM DESIGN LAB | | | | M.Tech DECS I Sem | | |
|---|---|---|---|---|---|---|---|
| Course Code | Category | Hours/Week | | | Credits | Maximum Marks | | |
| 1854110 | CORE | L | T | P | C | Continuous Internal Assessment | End Exams | Total |
| | | 0 | 0 | 4 | 2 | 50 | 50 | 100 |
| | | | | | End Exam Duration: 3Hrs | | | |

**Course Objectives:**

- To understand the combinational and sequential circuit design.
- To learn simulation tools.

**Course Outcomes:**

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

1. Identify, formulate, solve and implement problems in Adders, multipliers, Flip-Flops, Counters etc using RTL design tools.
2. Use EDA tools like Mentor Graphics and Xilinx.
3. Simulation and Verification of Logic Gates.
4. Design and Simulation of Half adder, Serial Binary Adder, Multi Precession Adder, Carry Look Ahead Adder and Full Adder.
5. Simulation and Verification of Decoder, MUXs, Encoder using all Modeling Styles.
6. Modeling of Flip-Flops with Synchronous and Asynchronous reset.
7. Design and Simulation of Counters-Ring Counter, Johnson Counter, and Up-Down
8. Counter, Ripple Counter.
9. Design of a N-bit Register of Serial-in Serial-out, Serial in Parallel out, Parallel in serial out and Parallel in Parallel Out.
10. Design of Sequence Detector (Finite State Machine-Mealy and Moore Machines).
11. 4-Bit Multiplier, Divider. (for 4-Bit Operand)
12. Design ALU to Perform –ADD, SUB, AND-OR, 1‟s and 2‟s COMPLIMENT, Multiplication, Division.
13. Design of Shift register.

<table>
<tr><td>Course Title</td><td colspan="4">DIGITAL COMMUNICATION TECHNIQUES LAB</td><td colspan="3">M.Tech DECS I Sem</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">1854111</td><td rowspan="2">CORE</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exams</td><td>Total</td></tr>
<tr><td>0</td><td>0</td><td>4</td><td>2</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="5"></td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives:<br>• To understand the problems in communication systems.<br>• To learn simulation tools.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Identify, formulate, solve and implement problems in communication systems</td></tr>
<tr><td>CO 2</td><td colspan="8">Use simulation like Matlab / COM SIM .</td></tr>
</table>

**Experiments:**

1. Simulate generation and detection of ASK Signal
2. Simulate generation and detection of FSK Signal
3. Simulate generation and demodulation of BPSK Signal
4. Simulate Rayleigh Fading Channel Using Either Clarke's Model or Jake's Model for different Doppler Spreads (Ex. 50 Hz and 100 Hz)
5. Generation of Maximal Sequences and Gold Sequences.
6. Performance Evaluation of QPSK System over Gaussian AWGN Channel.
7. Performance Evaluation of QPSK System over Rayleigh Fading Channel.
8. M-ary QAM with AWGN fading
9. Equalization of Multipath Channel using LMS or RLS Algorithms.
10. Performance Evaluation of RAKE Receiver over Slow Fading Channel.
11. Error detection and correction using CRC method.
12. Generation of Hamming code sequence.
13. Correlation: Auto and Cross.

| Course Title | DISASTER MANAGEMENT (Audit Course) | | | | M.Tech DECS I Sem | | |
|---|---|---|---|---|---|---|---|
| Course Code | Category | Hours/Week | | | Credits | Maximum Marks | | |
| 1870A02 | Audit Course | L | T | P | C | Continuous Internal Assessment | End Exams | Total |
| | | 2 | 0 | 0 | 0 | 40 | -- | 40 |
| Mid Exam Duration: 2 Hours | | | | | | | | |

**Course Objectives:**

- 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.

**Course Outcomes:On successful completion of this course, the students will be able to**

| | |
|---|---|
| **CO 1** | Understand foundations of hazard, disasters and natural/social phenomena. |
| **CO 2** | Analyze Repercussions of disasters and hazards. |
| **CO 3** | Understand key concepts in disaster risk reduction and humanitarianresponse. |

## UNIT I

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

## UNIT II

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

## UNIT III

**Disaster Prone Areas In India**

Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics.

**UNIT IV**

**Disaster Preparedness and Management**

Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

**UNIT V**

**Risk Assessment**

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

**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:**

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.

2. Sahni, Pardeep Et.Al. (Eds.)," Disaster Mitigation Experiences and Reflections", Prentice Hall Of India, NewDelhi.

3. Goel S. L. , Disaster Administration And Management Text And Case Studies" ,Deep &Deep Publication Pvt. Ltd., NewDelhi.

**Reference Books:**

1. Fundamentals of Disaster Management, Shekhawat R.S, Bhatnagar Harshul.
2. Disaster management, Ruthra, Lakshmi Publications.
3. Disaster Management and Preparedness, Nidhi Gauba Dhawan, Ambrina Sardar Khan, CBS Publishers.

# M.TECH.-II- SEMESTER SYLLABUS

<table>
<tr><td>Course Title</td><td colspan="5">MICROCONTROLLERS AND PROGRAMMABLE DIGITAL SIGNAL PROCESSORS<br>(Core-3)</td><td colspan="3">M.Tech DECS II Sem</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">1854201</td><td rowspan="2">CORE-3</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exams</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="4">Mid Exam Duration: 2 Hours</td><td colspan="5">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives:<br>• To understand ARM Processor and SoC.<br>• To learn Programmable DSP Processors.<br>• To get exposed to various applications.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Compare and select ARM processor core based SoC with several features/peripherals based on requirements of embedded applications.</td></tr>
<tr><td>CO 2</td><td colspan="8">Identify and characterize architecture of Programmable DSP Processors.</td></tr>
<tr><td>CO 3</td><td colspan="8">Develop small applications by utilizing the ARM processor core and DSP processor based platform.</td></tr>
</table>

**UNIT I**

ARM Cortex-M3 processor: Applications, Programming model – Registers, Operation modes, Exceptions and Interrupts, Reset Sequence Instruction Set, Unified Assembler Language, Memory Maps, Memory Access Attributes, Permissions, Bit-Band Operations, Unaligned and Exclusive Transfers, Pipeline, Bus Interfaces.

**UNIT II**

Exceptions, Types, Priority, Vector Tables, Interrupt Inputs and Pending behaviour, Fault Exceptions, Supervisor and Pendable Service Call, Nested Vectored Interrupt Controller, Basic Configuration, SYSTICK Timer, Interrupt Sequences, Exits, Tail Chaining, Interrupt Latency.

**UNIT III**

LPC 17xx microcontroller- Internal memory, GPIOs, Timers, ADC, UART and other serial interfaces, PWM, RTC, WDT

**UNIT IV**

Programmable DSP (P-DSP) Processors: Harvard architecture, Multi port memory, architectural structure of P-DSP- MAC unit, Barrel shifters, VLIW architecture, Introduction to TI DSP processor family, TMS320C6000 series, architecture study, data paths, cross paths.

**UNIT V**

Introduction to Instruction level architecture of C6000 family, Assembly Instructions memory addressing, for arithmetic, logical operations, Code Composer Studio for application development for digital signal processing, On chip peripherals , Processor benchmarking.

**Reference Books:**

1. Joseph Yiu, "The definitive guide to ARM Cortex-M3", Elsevier, 2nd Edition

2. Venkatramani B. and Bhaskar M. "Digital Signal Processors: Architecture, Programming and Applications" , TMH , 2nd Edition

3. Sloss Andrew N, Symes Dominic, Wright Chris, "ARM System Developer's Guide: Designing and Optimizing", Morgan Kaufman Publication

4. Steve furber, "ARM System-on-Chip Architecture", Pearson Education

5. Frank Vahid and Tony Givargis, "Embedded System Design", Wiley

6. Technical references and user manuals on www.arm.com, NXP Semiconductor www.nxp.com and Texas Instruments www.ti.com

<table>
<tr><td colspan="2">Course Title</td><td colspan="5">ADVANCED DIGITAL SIGNAL PROCESSING<br>(Core-4)</td><td colspan="3">M.Tech DECS II Sem</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">1854202</td><td rowspan="2">CORE-4</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exams</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 2 Hours</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives:<br>• To understand theory of different filters and algorithms<br>• To understand theory of multirate DSP, solve numerical problems and write algorithms<br>• To understand theory of prediction and solution of normal equations<br>• To know applications of DSP at block level</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">To understand theory of different filters and algorithms</td></tr>
<tr><td>CO 2</td><td colspan="8">To understand theory of multirate DSP, solve numerical problems and write algorithms</td></tr>
<tr><td>CO 3</td><td colspan="8">To understand theory of prediction and solution of normal equations</td></tr>
<tr><td>CO 4</td><td colspan="8">To know applications of DSP at block level</td></tr>
</table>

**UNIT I**

Overview **:**Discrete-Time Signals, Sequences and sequence Representation, Discrete-Time Systems, Time-Domain Characterization and Classification of LTI Discrete-Time Systems. The Continuous-Time Fourier Transform, The discrete-Time Fourier Transform, energy Density Spectrum of a Discrete-Time Sequence, Band-Limited Discrete-Time signals, The Frequency Response of LTI Discrete-Time System.

**UNIT II**

Multi rate DSP, Decimators and Interpolators, Sampling rate conversion, multistage decimator & interpolator, poly phase filters, QMF, digital filter banks, Applications in Multi rate systems.

**UNIT III**

Linear prediction & optimum linear filters, stationary random process, forward-backward linear prediction filters, solution of normal equations, AR Lattice and ARMA Lattice-Ladder Filters, Wiener Filters for Filtering and Prediction.

**UNIT IV**

Estimation of Spectra from Finite-Duration Observations of Signals. Nonparametric Methods for Power Spectrum Estimation,Parametric Methods for Power Spectrum Estimation, Minimum-Variance Spectral Estimation, Eigenanalysis Algorithms for Spectrum Estimation.

**UNIT V**

Application of DSP: Dual-Tone Multi frequency Signal Design, Spectral analysis of Sinusoidal Signals, Spectral analysis of non stationary signals, Musical sound processing, Discrete-time analytic signal generation, Subband coding of speech and audio signals, transmultiplexers and Oversampling A/D and D/C converters.

**Text Books:**

1. Digital Signal Processing by Sanjit K Mitra, Tata MCgraw Hill Publications.

2. Digital Signal Processing Principles, Algorithms, Applications by J G Proakis, D G Manolokis, PHI.

**Reference Books:**

1. Discrete-Time Signal Processing by A V Oppenhiem, R W Schafer, Pearson Education.

2. DSP- A Practical Approach- Emmanuel C Ifeacher Barrie. W. Jervis, Pearson Education.

3. Modern spectral Estimation techniques by S. M .Kay, PHI, 1997

<table>
<tr><td colspan="2">Course Title</td><td colspan="5">ADVANCED COMPUTER ARCHITECTURE (PSE-3)</td><td colspan="3">M.Tech DECS II Sem</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">1854203</td><td rowspan="2">PSE-3</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exams</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 2 Hours</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives:<ul><li>To make student learn the advanced concepts related to computer architecture and storage systems.</li><li>Understand parallelism and pipelining concepts, the design aspects and challenges.</li><li>Study and analyze the high performance scalable Multithreaded and multiprocessor systems.</li></ul></td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Understand parallelism and pipelining concepts, the design aspects and challenges.</td></tr>
<tr><td>CO 2</td><td colspan="8">Analyze the high performance scalable Multithreaded and multiprocessor systems.</td></tr>
</table>

## UNIT I

**Fundamentals of Computer Design:** Technology trends, cost- measuring and reporting performance quantitative principles of computer design.

**Instruction Set Principles and Examples: c**lassifying instruction set- memory addressing- type and size of operands- addressing modes for signal processing operations in the instruction set, instructions for control flow, encoding an instruction set, the role of compiler

## UNIT II

**Instruction Level Parallelism (ILP):** overcoming data hazards reducing branch costs, high performance instruction delivery, hardware based speculation, limitation of ILP

**ILP Software Approach**: compiler techniques- static branch protection, VLIW approach, H.W support for more ILP at compile time- H.W verses S.W solutions

## UNIT III

**Memory Hierarchy Design**: cache performance, reducing cache misses penalty and miss rate, virtual memory, protection and examples of VM.

**UNIT IV**

**Multiprocessors and Thread Level Parallelism**: Symmetric shared memory architectures, distributed shared memory, Synchronization, multi threading.

**UNIT V**

**Storage Systems**-Types, Buses, RAID, errors and failures, bench marking a storage device, designing a I/O system.

**Interconnection Networks and Clusters**: Inter connection network media, practical issues in interconnecting networks- examples, clusters, designing a Cluster

**Text Books:**

1. Computer Architecture A quantitative approach 3rd edition John L. Hennessy & David A. Patterson Morgan Kufmann (An Imprint of Elsevier)

**Reference Books:**

1. Kai Hwang and A.Briggs "Computer Architecture and parallel processing", International Edition McGraw-Hill.
2. Kai Hwang, "Advanced Computer Architecture", McGraw Hill Education,1993.
3. DezsoSima, Terence Fountain, Peter Kacsuk, "Advanced Computer Architectures", Pearson.

| Course Title | IOT & APPLICATIONS (PSE-3) | | | | | M.Tech DECS II Sem | | |
|---|---|---|---|---|---|---|---|---|
| Course Code | Category | Hours/Week | | | Credits | Maximum Marks | | |
| 1854204 | PSE-3 | L | T | P | C | Continuous Internal Assessment | End Exams | Total |
| | | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| Mid Exam Duration: 2 Hours | | | | | End Exam Duration: 3Hrs | | | |

**Course Objectives:**

- To Understand the concept of IOT and M2M
- To learn IOT architecture and applications in various fields
- To learn the security and privacy issues in IOT

**Course Outcomes: On successful completion of this course, the students will be able to**

| | |
|---|---|
| **CO 1** | Understand the concept of IOT and M2M |
| **CO 2** | Study IOT architecture and applications in various fields |
| **CO 3** | Study the security and privacy issues in IOT |

## UNIT I

IoT& Web Technology The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.

## UNIT II

M2M to IoT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

## UNIT III

IoT Architecture -State of the Art – Introduction, State of the art, Architecture Reference Model Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

**UNIT IV**

IoT Applications for Value Creations Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth.

**UNIT V**

Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security.

**Reference Books:**


1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st
2. Edition, VPT, 2014.
3. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting
4. Everything", 1stEdition, Apress Publications, 2013.
5. CunoPfister, "Getting Started with the Internet of Things", OReilly Media, 2011.
6. Dr. OvidiuVermesan, Dr. Peter Friess, Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, River Publishers, 2013.
7. Catherine Mulligan, David Boyle, Jan Holler, Stamatis Karnouskos, and VlasiosTsiatsis, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", Elsevier, 2014.

| Course Title | VLSI SIGNAL PROCESSING (PSE-3) | | | | M.Tech DECS II Sem | | |
|---|---|---|---|---|---|---|---|
| Course Code | Category | Hours/Week | | | Credits | Maximum Marks | | |
| 1854205 | PSE-3 | L | T | P | C | Continuous Internal Assessment | End Exams | Total |
| | | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| Mid Exam Duration: 2 Hours | | | | | End Exam Duration: 3Hrs | | | |

**Course Objectives:**

- To understand DSP algorithms, pipelining and parallel processing.
- To learn retiming techniques folding and register minimization path problems.
- To learn algorithmic strength reduction techniques.
- To understand Finite word length effects.

**Course Outcomes: On successful completion of this course, the students will be able to**

| | |
|---|---|
| **CO 1** | Acquired knowledge about DSP algorithms, its DFG representation, pipelining and parallel processing approaches. |
| **CO 2** | Ability to acquire knowledge about retiming techniques, folding and register minimization path problems. |
| **CO 3** | Ability to have knowledge about algorithmic strength reduction techniques and parallel processing of FIR and IIR digital filters. |
| **CO 4** | Acquired knowledge about finite word-length effects and round off noise computation in DSP systems. |

**UNIT I**

Introduction to DSP systems, Pipelined and parallel processing.

**UNIT II**

Iteration Bound, Retiming, unfolding, algorithmic strength reduction in filters and Transforms.

**UNIT III**

Systolic architecture design, fast convolution, pipelined and parallel recursive and adaptive filters, Scaling and round off noise.

**UNIT IV**

Digital lattice filter structures, bit level arithmetic, architecture, redundant arithmetic.

**UNIT V**

Numerical strength reduction, synchronous, wave and asynchronous pipe lines, low power design.

**Reference Books:**

1. Keshab K. Parthi , VLSI Digital signal processing systems, design and implementation , Wiley, Inter Science, 1999.
2. Mohammad Isamail and Terri Fiez, Analog VLSI signal and information processing,

   McGraw Hill, 1994
3. S.Y. Kung, H.J. White House, T. Kailath, VLSI and Modern Signal Processing, Prentice Hall, 1985.

| Course Title | DETECTION AND ESTIMATION OF SIGNALS (PSE-4) | | | | M.Tech DECS II Sem | | |
|---|---|---|---|---|---|---|---|
| Course Code | Category | Hours/Week | | | Credits | Maximum Marks | |
| 1854206 | PSE-4 | L | T | P | C | Continuous Internal Assessment | End Exams | Total |
| | | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| Mid Exam Duration: 2 Hours | | | | | End Exam Duration: 3Hrs | | |

**Course Objectives:**

- To provide knowledge about various estimation techniques like parametric and non-parametric estimation techniques.
- To provide knowledge for finding good estimators.
- To provide enough knowledge for detection of signal in noise and estimate the signals in the presence of noise.

**Course Outcomes:On successful completion of this course, the students will be able to**

| | |
|---|---|
| **CO 1** | Compare various estimation techniques. |
| **CO 2** | Estimating the signals in the presence of noise. |

## UNIT I

**Introduction to Discrete-Ttime Signals:** Fourier Transform of a discrete time signal. Amplitude and phase spectrum.Frequency content and sampling rates. Transfer function. Frequency response.

**Random – Discrete-time signals:** Review of probability – Random data –Filtered signals – Autocorrelation and power spectral density.

## UNIT II

**Statistics:** Measurements, Nonparametric Estimators of Probability Distribution and Density Functions, Point Estimators of Parameters, Measures of the Quality of Estimators, Introduction to Interval Estimates, Distribution of Estimators, Tests of Hypotheses, Simple Linear Regression, Multiple Linear Regression.

## UNIT III

**Detection of Signals in Noise:** Minimum probability of Error criterion, Neyman-Pearson criterion for Radar detection of constant and variable, amplitude signals, Matched Filters, optimum formulation, detection of random signals, simple problems thereon with multisample cases.

## UNIT IV

**Estimation of signals in Noise:** Linear mean squared estimation, non-linear estimates, MAP and ML estimates, maximum likelihood estimate of parameters of linear system, simple problems theoreon.

## UNIT V

**Recursive Linear Mean Squared Estimation:** Estimation of a signal parameter. Estimation of time-varying signals, Kalman filtering, Filtering signals in noise, Treatment restricted to two variable case only, Simple problems.

## Text Books:

1. Signal processing: Discrete Spectral analysis, Detection and Estimation, Mischa Schwartz and Leonard Shaw, Mc-Graw Hill Book Company, 1975.
2. Shanmugam and Breipohl, 'Detection of signals in noise and estimation', John Wiley &Sons, New York, 1985.

## Reference Books:

1. E.L. Van Trees, Detection, Estimation and Modulation Theory, Wiley, New York, 1968.
2. Srinath, Rajasekaran&Viswanathan, Introduction to statistical Signal processing with Applications, Prentice Hall of India, New Delhi, 110 001,1989.

| Course Title | OPTICAL NETWORKS (PSE-4) | | | | | M.Tech DECS II Sem | | |
|---|---|---|---|---|---|---|---|---|
| Course Code | Category | Hours/Week | | | Credits | Maximum Marks | | |
| 1854207 | PSE-4 | L | T | P | C | Continuous Internal Assessment | End Exams | Total |
| | | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| Mid Exam Duration: 2 Hours | | | | | End Exam Duration: 3Hrs | | | |

**Course Objectives:**

- To learn optical networks and WDM network design.
- To understand latest technologies.

**Course Outcomes:On successful completion of this course, the students will be able to**

| | |
|---|---|
| **CO 1** | Contribute in the areas of optical network and WDM network design. |
| **CO 2** | Implement simple optical network and understand further technology developments for future enhanced network. |

**UNIT I**

**Client Layers of the Optical Layer**: SONET/SDH, Multiplexing, SONET/SDH Layers, SONET Frame Structure, SONET/SDH Physical Layer, Elements of a SONET/SDH Infrastructure optical transport network, Frame Structure, Multiplexing, IP- routing and forwarding, multiprotocol label switching - Labels and Forwarding, Quality of Service, Signaling and Routing

**UNIT II**

**WDM network elements:** optical line terminals and amplifiers, optical add/drop multiplexers, OADM architectures, reconfigurable OADM, optical cross connects.

**UNIT III**

**Control and management:** network management functions, optical layer services and interfacing, performance and fault management, configuration management.

**UNIT IV**

**Network Survivability:** protection in SONET/SDH & client layer.

**WDM network design:** LTD and RWA problems, dimensioning wavelength routing

networks, statistical dimensioning models.

**UNIT V**

**Photonic packet switching:** Optical time division multiplexing, synchronization, header processing, buffering, burst switching, test beds.

**Text Books:**

1. Rajiv Ramaswami, Sivarajan, Sasaki, "Optical Networks: A Practical Perspective", MK, Elsevier, 3 rd edition, 2010.
2. C. Siva Ram Murthy and Mohan Gurusamy, "WDM Optical Networks: Concepts Design, and Algorithms", PHI, EEE, 2001.

| Course Title | BIOMEDICAL SIGNAL PROCESSING (PSE-4) | | | | M.Tech DECS II Sem | | |
|---|---|---|---|---|---|---|---|
| Course Code | Category | Hours/Week | | | Credits | Maximum Marks | |
| 1854208 | PSE-4 | L | T | P | C | Continuous Internal Assessment | End Exams | Total |
| | | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| Mid Exam Duration: 2 Hours | | | | | End Exam Duration: 3Hrs | | |

**Course Objectives:**

- To understand different types of biomedical signals.
- To get exposed to various biomedical signal processing applications.

**Course Outcomes:On successful completion of this course, the students will be able to**

| | |
|---|---|
| **CO 1** | Understand different types of biomedical signal. |
| **CO 2** | Identify and analyze different biomedical signals. |
| **CO 3** | Find applications related to biomedical signal processing |

**UNIT I**

**Introduction:** Acquisition, Generation of Bio-signals, Origin of bio-signals, Types of bio-signals, Study of diagnostically significant bio-signal parameters

**UNIT II**

**Data Compression Techniques:**Lossy and Lossless data reduction Algorithms. ECG data compression using Turning point, AZTEC, CORTES, Huffman coding, vector quantization, DICOM Standards

**UNIT III**

**Cardiological Signal Processing:** Pre-processing, QRS Detection Methods, Rhythm analysis, Arrhythmia Detection Algorithms, Automated ECG Analysis, ECG Pattern Recognition. **Adaptive Noise Cancelling:** Principles of Adaptive Noise Cancelling, Adaptive Noise Cancelling with the LMS Adaptation Algorithm, Noise Cancelling Method to Enhance ECG Monitoring, Fetal ECG Monitoring.

**UNIT IV**

**Signal Averaging, Polishing** : Mean and trend removal, Prony's method, Prony's Method based on the Least Squares Estimate, Linear prediction, Yule – Walker (Y –W) equations, Analysis of Evoked Potentials.

## UNIT V

**Neurological Signal Processing:** Modeling of EEG Signals, Detection of spikes and spindles Detection of Alpha, Beta and Gamma Waves. Auto Regressive (A.R.) modeling of seizure EEG. Sleep Stage analysis, Inverse Filtering, Least squares and polynomial modeling.

## Text Books:

1. Rangaraj M. Rangayyan – Biomedical Signal Analysis. IEEE Press, 2001.
2. D. C. Reddy, Biomedical Signal Processing- principles, and techniques, Tata McGraw-Hill, 2005.
3. Biomedical Digital Signal Processing, Willis J. Tompkins, PHI.

| CourseTitle | MINI PROJECT WITH SEMINAR | | | | M.Tech DECS II Sem | | |
|---|---|---|---|---|---|---|---|
| CourseCode | Category | Hours/Week | | | Credits | MaximumMarks | | |
| 1854209 | CORE | L | T | P | C | Continuous Internal Assessment | End Exams | Total |
| | | 0 | 0 | 4 | 2 | 100 | -- | 100 |
| Internal Assessment | | | | | | | | |

**Course Objectives:**

- Acquire and apply new knowledge as needed, using appropriate learning strategies.

**CourseOutcomes:Onsuccessfulcompletionofthiscourse,thestudentswill be able to**

| | |
|---|---|
| **CO1** | Demonstrate a technical knowledge of their selected project topic. |
| **CO2** | Understand problem identification, formulation and solution. |
| **CO3** | Designengineeringsolutionstocomplexproblemsutilizingasystemsapproach. |
| **CO4** | Communicatewithengineersandthecommunityatlargeinwrittenanoralform. |
| **CO5** | Demonstrate the knowledge, skills and attitudes of a professional engineer. |

<table>
<tr><td>Course Title</td><td colspan="5">MICROCONTROLLERS AND PROGRAMMABLE DIGITAL SIGNAL PROCESSORS LAB</td><td colspan="3">M.Tech DECS II Sem</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">1854210</td><td rowspan="2">CORE</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exams</td><td>Total</td></tr>
<tr><td>0</td><td>0</td><td>4</td><td>2</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="5"></td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives:<br>• To understand Cortex-M3 development board.<br>• To learn GNU tool chain.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Install, configure and utilize tool sets for developing applications based on ARM processor core SoC and DSP processor</td></tr>
<tr><td>CO 2</td><td colspan="8">Develop prototype codes using commonly available on and off chip peripherals on the Cortex M3 and DSP development boards</td></tr>
</table>

**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 SysTick timer.
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 once 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.

**Part B) Experiments to be carried out on DSP C6713 evaluation kits and using Code Composer**

**Studio (CCS)**

1. To develop an assembly code and C code to compute Euclidian distance between any two points
2. To develop assembly code and study the impact of parallel, serial and mixed execution
3. To develop assembly and C code for implementation of convolution operation
4. To design and implement filters in C to enhance the features of given input sequence/signal

| Course Title | ADVANCED DIGITAL SIGNAL PROCESSING LAB | | | | M.Tech DECS II Sem | | |
|---|---|---|---|---|---|---|---|
| Course Code | Category | Hours/Week | | | Credits | Maximum Marks | | |
| 1854211 | CORE | L | T | P | C | Continuous Internal Assessment | End Exams | Total |
| | | 0 | 0 | 4 | 2 | 50 | 50 | 100 |
| | | | | | End Exam Duration: 3Hrs | | | |

**Course Objectives:**

- To understand digital filters.
- To understand various transforms in time and frequency domain.
- To learn decimation and interpolation techniques.

**Course Outcomes: On successful completion of this course, the students will be able to**

| | |
|---|---|
| **CO 1** | Design different digital filters in software |
| **CO 2** | Apply various transforms in time and frequency |
| **CO 3** | Perform decimation and interpolation |

**List of Assignments:**

1. Basic Signal Representation
2. Auto Correlation And Cross Correlation
3. Stability Using Hurwitz Routh Criteria
4. Sampling FFT Of Input Sequence
5. Butterworth Low pass And High pass Filter Design
6. Chebychev Type I,II Filter
7. Normal Equation Using Levinson Durbin
8. Decimation And Interpolation Using Rationale Factors
9. Maximally Decimated Analysis DFT Filter
10. Cascade Digital IIR Filter Realization
11. Convolution And M Fold Decimation &PSD Estimator
12. Estimation Of PSD
13. Separation Of T/F
14. Parallel Realization of IIR filter

| Course Title | ENGLISH FOR RESEARCH PAPER WRITING | | | | M.Tech DECS II Sem | | |
|---|---|---|---|---|---|---|---|
| Course Code | Category | Hours/Week | | | Credits | Maximum Marks | |
| 1870A01 | Audit Course | L | T | P | C | Continuous Internal Assessment | End Exams | Total |
| | | 2 | 0 | 0 | 0 | 40 | -- | 40 |
| Mid Exam Duration: 2 Hours | | | | | | | | |

**Course Objectives:**

- 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.

**Course Outcomes:On successful completion of this course, the students will be able to**

| | |
|---|---|
| CO 1 | Understand Writing skills and level of Readability. |
| CO 2 | Analyze what to write in each section. |

**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 Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction, Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

**UNIT III**

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 IV**

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

**UNIT V**

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

**Suggested Studies:**

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.

# M.TECH.-III- SEMESTER SYLLABUS

| Course Title | MICROCOMPUTER SYSTEM DESIGN (PSE-5) | | | | M.Tech DECS III Sem | | |
|---|---|---|---|---|---|---|---|
| Course Code | Category | Hours/Week | | | Credits | Maximum Marks | | |
| 1854301 | PSE-5 | L | T | P | C | Continuous Internal Assessment | End Exams | Total |
| | | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| Mid Exam Duration: 2 Hours | | | | | End Exam Duration: 3Hrs | | | |

**Course Objectives:**

- To become familiar with 8086, 80X86, Pentium & Pentium IV Microprocessor Architecture, Instructions, Operating Modes, and Programming.
- To study I/O, Multi programming and Arithmetic Coprocessor.

**Course Outcomes: On successful completion of this course, the students will be able to**

| | |
|---|---|
| **CO 1** | List out the features of 8086, 80X86, Pentium & Pentium IV Microprocessor. |
| **CO 2** | Develop and algorithm and write a program to Solve numerical problems |

**UNIT I**

**Review of 8086 Processor:** Architecture, Register organization, Addressing Modes and Instruction Set (Brief treatment only), Difference between 8086 and 8088 with rest to pin structures.

**The 80286 Microprocessors:** Architecture, Register Organization, Addressing Modes and instruction sets of80286 (brief treatment only)

**UNIT II**

**The 80386, and 80486 Microprocessors:** Architectural features, Register Organization, Memory management, Virtual 8086 mode, The Memory Paging Mechanism, Pin Definitions of 80386 and 80486 (brief treatment).

**UNIT III**

**The Pentium and Pentium Pro-processors:** The Memory System, Input/output system, Branch Prediction Logic, Cache Structure, Pentium Registers, Serial Pentium pro features.

**The Pentium IV and Dual Core Microprocessors:** Architecture, Special Registers and Pin Structures (brief treatment only).

**UNIT IV**

**I/O Programming:** Fundamentals of I/O Considerations Programmed I/O, Interrupt I/O, Block Transfers and DMA, I/O Design Example.

**Introduction to Multiprogramming:** Process Management, Semaphores Operations,

Common Procedure Sharing, Memory Management, Virtual Memory Concept of 80286 and other advanced Processors.

**UNIT V**

**Arithmetic Coprocessor, MMX and SIMD Technologies:** Data formats for Arithmetic Coprocessor, Internal Structure of 8087 and Advanced Coprocessors. Instruction Set (brief treatment).

**Text Books:**

1. Barry, B. Brey, "The Intel Microprocessors,"8th Edition Pearson Education, 2009.
2. A.K. Ray and K.M. Bhurchandi,"Advanced Microprocessor and Peripherals," TMH.
3. YU-Chang, Glenn A. Gibson, "Micro Computer Systems: The 8086/8088 Family Architecture, Programming and Design" 2nd Edition, Pearson Education, 2007.

**Reference Books:**

1. The 8088 and 8086 Microprocessors: Programming, Interfacing, Software, Hardware, and Applications : Including the 80286, 80386, 80486, and Pentium Processors Walter A. Triebel, Avtar Singh Prentice Hall, 2000
2. Douglas V. Hall, "Microprocessors and Interfacing," Special Indian Edition, 2006

| Course Title | JOINT TIME FREQUENCY ANALYSIS & MULTI RESOLUTION ANALYSIS (PSE-5) | | | | M.Tech DECS III Sem | | |
|---|---|---|---|---|---|---|---|
| Course Code | Category | Hours/Week | | | Credits | Maximum Marks | |
| 1854302 | PSE-5 | L | T | P | C | Continuous Internal Assessment | End Exams | Total |
| | | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| Mid Exam Duration: 2 Hours | | | | | End Exam Duration: 3Hrs | | |

**Course Objectives:**

- To understand various transforms in signal processing.
- To understand Time -Frequency Analysis & Multi resolution Analysis.
- To learn wavelets and its applications.

**Course Outcomes: On successful completion of this course, the students will be able to**

| | |
|---|---|
| **CO 1** | Introduction to Transforms in signal processing |
| **CO 2** | To understand Time -Frequency Analysis & Multi resolution Analysis |
| **CO 3** | Study of Wavelets and its Applications |

## UNIT I

Introduction: Review of Fourier Transform, Parseval Theorem and need for joint time-frequency Analysis. Concept of non-stationary signals, Short-time Fourier transforms (STFT), Uncertainty Principle, and Localization/Isolation in time and frequency, Hilbert Spaces, Banach Spaces, and Fundamentals of Hilbert Transform.

## UNIT II

Bases for Time-Frequency Analysis: Wavelet Bases and filter Banks, Tiling's of Wavelet Packet and Local Cosine Bases, Wavelet Transform, Real Wavelets, Analytic Wavelets, Discrete Wavelets, Instantaneous Frequency, Quadratic time-frequency energy, Wavelet Frames, Dyadic wavelet Transform, Construction of Haar and Roof scaling function using dilation equation and graphical method.

## UNIT III

Multiresolution Analysis: HaarMultiresolution Analysis, MRA Axioms, Spanning Linear Subspaces, nested subspaces, Orthogonal Wavelets Bases, Scaling Functions, Conjugate Mirror Filters, Haar 2-band filter Banks, Study of up samplers and down samplers, Conditions for alias

cancellation and perfect reconstruction, Discrete wavelet transform and relationship with filter Banks, Frequency analysis of Haar 2-band filter banks, scaling and wavelet dilation equations in time and frequency domains, case study of decomposition and reconstruction of given signal using orthogonal framework of Haar 2band filter bank.

**UNIT IV**

Wavelets: Daubechies Wavelet Bases, Daubechies compactly supported family of wavelets;

Daubechies filter coefficient calculations, Case study of Daub-4 filter design, Connection between Haar and Daub-4, Concept of Regularity, Vanishing moments. Other classes of wavelets like Shannon, Meyer, and Battle-Lamarie.

**UNIT V**

Bi-orthogonal wavelets and Applications: Construction and design. Case studies of biorthogonal 5/3 tap design and its use in JPEG 2000. Lifting schemes for generating orthogonal bases of second generation wavelets.

JTFA Applications: Speech, audio, image and video compression; signal denoising, feature extraction, inverse problem.

**Reference Books:**

1. S. Mallat, "A Wavelet Tour of Signal Processing," 2nd Edition, Academic Press, 1999.
2. L. Cohen, “Time-frequency analysis”, 1st Edition, Prentice Hall, 1995.
3. G.Strang and T. Q. Nguyen, “Wavelets and Filter Banks",2nd Edition, Wellesley
4. Cambridge Press, 1998.
5. I. Daubechies, "Ten Lectures on Wavelets", SIAM, 1992.
6. P. P. Vaidyanathan, "Multirate Systems and Filter Banks", Prentice Hall, 1993.
7. M. Vetterli and J. Kovacevic, "Wavelets and Subband Coding", Prentice Hall, 1995

| Course Title | PATTERN RECOGNITION AND MACHINE LEARNING (PSE-5) | | | | M.Tech DECS III Sem | | |
|---|---|---|---|---|---|---|---|
| Course Code | Category | Hours/Week | | | Credits | Maximum Marks | |
| 1854303 | PSE-5 | L | T | P | C | Continuous Internal Assessment | End Exams | Total |
| | | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| Mid Exam Duration: 2 Hours | | | | | End Exam Duration: 3Hrs | | |

**Course Objectives:**

- Study the parametric and linear models for classification
- Design neural network and SVM for classification
- Develop machine independent and unsupervised learning techniques.

**Course Outcomes:On successful completion of this course, the students will be able to**

| | |
|---|---|
| **CO 1** | Apply various classification models. |
| **CO 2** | Design neural network and SVM for classification. |
| **CO 3** | Develop machine independent and unsupervised learning techniques. |

## UNIT I

**Introduction to Pattern Recognition**: Problems, applications, design cycle, learning and adaptation, examples, Probability Distributions, Parametric Learning - Maximum likelihood and Bayesian Decision Theory- Bayes rule, discriminant functions, loss functions and Bayesian error analysis

## UNIT II

**Linear models for classification:** Discriminant functions, Two and multiple classes, Fisher's linear discriminant, Fisher's discriminant for multiple classes, The perceptron algorithm.

## UNIT III

**Neural Network**: perceptron, multi-layer perceptron, backpropagation algorithm, error surfaces, practical techniques for improving backpropagation, additional networks and training methods.

## UNIT IV

**Linear discriminant functions -** decision surfaces, two-category, multi-category, minimumsquared error procedures, the Ho-Kashyap procedures, linear programming algorithms, Support vector machine

## UNIT V

**Algorithm independent machine learning** – lack of inherent superiority of any classifier, bias and variance, re-sampling for classifier design.

**Unsupervised learning and clustering –** k-means clustering, fuzzy k-means clustering,hierarchical clustering

**Text Books:**

1. Richard O. Duda, Peter E. Hart, David G. Stork, "Pattern Classification", 2nd Edition John Wiley & Sons, 2001.
2. Trevor Hastie, Robert Tibshirani, Jerome H. Friedman, "The Elements of Statistical Learning", 2nd Edition, Springer, 2009.
3. C. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.

# OPEN ELECTIVES

1. Business Analytics
2. Industrial Safety
3. Operations Research
4. Cost Management of Engineering Projects
5. Composite Materials
6. Waste to Energy

| Course Title | BUSINESS ANALYTICS (Open Elective) | | | | M.Tech DECS III Sem | | |
|---|---|---|---|---|---|---|---|
| Course Code | Category | Hours/Week | | | Credits | Maximum Marks | |
| 1871304 | OEC | L | T | P | C | Continuous Internal Assessment | End Exams | Total |
| | | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| Mid Exam Duration: 2 Hours | | | | | End Exam Duration: 3Hrs | | |

**Course Objectives:**

- Understand the role of business analytics within anorganization.
- Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of anorganization.
- To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decisionmaking.
- To become familiar with processes needed to develop, report, and analyze businessdata. Use decision-making tools/Operations researchtechniques.
- Mange business process using analytical and managementtools.
- Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospaceetc.

**Course Outcomes: On successful completion of this course, the students will be able to**

| | |
|---|---|
| **CO 1** | Students will demonstrate knowledge of data analytics. |
| **CO 2** | Students will demonstrate the ability of think critically in making decisions based on data and deep analytics. |
| **CO 3** | Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making. |
| **CO 4** | Students will demonstrate the ability to translate data into clear, action able insights. |

## UNIT I

**Business analytics:** Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modeling, sampling and estimation methods overview.

**UNIT II**

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

**UNIT III**

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

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

**UNIT IV**

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

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

**UNIT V**

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

**Text Books:**

1. Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, "Business analytics Principles, Concepts, and Applications", Pearson FTPress.

2. James Evans, "Business Analytics", personsEducation.

3. Essentials of Business Analytics: An Introduction to the Methodology and its Applications, BhimsankarmPochiraju, Sridhar Seshadri, Springer.

**Reference Books:**

1. Business Analytics: Data Analysis and Decision Making, S. Christian Albright, Wayne L. Winstone, 6th Edition, Cengage Learning.
2. An Introduction to Business Analytics, GerKoole, MG Books.

| Course Title | INDUSTRIAL SAFETY (Open Elective) | | | | M.Tech DECS III Sem | | |
|---|---|---|---|---|---|---|---|
| Course Code | Category | Hours/Week | | Credits | Maximum Marks | | |
| 1871305 | OEC | L | T | P | C | Continuous Internal Assessment | End Exams | Total |
| | | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| Mid Exam Duration: 2 Hours | | | | | End Exam Duration: 3Hrs | | |

**Course Objectives:**

- To Know about Industrial Safety Program, Fundamentals of Maintenance Engineering to understand Wear and Corrosion and their preventions.
- To Analyze Fault tracking, Periodic and preventive Maintenance.

**Course Outcomes: On successful completion of this course, the students will be able to**

| | |
|---|---|
| **CO 1** | Analyze the Industrial Safety, Drinking water layouts, fire prevention, etc |
| **CO 2** | Understand the Wear and Corrosion and their Preventions. |
| **CO 3** | Analyze faults in machine tools and their general causes. |
| **CO 4** | Understand Periodic and preventive maintenance |

## UNIT I

**Industrial safety:** Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment andmethods.

## UNIT II

**Fundamentals of maintenance engineering:** Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

## UNIT III

**Wear and Corrosion and their prevention:** Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

**UNIT IV**

**Fault tracing:** Fault tracing-concept and importance, decision treeconcept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, Electrical motors, Types of faults in machine tools and their general causes.

**UNIT V**

**Periodic and preventive maintenance:** Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii.Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance.

**Text Books:**

1. Higgins & Morrow, "Maintenance Engineering Handbook", Da Information Services.
2. H. P. Garg, S. Chand and Company, "Maintenance Engineering".
3. Audels, "Pump-hydraulic Compressors", Mcgrew Hill Publication.
4. Winterkorn, Hans, "Foundation Engineering Handbook", Chapman & Hall London.

**Reference Books:**

1. D.A. Crowl and J.F. Louvar, Chemical Process Safety: Fundamentals with Applications, Prentice Hall, 2011.
2. Fawcett H.H and W.S. Wood, Safety and Accident Prevention in Chemical Operations, 2nd Edition, John Wiley and Sons inc.

<table>
<tr><td colspan="2">Course Title</td><td colspan="5">OPERATIONS RESEARCH<br>(Open Elective)</td><td colspan="3">M.Tech DECS III Sem</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">1871306</td><td rowspan="2">OEC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exams</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 2 Hours</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives:<br>• To Apply various optimization Techniques for Decision Making.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.</td></tr>
<tr><td>CO 2</td><td colspan="8">Students should able to apply the concept of non-linear programming</td></tr>
<tr><td>CO 3</td><td colspan="8">Students should able to carry out sensitivity analysis</td></tr>
<tr><td>CO 4</td><td colspan="8">Student should able to model the real world problem and simulate it</td></tr>
</table>

**UNIT I**

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

**UNIT II**

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

**UNIT III**

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

**UNIT IV**

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

**UNIT V**

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation.

**Text Books:**

1. H.A. Taha, Operations Research, An Introduction, PHI,2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi,1982.
3. Hitler Libermann Operations Research: McGraw Hill Pub.2009
4. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India2010.

**Reference Books:**

1. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi,2008.
2. Pannerselvam, Operations Research: Prentice Hall of India2010
3. Operations Research: Principles and Applications, G. Srinivasan, PHI.

| Course Title | COST MANAGEMENT OF ENGINEERING PROJECTS (Open Elective) | | | | M.Tech DECS III Sem | | |
|---|---|---|---|---|---|---|---|
| Course Code | Category | Hours/Week | | | Credits | Maximum Marks | |
| 1871307 | OEC | L | T | P | C | Continuous Internal Assessment | End Exams | Total |
| | | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| Mid Exam Duration: 2 Hours | | | | | End Exam Duration: 3Hrs | | |

**Course Objectives:**

- Understand the concepts of Project management for planning to execution of Projects.

**Course Outcomes: On successful completion of this course, the students will be able to**

| | |
|---|---|
| **CO 1** | Understand project characteristics and various stages of project. |
| **CO 2** | Analyze the learning and understanding techniques for project planning, scheduling and execution control. |

## UNIT I

Introduction and Overview of the Strategic Cost Management Process Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

## UNIT II

**Project:** meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and non- technical activities.Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts.Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process.

## UNIT III

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems.Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector.

## UNIT IV

Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints.Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis.Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets.Measurement of Divisional profitability pricing decisions including transfer pricing.

## UNIT V

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

### Text Books:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, NewDelhi
2. Charles T. Horngren and George Foster, Advanced ManagementAccounting
3. Robert S Kaplan Anthony A. Alkinson, Management & CostAccounting

### Reference Books:

1. AshishK. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheelerpublisher
2. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co.
3. The Engineer's Cost Handbook, Richard E. Westney, P.E, CRC Press.

| Course Title | COMPOSITE MATERIALS (Open Elective) | | | | M.Tech DECS III Sem | | |
|---|---|---|---|---|---|---|---|
| Course Code | Category | Hours/Week | | | Credits | Maximum Marks | |
| 1871308 | OEC | L | T | P | C | Continuous Internal Assessment | End Exams | Total |
| | | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| Mid Exam Duration: 2 Hours | | | | | End Exam Duration: 3Hrs | | |

**Course Objectives:**

- Train student on Composite materials-definition, Advantages and classification.
- Equip students with knowledge on composite strengthening addition of components and their production rules.

**Course Outcomes: On successful completion of this course, the students will be able to**

| | |
|---|---|
| **CO 1** | Identify and understand the behavior of composite materials |
| **CO 2** | Apply the choices made for using certain type of composites in certain applications with reference to composite properties. |
| **CO 3** | Analyze the manufacturing of metal matrix composites and polymer matrix composites. |

## UNIT I

**Introduction:** Definition – Classification and characteristics of Composite materials. Advantages and application of composites.Functional requirements of reinforcement and matrix.Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

## UNIT II

**Reinforcements:** Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

## UNIT III

**Manufacturing of Metal Matrix Composites:** Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing.Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

**UNIT IV**

**Manufacturing of Polymer Matrix Composites:** Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

**UNIT V**

**Strength:** Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

**Text Books:**

1. R.W.Cahn, "Material Science and Technology" – Vol 13 – Composites,– VCH, West Germany.
2. Callister, Jr., Adapted by R. Balasubramaniam, "Materials Science and Engineering, An introduction". WD, John Wiley & Sons, NY, Indian edition,2007.
3. ed-Lubin, "Hand Book of CompositeMaterials".
4. K.K.Chawla, "Composite Materials".

**Reference Books:**

1. Deborah D.L. Chung, "Composite Materials Science and Applications".
2. Danial Gay, Suong V. Hoa, and Stephen W. Tasi, "Composite Materials Design and Applications".
3. Mathews F.L and Rawlings R.D, Composite materials: Engineering and Science, Chapman and Hall, London, England, 1st Edition.
4. Mallick, P.K, Composite Materials Technology: Process and Properties, Hanser, New York.

| Course Title | WASTE TO ENERGY (Open Elective) | | | | M.Tech DECS III Sem | | |
|---|---|---|---|---|---|---|---|
| Course Code | Category | Hours/Week | | | Credits | Maximum Marks | |
| 1871309 | OEC | L | T | P | C | Continuous Internal Assessment | End Exams | Total |
| | | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| Mid Exam Duration: 2 Hours | | | | | End Exam Duration: 3Hrs | | |

**Course Objectives:**

- To create awareness in students of energy conservation.
- To Identify use of different types of Bio waste energy resources.
- To Understand different types of Bio waste energy conservations.
- To detect different waste conservation into different forms of energy.

**Course Outcomes: On successful completion of this course, the students will be able to**

| | |
|---|---|
| **CO 1** | Understand different types of energy from waste to produce electrical power. |
| **CO 2** | Estimate the use of bio waste to produce electrical energy. |
| **CO 3** | Understand different types of bio waste and its energy conversions. |
| **CO4** | Analyze the bio waste utilization and to avoid the environmental pollution. |

## UNIT I

**Introduction to Energy from Waste:** Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors.

## UNIT II

**Biomass Pyrolysis:** Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

## UNIT III

**Biomass Gasification:** Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

**UNIT IV**

**Biomass Combustion:** Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

**UNIT V**

**Biogas:** Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

**Text Books:**

1. Biogas Technology- Transfer and Diffusion, M.M. Halwagi, Elsevier.
2. C. Y. WereKo-Brobby and E. B. Hagan, "Biomass Conversion and Technology", John Wiley & Sons,1996.
3. Introduction to Biomass Energy Conservations, Sergio Capareda.

**Reference Books:**

1. Desai, Ashok V, "Non Conventional Energy", Wiley Eastern Ltd.,1990.
2. Khandelwal, K. C. and Mahdi, S. S, "Biogas Technology - A Practical Hand Book" - , Vol. I & II, Tata McGraw Hill Publishing Co. Ltd.,1983.
3. Challal, D. S., "Food, Feed and Fuel from Biomass", IBH Publishing Co. Pvt. Ltd.,1991.

| Course Title | DISSERTATION PHASE-I | | | | M.Tech DECS III Sem | | |
|---|---|---|---|---|---|---|---|
| Course Code | Category | Hours/Week | | | Credits | Maximum Marks | | |
| 1854310 | MAJOR PROJECT | L | T | P | C | Continuous Internal Assessment | End Exams | Total |
| | | 0 | 0 | 20 | 10 | 100 | -- | 100 |
| Internal Assessment | | | | | | | | |

**Course Objectives:**

- Acquire and apply new knowledge as needed, using appropriate learning strategies.

**Course Outcomes: On successful completion of this course, the students will be able to**

| | |
|---|---|
| **CO1** | Demonstrate a technical knowledge of their selected project topic. |
| **CO2** | Understand problem identification, formulation and solution. |
| **CO3** | Communicate with engineers and the community at large in written an oral form. |
| **CO4** | Demonstrate the knowledge, skills and attitudes of a professional engineer. |

# M.TECH.-IV- SEMESTER SYLLABUS

| Course Title | DISSERTATION PHASE-II | | | | M.Tech DECS IV Sem | | |
|---|---|---|---|---|---|---|---|
| Course Code | Category | Hours/Week | | | Credits | MaximumMarks | | |
| 1854401 | MAJOR PROJ | L | T | P | C | Continuous Internal Assessment | End Exams | Total |
| | | 0 | 0 | 32 | 16 | 50 | 50 | 100 |
| | | | | | External Assessment | | | |

**Course Objectives:**

- Acquire and apply new knowledge as needed, using appropriate learning strategies.

**Course Outcomes: On successful completion of this course, the students will be able to**

| | |
|---|---|
| **CO1** | Demonstrate a technical knowledge of theirs elected project topic. |
| **CO2** | Design engineering solutions to complex problems utilizing a systems approach. |
| **CO3** | Communicate with engineers and the community at large in written an oral form. |
| **CO4** | Demonstrate the knowledge, skills and attitudes of a professional engineer. |