ANNAMALAI UNIVERSITY
FACULTY OF ENGINEERING AND TECHNOLOGY

M.E. Embedded Systems
(Two-Year Full Time & Three-year Part Time)

DEGREE PROGRAM
Choice Based Credit System

Regulations & Curriculum – 2019

HAND BOOK
2019

DEPARTMENT OF ELECTRICAL ENGINEERING
1. Conditions for Admission
Candidates for admission to the first year of the four-semester M.E / M.Tech Degree program in Engineering shall be required to have passed B.E / B.Tech degree of Annamalai University or any other authority accepted by the syndicate of this University as equivalent thereto. They shall satisfy the conditions regarding qualifying marks and physical fitness as may be prescribed by the Syndicate of the Annamalai University from time to time. The admission for M.E Part Time program is restricted to those working or residing within a radius of 90 km from Annamalainagar. The application should be sent through their employers.

2. Branches of Study in M.E / M.Tech
The Branch and Eligibility criteria of programs are given in Annexure I

3. Courses of study
The courses of study along with the respective syllabi and the scheme of Examinations for each of the M.E / M. Tech programs offered by the different Departments of study in the Faculty of Engineering and Technology are given separately.

4. Choice Based Credit System (CBCS)
The curriculum includes three components namely Program Core, Program Electives and Open Electives, Mandatory Learning Courses and Audit Courses in addition to Thesis. Each semester curriculum shall normally have a blend of theory and practical courses.

5. Assignment of Credits for Courses
Each course is normally assigned one credit per hour of lecture / tutorial per week and 0.5 credit for one hour of laboratory or project or industrial training or seminar per week. The total credits for the program will be 68.

6. Duration of the program
A student of M.E / M.Tech program is normally expected to complete in four semesters for full-time / six semesters for part-time but in any case not more than four years for full-time / six years for part-time from the date of admission.

7. Registration for courses
A newly admitted student will automatically be registered for all the courses prescribed for the first semester, without any option. Every other student shall submit a completed registration form indicating the list of courses intended to be credited during the next semester. This registration will be done a week before the last working day of the current semester. Late registration with the approval of the Dean on the recommendation of the Head of the Department along with a late fee will be done up to the last working day. Registration for the Thesis Phase - I and Phase-II shall be done at the appropriate semesters.
8. Electives

8.1 Program Electives
The student has to select two electives in first semester, another two electives in the second semester and one more in the third semester from the list of Program Electives.

8.2 Open Electives
The student has to select two electives in third semester from the list of Open Electives offered by the Department and / or other departments in the Faculty of Engineering and Technology.

8.3 MOOC (SWAYAM) Courses
Further, the student can be permitted to earn credits by studying the Massive Open Online Courses offered through the SWAYAM Portal of UGC with the approval of the Head of the Department concerned. These courses will be considered as equivalent to open elective courses. Thus the credit earned through MOOC courses can be transferred and considered for awarding Degree to the student concerned.

8.4 Value added courses (Inter Faculty Electives)
Of the two open elective courses, a student must study one value added course that is offered by other Faculties in our University either in second or third semester of the M.E program.

9. Industrial Project
A student may be allowed to take up the one program elective and two open elective courses of third semester (Full Time program) in the first and second semester, to enable him/her to carry out Project Phase-I and Phase-II in an industry during the entire second year of study. The condition is that the student must register those courses in the first semester itself. Such students should meet the teachers offering those elective courses themselves for clarifications. No specific slots will be allotted in the time table for such courses.

10. Assessment

10.1 Theory Courses
The break-up of continuous assessment and examination marks for theory courses is as follows:

<table>
<thead>
<tr>
<th>Assessment Type</th>
<th>Marks</th>
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<tr>
<td>First assessment (Mid-Semester Test-I)</td>
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<tr>
<td>Second assessment (Mid-Semester Test-II)</td>
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<td>Third Assessment</td>
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<td>End Semester Examination</td>
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10.2 Practical Courses
The break-up of continuous assessment and examination marks for Practical courses is as follows:

<table>
<thead>
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</thead>
<tbody>
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<tr>
<td>Second assessment (Test-II)</td>
<td>15</td>
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<tr>
<td>Maintenance of record book</td>
<td>10</td>
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<tr>
<td>End Semester Examination</td>
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</table>

10.3 Thesis work
The thesis Phase I will be assessed for 40 marks by a committee consisting of the Head of the Department, the guide and a minimum of two members nominated by the Head
of the Department. The Head of the Department will be the chairman. The number of reviews must be a minimum of three per semester. 60 marks are allotted for the thesis work and viva voce examination at the end of the third semester. The same procedure will be adopted for thesis Phase II in the fourth semester.

10.4 Seminar / Industrial Training
The continuous assessment marks for the seminar / industrial training will be 40 and to be assessed by a seminar committee consisting of the Seminar Coordinator and a minimum of two members nominated by the Head of the Department. The continuous assessment marks will be awarded at the end of the seminar session. 60 marks are allotted for the seminar / industrial training and viva voce examination conducted based on the seminar / industrial training report at the end of the semester.

11. Student Counselors (Mentors)
To help the students in planning their course of study and for general advice on the academic program, the Head of the Department will attach a certain number of students to a member of the faculty who shall function as student counselor (mentors) for those students throughout their period of study. Such student counselors shall advise the students in selecting open elective courses from, give preliminary approval for the courses to be taken by the students during each semester, and obtain the final approval of the Head of the Department monitor their progress in SWAYAM courses / open elective courses.

12. Class Committee
For each of the semesters of M.E / M.Tech programs, separate class committees will be constituted by the respective Head of the Departments. The composition of the class committees from first to fourth semesters for Full time and first to sixth semesters for Part-time will be as follows:

- Teachers of the individual courses.
- A Thesis coordinator (for Thesis Phase I and II) shall be appointed by the Head of the Department from among the Thesis supervisors.
- A thesis review committee chairman shall be appointed by the Head of the Department
- One Professor or Associate Professor, preferably not teaching the concerned class, appointed as Chairman by the Head of the Department.
- The Head of the Department may opt to be a member or the Chairman.
- All counselors of the class and the Head of the Department (if not already a member) or any staff member nominated by the Head of the Department may opt to be special invitees.

The class committee shall meet three times during the semester. The first meeting will be held within two weeks from the date of class commencement in which the type of assessment like test, assignment etc. for the third assessment and the dates of completion of the assessments will be decided.

The second meeting will be held within a week after the completion of the first assessment to review the performance and for follow-up action.

The third meeting will be held after all the assessments but before the University semester examinations are completed for all the courses, and at least one week
before the commencement of the examinations. During this meeting the assessment on a maximum of 25 marks for theory courses / 40 marks for practical courses, for Industrial Training and for Thesis work (Phase-I and Phase-II) will be finalized for every student and tabulated and submitted to the Head of the Department for approval and transmission to the Controller of Examinations.

13. **Temporary Break Of Study**
A student can take a one-time temporary break of study covering the current semester and / or the next semester with the approval of the Dean on the recommendation of the Head of the Department, not later than seven days after the completion of the mid-semester test. However, the student must complete the entire program within the maximum period of **four years for Full time / six years for Part time**.

14. **Substitute Assessments**
A student who has missed, for genuine reasons accepted by the Head of the Department, one or more of the assessments of a course other than the end of semester examination may take a substitute assessment for any one of the missed assessments. The substitute assessment must be completed before the date of the third meeting of the respective class committees.

A student who wishes to have a substitute assessment for a missed assessment must apply to the Head of the Department within a week from the date of the missed assessment.

15. **Attendance Requirements**
The students with 75% attendance and above are permitted to appear for the University examinations. However, the Vice Chancellor may give a rebate / concession not exceeding 10% in attendance for exceptional cases only on Medical Grounds.

A student who withdraws from or does not meet the minimum attendance requirement in a semester must re-register and repeat the same semester in the subsequent academic years.

16. **Passing and declaration of Examination Results**
All assessments of all the courses on an absolute marks basis will be considered and passed by the respective results passing boards in accordance with the rules of the University. Thereafter, the controller of examinations shall convert the marks for each course to the corresponding letter grade as follows, compute the grade point average (GPA) and cumulative grade point average (CGPA) and prepare the mark sheets.

<table>
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<tr>
<th>Marks Range</th>
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<tbody>
<tr>
<td>90 to 100 marks</td>
<td>Grade ‘S’</td>
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<tr>
<td>80 to 89 marks</td>
<td>Grade ‘A’</td>
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<tr>
<td>70 to 79 marks</td>
<td>Grade ‘B’</td>
</tr>
<tr>
<td>60 to 69 marks</td>
<td>Grade ‘C’</td>
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<tr>
<td>55 to 59 marks</td>
<td>Grade ‘D’</td>
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<td>50 to 54 marks</td>
<td>Grade ‘E’</td>
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<tr>
<td>Less than 50 marks</td>
<td>Grade ‘E’</td>
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<tr>
<td>Withdrawn from the Examination</td>
<td>Grade ‘W’</td>
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</table>
A student who obtains less than 30 / 24 marks out of 75 / 60 in the theory / practical examinations respectively or is absent for the examination will be awarded grade RA.
A student who earns a grade of S, A, B, C, D or E for a course is declared to have successfully completed that course and earned the credits for that course. Such a course cannot be repeated by the student.
A student who obtains letter grade RA / W in the mark sheet must reappear for the examination of the courses.
The following grade points are associated with each letter grade for calculating the grade point average and cumulative grade point average.

S - 10; A - 9; B - 8; C - 7; D - 6; E - 5; RA - 0

Courses with grade RA / W are not considered for calculation of grade point average or cumulative grade point average.

A student can apply for re-totaling of one or more of his examination answer papers within a week from the date of issue of mark sheet to the student on payment of the prescribed fee per paper. The application must be made to the Controller of Examinations with the recommendation of the Head of the Department.

After the results are declared, mark sheets will be issued to the students. The mark sheet will contain the list of courses registered during the semester, the grades scored and the grade point average for the semester.

GPA is the sum of the products of the number of credits of a course with the grade point scored in that course, taken over all the courses for the semester, divided by the sum of the number of credits for all courses taken in that semester.

CGPA is similarly calculated considering all the courses taken from the time of admission.

17. Awarding Degree
After successful completion of the program, the degree will be awarded with the following classifications based on CGPA.
For First Class with Distinction the student must earn a minimum of 68 credits within four semesters for full-time / six semesters for Part time from the time of admission, pass all the courses in the first attempt and obtain a CGPA of 8.25 or above.
For First Class, the student must earn a minimum of 68 credits within two years and six months for full-time / three years and six months for Part time from the time of admission and obtain a CGPA of 6.75 or above.
For Second class, the student must earn a minimum of 68 credits within four years for full-time / six years for Part time from the time of admission.

18. Ranking of Candidates
The candidates who are eligible to get the M.E / M.Tech degree in First Class with Distinction will be ranked on the basis of CGPA for all the courses of study from I to IV semester for M.E / M.Tech full-time / I to VI semester for M.E / M.Tech part-time.
The candidates passing with First Class and without failing in any subject from the time of admission will be ranked next to those with distinction on the basis of CGPA for all the courses of study from I to IV semester for full-time / I to VI semester for M.E / M.Tech part-time.
19. **Transitory Regulations**

If a candidate studying under the old regulations M.E. / M.Tech could not attend any of the courses in his/her courses, shall be permitted to attend equal number of courses, under the new regulation and will be examined on those subjects. The choice of courses will be decided by the concerned Head of the department. However he/she will be permitted to submit the thesis as per the old regulations. The results of such candidates will be passed as per old regulations.

The University shall have powers to revise or change or amend the regulations, the scheme of examinations, the courses of study and the syllabi from time to time.
<table>
<thead>
<tr>
<th>S.No.</th>
<th>Department</th>
<th>Program (Full Time &amp; Part time)</th>
<th>Eligible B.E./B.Tech Program</th>
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<tr>
<td>1</td>
<td>Chemical Engineering</td>
<td>i. Chemical Engineering</td>
<td>B.E. / B.Tech – Chemical Engg, Petroleum Engg, Petrochemical Technology</td>
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<tr>
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<td>iii. Industrial Bio Technology</td>
<td>B.E. / B.Tech - Chemical Engg, Food Technology, Biotechnology, Leather Technology</td>
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<td>iv. Industrial Safety Engineering</td>
<td>B.E. / B.Tech – Any Branch of Engineering</td>
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<td>ii. Environmental Engineering &amp; Management</td>
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<td>iii. Water Resources Engineering &amp; Management</td>
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<td>ii. Construction Engg. and Management</td>
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<td>iii. Geotechnical Engineering</td>
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<td>iv. Disaster Management &amp; Engg.</td>
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<tr>
<td>S.No.</td>
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<td>Program (Full Time &amp; Part time)</td>
<td>Eligible B.E./B.Tech Program</td>
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VISION

To develop the Department into a “Centre of Excellence” with a perspective to provide quality education and skill-based training with state-of-the-art technologies to the students, thereby enabling them to become achievers and contributors to the industry, society and nation together with a sense of commitment to the profession.

MISSION

M1: To impart quality education in tune with emerging technological developments in the field of Electrical and Electronics Engineering.
M2: To provide practical hands-on-training with a view to understand the theoretical concepts and latest technological developments.
M3: To produce employable and self-employable graduates.
M4: To nurture the personality traits among the students in different dimensions emphasizing the ethical values and to address the diversified societal needs of the Nation
M5: To create futuristic ambience with the state-of-the-art facilities for pursuing research.

PROGRAM EDUCATIONAL OBJECTIVES

PEO1: Envisage a solid foundation in Basic Sciences, Electrical and Electronics Engineering for a successful career and Life-long Learning in the fields of having Societal Implications.
PEO2: Design and implement effective solutions for complex Electrical and Electronics Engineering problems using modern tools and techniques.
PEO3: Establish Professionalism, Good Communication skills and ethical attitude in multi-disciplinary team work.
PEO4: Apply creative thinking and critical reasoning skills in collaborative research.
PEO5: Contribute to the economical growth of the country by creating job opportunities through entrepreneurship.
PROGRAM OUTCOMES (POs)

After the successful completion of B.E (Electrical and Electronics Engineering Engineering)

Program the students will be able to:

PO 1: **Engineering Knowledge:**
Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO 2: **Problem Analysis:**
Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3: **Design/Development of Solutions:**
Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4: **Conduct Investigations of Complex Problems:**
Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5: **Modern Tool Usage:**
Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO 6: **The Engineer and Society:**
Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 7: **Environment and Sustainability:**
Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8: Ethics:
Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9: Individual and Team Work:
Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10: Communication:
Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO 11: Project Management and Finance:
Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12: Life-Long Learning:
Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

At the time of graduation, the students will be able to:

PSO 1: Identify, formulate and investigate various problems of electrical and electronic circuits, power electronics and power systems by applying the fundamental knowledge of mathematics, science and engineering.

PSO 2: Design, develop and implement multidisciplinary projects in the field of electrical power and energy using state-of-the-art technologies and modern software tools.

PSO 3: Develop effective communication skills and leadership qualities with professional and ethical responsibilities to meet the global technological challenges of the society and electrical industry.
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### CURRICULUM - 2019

#### SEMESTER I

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#### SEMESTER II

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Note: * - Four weeks during the summer vacation at the end of II Semester.

COURSES OF STUDY AND SCHEME OF EXAMINATION (REGULATION – 2019)
M.E (EMBEDDED SYSTEMS)- PART-TIME

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PE - PROGRAM ELECTIVES

1. Advanced Digital Signal Processing
2. Distributed Embedded Computing
3. Real Time Operating System
4. VLSI for Embedded Applications
5. SCADA for Embedded Applications
6. Embedded Product Development Technologies
7. Digital Instrumentation
8. Medical Instrumentation
9. Micro Electro Mechanical Systems
10. Digital Image Processing
11. Software Technology for Embedded Systems
12. Robotics and Automation
13. Wireless Sensor Networks
14. Wireless and Mobile Communication
15. FPGA Based Embedded System Design

OE - OPEN ELECTIVES

1. Business Analytics
2. Industrial Safety
3. Operations Research
5. Composite Materials
6. Waste to Energy

AC - AUDIT COURSES

1. English for Research Paper Writing
2. Disaster Management
3. Sanskrit for Technical Knowledge
4. Value Education
5. Constitution of India
6. Pedagogy Studies
7. Stress Management by Yoga
8. Personality Development through Life Enlightenment Skills.
COURSE OBJECTIVES:

- To introduce the fundamentals of microcontroller based system design.
- To study the interfacing peripherals with microcontrollers.
- To learn the features, architecture and programming of PIC.
- To introduce PIC peripheral system design.
- To study on basic tool features for target configuration.
- To give case study experiences for microcontroller based applications.

Introduction

Need for Microcontroller based system design - Design cycle - Design problem - Hardware and software considerations - System integration/Structure and characteristics - Interrupt structures - Programmable timers - Latency - Interrupt density - Interval considerations.

89C51 Processor

Review of architectures and instruction sets of 89C51 Processor - Coprocessor configuration - Closely coupled and loosely coupled configurations - Architecture and instruction set of I/O processor - I/O control - I/O timing - Data buffering with FIFO - Key boards and switches - Remote instrument control - Self test hardware - Key board parsing - Real time programming - Self test algorithm.

PIC Microcontroller


Trouble Shooting and Development Systems


System Design Examples


REFERENCES:


**COURSE OUTCOMES:**
1. Understand the fundamentals of microcontroller systems and interface, and have the ability to apply them.
2. Understand the architecture and capabilities of PIC microcontroller.
3. Learn importance of PIC in designing embedded application.
4. Learn use of hardware and software tools.
5. Develop interfacing to real world devices.

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COURSE OBJECTIVES:
- Review the analysis and design of combinational logic circuits.
- Establish the methods for the analysis, modeling and design of synchronous sequential circuits.
- Incorporate the analysis and design of asynchronous circuit and obtain the hazard free circuits.
- Implement the digital systems on reconfigurable programmable logic devices.
- Study the different digital fault diagnosis and test methods.

Introduction
Review of Combinational circuit analysis – Minimization and design – Top-down modular design – Decoders, Encoders – Multiplexer and Demultiplexer – Incompletely specified functions – Circuit design.

Sequential Circuit Design

Asynchronous Sequential Circuit Design

Synchronous Design Using Programmable Devices

Fault Analysis

REFERENCES:

COURSE OUTCOMES:
1. Gather a review of combinational circuit and analysis.
2. Develop the ability to analyze and design synchronous sequential circuits.
3. Equip the capability to design Asynchronous sequential circuits and realize hazard free circuit.
4. Gain knowledge on implementation of sequential circuits using PLDs.
5. Understand the concepts fault diagnosis and testability.

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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

Effective literature studies approaches, analysis-Plagiarism, Research ethics

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


REFERENCES:
2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”

COURSE OUTCOMES:
Students will be able to:
1. Understand research problem formulation.
2. Analyze research related information
3. Understand that today’s world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.

4. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasise the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.

5. 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.

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COURSE OBJECTIVES:

- To learn the working principles of 89C51 microcontroller and PIC Microcontroller.
- To understand the characteristics of real time systems.
- To involve the students to Practice on Workbench /Software Tools/ Hardware Processor Boards with the supporting Peripherals.
- To instruct the concepts of algorithm development & programming on software tools and micro Controllers with peripheral interfaces.
- To practice through at least one of the subdivisions covered within experiments listed below to expose the students into the revising the concepts acquired from theory subjects.

LIST OF EXPERIMENTS

1. Study of Microcontrollers
   (i) 89C51 Microcontroller
   (ii) PIC 16F877 Microcontroller
2. Applications of 89C51 Microcontroller
   (i) Frequency Measurement
   (ii) Checking of Boolean Functions
3. Seven Segment LED Display Using 89C51 Microcontroller
4. Stepper Motor Control Using 89C51 Microcontroller
5. Seven Segment LED Display, ADC and PWM Generation using PIC 16F877 Microcontroller
6. Application of I^2C Logic for Character Display in PIC 16F877 Microcontroller
7. Realization of Real Time Clock using PIC16F877 Microcontroller
8. Serial Data Communication Using PIC16F877 Microcontroller

COURSE OUTCOMES:

Students will be able to:

1. Explain the architecture and operation of 89C51 and PIC16F877 Microcontrollers
2. Identify and explain the operations of peripherals and memories typically interfaced with these controllers
3. Analyze instruction sets of 89C51 and PIC16F877 Microcontrollers.
4. Gain hands-on experience in doing experiments on 89C51 and PIC16F877 Microcontrollers, by using hardware kits in the laboratory and present the report.
5. Students should understand the hardware/software tradeoffs involved in the design of these Controllers
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COURSE OBJECTIVES:

- To provide an introduction to DSP Processors.
- To explain Embedded C language programming techniques.
- To study the Hardware interfacing circuits and DSP Processor applications.

LIST OF EXPERIMENTS

1. Study of DSP Processors
   (i) TMS320F2812 Processor
   (ii) TMS320C5416 Processor
   (iii) TMS320C6713 Processor
2. Study of Code Composer Studio Software
3. Seven Segment LED Display Using DSP TMS320F2812 Processor
4. Linear and Circular Convolution using DSP TMS320C5416 Processor
5. Analog to Digital Conversion using DSP TMS320C5416 Processor
6. Digital to Analog Conversion using DSP TMS320C5416 Processor
7. Applications of DSP TMS320C6713 Processor
   (i) Low Pass Filter
   (ii) High Pass Filter
   (iii) Band Pass Filter
   (iv) Band Rejection Filter
9. ADC and DAC Using DSP TMS320C6713 Processor
10. Computation of Power Density Spectrum of a sequence using DSP TMS320C6713 Processor

COURSE OUTCOMES:

Upon completion of the course the student will be able to

1. Explain the architecture and operation of various DSP Processors.
2. Identify and explain the operations of peripherals and memories typically interfaced with DSP Processors.
3. Analyze instruction sets of TMS320F2812, TMS320VC5416 and TMS320C6713 Processor.
4. Gain hands-on experience in doing experiments on TMS320F2812, TMS320VC5416 and TMS320C6713 Processor by using hardware kit in the laboratory and present the report.
5. Explain the hardware/software trade-offs involved in the design of DSP Processors.
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COURSE OBJECTIVES:
- To acquire knowledge about the features of advanced processors.
- To study the architectures of CISC processor.
- To discuss on memory management, application development of CISC processors.
- To discuss the architecture and instruction set of ARM processor.
- To learn the programming concept in ARM processor
- To study about ARM application.

Features of Advanced Processors

Architecture of CISC Processors

ARM Architecture

ARM Programming
- Basic Assembly language program -The ARM Programr's model - Registers - Pipeline - Interrupts – ARM organization - ARM processor family – Co-processors – Instruction cycle timings

ARM Application Development
- Handling – Interrupts – Interrupt handling schemes- Firmware and boot loader
REFERENCES:

COURSE OUTCOMES:
1. Delivers insight into various embedded processors of RISC and CISC architecture with improved design strategies.
2. Introduces the recent advanced features in RISC and CISC processors.
3. Gives an idea about the instruction set in ARM processor
4. Explains the programming model in the processors.
5. Develops an overview about the application of the advanced processors.

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Mapping with Program Outcomes
COURSE OBJECTIVES:

- To provide a clear understanding on the basic concept of embedded control system.
- To know the fundamentals of Real time operating system.
- To study the software and hardware design interface, SPI, RTC interfacing and programming.
- To teach the basic concepts of developing device driver-software –interfacing and porting using C & C++.
- To teach the application development on embedded controller.

Embedded System Organization

Embedded computing – characteristics of embedded computing applications – embedded system design challenges; Build process of Real-time Embedded system – Selection of processor; Memory; I/O devices-Rs-485, MODEM, Bus Communication system using I2C, CAN, USB buses, 8 bit –ISA, EISA bus;

Real-Time Operating System

Introduction to RTOS; RTOS- Inter Process communication, Interrupt driven Input and Output -Nonmaskable interrupt, Software interrupt; Thread – Single, Multithread concept; Multitasking Semaphores.

Interface with Communication Protocol

Design methodologies and tools – design flows – designing hardware and software Interface. –system integration; SPI, High speed data acquisition and interface-SPI read/write protocol, RTC interfacing and programming.

Design of Software for Embedded Control


Case Studies with Embedded Controller

Programmable interface with A/D & D/A interface; Digital voltmeter, control- Robot system; -PWM motor speed controller, serial communication interface.

REFERENCES:


COURSE OUTCOMES:
1. Understand the basic concept of embedded system such as memory, I/O devices, and bus communication system.
2. Design real time embedded systems using the concepts of RTOS.
3. Explain and design of software for embedded control.
4. Implement the real-time operating system principle.
5. Design simple A/D and D/A interface circuits.

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Mapping with Program Outcomes
COURSE OBJECTIVES:

- To provide an introduction to various ARM Processors.
- To explain Embedded C language programming techniques.
- To study the Hardware interfacing circuits and ARM Processor applications.

List of Experiments

1. Study of ARM Processors LPC 2148
2. ADC and DAC using ARM Processor LPC 2148
3. LCD and Seven Segment LED Display using ARM Processor LPC2148
4. Graphics LCD Display using ARM processor LPC2148
5. Interfacing Real Time Clock and Serial port with ARM processor LPC 2148
6. Stepper motor control using ARM processor LPC 2148
7. LCD Display Using Cortex M4 ARM processor
8. DAC using Cortex M4 ARM Processor
9. Study of SPARTAN 6 FPGA Processor
10. LCD and 7 segment LED Display using SPARTAN 6 Processor

COURSE OUTCOMES:

1. Upon completion of the course the student will be able to
2. Explain the architecture and operation of ARM Processors.
3. Identify and explain the operations of peripherals and memories typically interfaced with ARM Processors.
5. Design and do experiments on ARM LPC 2148 Processor by using hardware kit in the laboratory and present the report.

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COURSE OBJECTIVES:

- To train the students in the Embedded Systems related areas and enable them to have a practical knowledge in carrying out Embedded Systems related works.
- To train and develop skills in solving problems during execution of certain works related to Embedded Systems.
- To work on a technical topic related to Embedded Systems and acquire the ability to make written and oral presentations
- To acquire the ability of writing technical papers for Conferences and Journals

The students should individually undergo a training program in reputed concerns in the field of Embedded Systems during the vacation for a minimum stipulated period of four weeks. At the end of the training, the students have to submit a detailed report on the training they had, within ten days from the commencement of the third semester for Full-time / fifth semester for part-time. The students will be evaluated, by a team of staff members nominated by Head of the department, through a viva-voce examination.

The students will work for two periods per week guided by student counsellor. They will be asked to present a seminar of not less than fifteen minutes and not more than thirty minutes on any technical topic of student's choice related to Embedded Systems and to engage in discussion with audience. They will defend their presentation. A brief copy of their presentation also should be submitted. Evaluation will be done by the student counselor based on the technical presentation and the report and also on the interaction shown during the seminar.

COURSE OUTCOMES:

1. The students can face the challenges in the field with confidence.
2. The students will be benefited by the training with managing the situation that arises during the execution of works related to Embedded Systems.
3. The students will be getting the training to face the audience and to interact with the audience with confidence.
4. To tackle any problem during group discussion in the corporate interviews.
5. To enable the students capable of preparing reports based on what they have learnt in the industry.
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COURSE OBJECTIVES:

- To carry out thesis Project work Phase – I which is an integral part of the thesis consisting of problem statement, literature review, thesis overview and scheme of implementation.
- To attempt the solution to the problem by analytical/simulation/experimental methods and validate with proper justification.

METHOD OF EVALUATION:

The student carries out literature survey and identifies the topic of thesis and finalizes it in consultation with Guide/Supervisor and prepare a comprehensive thesis report after completing the work to the satisfaction of the supervisor.

The progress of the thesis is evaluated based on a minimum of three reviews. The review committee will be constituted by the Head of the Department.

Thesis report has to be submitted at the end of the semester.

The thesis work is evaluated based on oral presentation and the thesis report jointly by external and internal examiners constituted by the Head of the Department.

COURSE OUTCOMES:

1. Review quality of Literature survey and Novelty in the problem
2. Assess clarity of Problem definition and Feasibility of problem solution
3. Validate the relevance to the specialization
4. Acquire Knowledge on the clarity of objective and scope
5. Improve the quality of Written and Oral Presentation

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Mapping with Program Outcomes

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COURSE OBJECTIVES:
- To carry out Thesis work Phase – II which is the remaining part of the thesis.
- To attempt the solution to the problem by analytical/simulation/experimental methods and validate with proper justification.

METHOD OF EVALUATION:
The progress of the thesis is evaluated based on a minimum of three reviews. The review committee will be constituted by the Head of the Department. Thesis report has to be submitted at the end of the semester. The thesis work is evaluated based on oral presentation and the thesis report jointly by external and internal examiners constituted by the Head of the Department.

COURSE OUTCOMES:
1. Identify the Embedded system problem
2. Analyze, design and implement solution methodologies
3. Apply modern engineering tools for solution
4. Write technical reports following professional ethics
5. Develop effective communication skills to present and defend their research work to a panel of experts.

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PROGRAM ELECTIVES

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**COURSE OBJECTIVES:**
- To study the analysis of discrete random signals.
- To study the digital filter design.
- To study the applications of adaptive filtering.
- To study the analysis of speech signals.
- To study the multi-rate signal processing fundamentals
- To introduce the various types of transforms.

**Discrete Random Signal Processing**

**Adaptive Signal Processing**

**Speech Signal Processing**

**Multirate Signal Processing**
- Mathematical representation of change of the sampling rate - Interpolation and Decimation -Decimation by integer factor – Interpolation by an integer factor - Direct form FIR filter structures – Single and multistage realization - Poly-phase realization – Application to sub band coding.

**Types of Transform**
- Fourier Transform – Short Time Fourier Transform (STFT) - Discrete Time Fourier Transform (DTFT) – Continuous Wavelet Transform (CWT) – Wavelet Transform (WT) – Recursive multi-resolution decomposition – Hilbert transform - applications and its limitations
REFERENCES:

COURSE OUTCOMES:
Students should be able to:
1. To understand advanced digital signal processing algorithms
2. To design adaptive filters for a given application
3. To design multi-rate DSP systems.
4. To understand decimation and interpolation of discrete-time signals.
5. To understand advanced digital signal transforms and their algorithms

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39
COURSE OBJECTIVES:

- To expose the students to the fundamentals of Network Management, Security and Communication Technologies.
- To understand the basics of internet with knowledge of internet server interfacing.
- To study Java based Networking.
- To get introduced to Embedded Network Routing Agents
- To study the Networking on-chip real time multiprocessor embedded systems.

**Internet Hardware Infrastructure**


**Internet Concepts**

Capabilities and limitations of the internet – Interfacing Internet server applications to corporate databases HTML and XML Web page design and the use of active components.

**Distributed Computing Using Embedded Java**


**Embedded Agent**


**Embedded Computing Architecture**


**REFERENCES:**


COURSE OUTCOMES:
The student will be able to
1. Explain various network hardware and security related issues
2. Explain basic concepts of internet database and webpage design.
3. Explain the distributed database computing using embedded Java.
4. Describe the embedded agent design and operation mechanism.
5. Explain the real time multiprocessor distributed embedded systems

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Mapping with Program Outcomes
**COURSE OBJECTIVES:**
- To impart students about the fundamentals of Real Time Systems and interaction with RTOS
- To teach the concepts of how process are created and controlled with RTOS.
- To study on programming logic of modeling and analyzing RTS
- To study about the services rendered by RTOS in an application.
- To acquire knowledge about the common problems in developing an RTOS.
- To discuss the application development using RTOS.

**RTOS**
Differences between General Purpose OS & RTOS, Real-time concepts, Hard Real time and Soft Real-time systems, Basic architecture of an RTOS, components in RTOS - kernel, objects, scheduler, Multitasking, context switch, Scheduling types - Preemptive priority based scheduling - Round-robin and preemptive scheduling - Task states - Task management.

**Kernel Objects**
Semaphores - Binary, counting, mutual exclusion (mutex) semaphores, Synchronization between two tasks and multiple tasks, Single shared-resource-access synchronization, Recursive shared-resource-access synchronization - message queue- Sending messages in FIFO or LIFO order- broadcasting messages. Common pipe- pipe operation- Select operation on multiple pipes-Pipes for inter-task- Synchronization - Event register - control block- Signals- Catch operation- Execution sequence of wait and signal operations.

**RTOS Services**
Overview- TCP/IP protocol- Stack- File system- Remote procedure calls- RTOS command shell-Exceptions and Interrupts- Programmable interrupt controller-Priority scheme- Task and stack- Interrupt nesting- Interrupt processing in two contexts. Timer and Timer Services - Real-time clock- Soft-timer- Servicing the timer interrupt in the task context- Timeout event handlers.

**I/O Subsystem and Memory Management**
Port-mapped I/O- Memory-mapped I/O- Write operation for a block-mode device- I/O function mapping- Associating devices with drivers-Memory allocation map, fragmentation, free operation, Management unit.
Typical RTOS

Introduction to RT Linux, Real-Time Linux Applications in Embedded system, Common Design Problems - Deadlock, priority inversion problem, Embedded RTOS for fault-Tolerant applications

REFERENCES:

COURSE OUTCOMES:
1. Acquire knowledge about Real Time Operating System.
2. Understand the concept of real time programming.
3. Understand the services rendered by an RTOS in a developed application.
4. Discuss about I/O and memory management concepts
5. Provide a concept to design and develop application using RTOS.

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Mapping with Program Outcomes
COURSE OBJECTIVES:

- To enlighten the student with the growth of integrated circuits and develop procedure for their design, simulation and implementation.
- The evolution and growth of integrated circuit, the methods of layout and the different approaches for their design are to be discussed.
- A detailed study of the fabrication techniques is to be made. Analysis of analog and digital VLSI circuits is to be carried out. The need for application of specific devices and their features along with examples are to be dealt.
- The course will refurbish the student to realign his ideas on a different plane. It will help the student to develop newer control strategies that can meet the desired performance more precisely.

VLSI Design Concepts

- Evolution of VLSI - VLSI design process - Architectural design - Logical design - Physical design - Lay-out styles - Full custom - Semi custom approaches - Need for design rules - Types of design rules - Design for MOS & CMOS circuits - Simple layout examples - Sheet resistance, area capacitance, wiring capacitance - Dry capacitive loads.

VLSI Fabrication Techniques

- Wafer fabrication - Wafer processing - Oxidation - Patterning - Silicon gate NMOS process - CMOS process - Nwell - Pwell - Twin tub - Silicon on insulator - CMOS Process enhancements - Analytical techniques - Ion beam techniques - Chemical methods - Package Fabrication technology - Reliability requirements - Field loss - Failure mechanism - Design automation.

Analog VLSI

- Introduction to analog VLSI - Analog circuit building blocks - Switches, active resistors - Current sources and sinks - Current mirrors/amplifiers - MOS & BJT, inverting amplifiers - CMOS and BJT two stage op-amp - Analog signal processing circuits - Sensors - D/A and A/D converters.

Digital VLSI

- Logic design - Switch logic - Gate logic - Dynamic CMOS logic - Structured design - Simple combinational logic design - Clocked sequential design - Sub-system design - Design of shifters - Arithmetic processors - ALU - Serial, Parallel and pipelined multiplier arrays.
FPGA Based Embedded Processor

FPGAs - Xilinx family. LCA - I/O block - programmable interconnect - Configuration memory. Hardware software task partitioning – FPGA fabric

REFERENCES:
3. 3 Rahul Dubey, “Introduction to Embedded System Design Using Field Programmable Gate Arrays”, Springer Verlag London Ltd., 2009

COURSE OUTCOMES:
1. Obtain the knowledge of basic fundamentals of VLSI design concepts
2. Understand various fabrication process technologies used in VLSI devices.
3. Able to analyze and design CMOS analog IC building blocks like MOS amplifiers,
4. Design multistage differential amplifiers
5. Able to analyze and design CMOS digital IC building blocks
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COURSE OBJECTIVES:

- To understand basics of SCADA.
- To understand the concept of various components involved with SCADA.
- To acquire knowledge about SCADA communication protocols.
- To study about monitoring and control techniques related to SCADA.
- To obtain basic knowledge implementation of SCADA in embedded systems.
- To learn about the application of SCADA in Embedded system.

Introduction to SCADA

Introduction to SCADA, Data acquisition systems, Evolution of SCADA, SCADA definitions, Communication technologies, Elements of a SCADA system, SCADA Functional requirements, SCADA Hierarchical concept, SCADA architecture, General features of SCADA.

SCADA System Components

Remote Terminal Unit (RTU), Interface units, Human- Machine Interface Units (HMI), Display Monitors/Data Logger Systems, Intelligent Electronic Devices (IED), Communication Network, SCADA Server, SCADA Control systems and Control panels.

SCADA Communication

SCADA Communication requirements, Communication protocols: Past, Present and Future, Structure of a SCADA Communications Protocol, Comparison of various communication protocols, IEC 61850 based communication architecture, Communication media like Fiber optic, PLCC, Interface provisions and communication extensions, synchronization with NCC, DCC.

SCADA Monitoring and Control

Online monitoring the event and alarm system, trends and reports, Blocking list, Event disturbance recording, Control function - Station control, bay control, breaker control and disconnector control.

SCADA Applications

Utility applications in Embedded systems, monitoring, analysis and improvement. SCADA applications in Utility Automation and Industries-Case studies, Implementation, Simulation Exercises

REFERENCES:


COURSE OUTCOMES:

1. Understanding the concept of SCADA.
2. Analyse various system components involved in SCADA system.
3. Acquires knowledge about monitoring and control methods in SCADA.
4. Helps to know about communication protocols in SCADA system.
5. Describes about application of SCADA in Embedded system.

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# COURSE OBJECTIVES:
- To understand basics of product design and development.
- To acquire knowledge about testing methodologies.
- To understand the basic concepts of product development based on its reliability, cost, robustness
- To discuss about the need for CAE, CAD, CAM, IDE tools in product design.
- To obtain basic knowledge on industrial design.
- To understand the concept of developing products in an embedded system.

## Concepts of Product Development

## Product Design Phase

## Approaches in Product Development

## Industrial Design
Integrate process design - Managing costs - Robust design –need for Involving CAE, CAD, CAM, IDE tools - Prototype basics - Principles of prototyping - Planning for prototypes- Economic & Cost Analysis - Understanding and representing tasks-baseline project planning -accelerating the project execution.
Developing Embedded Product Design

REFERENCES:

COURSE OUTCOMES:
1. Gives an idea about an approach to concept creativity, selection and testing.
2. Provides an idea for designing a consumer specific product.
3. Gives knowledge up gradation on recent trends in embedded systems design.
4. Describes the economic analysis and the consideration while designing a product.
5. Helps to improve the integration of customer requirements in product design.

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COURSE OBJECTIVES:

- To obtain the subject knowledge and ability to use basic Data acquisition system concepts.
- To familiarize the students the functioning of different types of instrument communication, interfacing and data transmission.
- To provide opportunity for students to work as part of teams on multi-disciplinary projects.
- To provide the P.G students with a sound foundation in the mathematical, scientific and engineering instruments to formulate, solve and analyze engineering problems and to prepare them for employability and higher studies.
- To promote student awareness of the lifelong learning and to introduce them to professional ethics and codes of professional practice.
- To prepare students for successful careers in industry that meets the needs of latest developments in industries as employable professionals.

Introduction

Data acquisition systems – Overview of A/D converter, types and characteristics – Sampling, Errors - Objective – Data acquisition interface requirements – Counters – Modes of operation – Frequency, Period, Time interval measurements, Prescaler, Heterodyne converter for frequency measurement, Single and Multi channel Data Acquisition systems.

Interfacing and Data Transmission


Instrument Communication

Visual Instrumentation


Case Studies

PC based DAS, Data loggers, PC based process measurements like flow, temperature, pressure and level development system, Programmable Logic Controllers, CRT interface and controller with monochrome and colour video display.

REFERENCES:


COURSE OUTCOMES:

1. To enhance teaching & research contributions in Embedded System Technology particularly for PC based Instrumentation concepts.
2. An ability to design and conduct experiments as well as to organize, analyze and interpret data on multidisciplinary domains.
3. Be able to identify problems in major issues of Instrument Communication Systems, analyze problems & solve them using the base of Embedded Technology.
4. To provide guidance and to develop inter-process communication techniques based on hardware– software approaches for real time process automations.
5. An ability to effectively communicate technical information in speech, presentation, and in writing.

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ANAMALAI UNIVERSITY

FEAT

52
COURSE OBJECTIVES:
- To understand basics of measurement system.
- To understand the concept of various biomedical instruments and technologies.
- To acquire knowledge about sensing devices used in biomedical instruments.
- To understand the biomedical instruments used in hospitals.
- To discuss about the reduction of noise in biomedical instruments.
- To obtain basic knowledge on medical imaging systems.

Medical Instrumentation Basics
Basic Medical Instrumentation system, General Constraints in design of medical instrumentation system, Classification of Biomedical Instruments, Biomedical Simulators, Sources of Bioelectric Potential and Electrodes- Resting and Action potential, Propagation of action potential, The bioelectric potentials: ECG, EEG, EMG, ERG, EOG, EGG; Digital Biosignals, Equipment standards and patient safety.

Sensing Devices for Biomedical Instruments

Measurement Systems

Artifacts and Noise In Medical Instrumentation
Examples of noise in medical instrumentation and biomedical signals – baseline wander, power line interference, electrode motion artifacts, Noise reduction with digital signal processing; QRS complex detection in ECG - Pan Tompkins Algorithm

Modern Medical Imaging Systems
Ultrasound and Ultrasonic imaging system – Ultrasound Doppler and flow detector, Echocardiogram; Physics of X-rays and X-ray machines, Information content of an Image, Radiography, Computed Radiography, Computer Tomography (CT), Magnetic Resonance Imaging (MRI), Positron Emission Tomography (PET).
REFERENCES:

COURSE OUTCOMES:
1. Helps to learn about Biomedical Instruments.
2. Acquires knowledge about Electrodes, Sensors and Transducers for biomedical signal acquisition.
3. Gives an idea about ECG, EEG and EMG recording techniques and their instrumentation.
4. Helps to know about signal processing and filtering techniques for noise and artifact removal.
5. Describes the modern medical imaging modalities and instruments.

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Mapping with Program Outcomes
COURSE OBJECTIVES:
- This course intends to provide a conceptual understanding of micro fabrication techniques and the issues surrounding them.
- To know the major classes, components and applications of MEMS devices/systems and to demonstrate an understanding of the fundamental principles behind the operation of these devices/systems.
- To learn Bulk micromachining process and to understand the concept of different etching process and etching materials in fabrication process.
- To impart knowledge about surface micromachining process and to understand the types and concept of bonding process.
- To study and design of different types of MEMS actuators, Micro grippers, MEMS resonators and their applications.

Introduction To Micro Machined Devices
Microsystems vs. MEMS - Markets for Microsystems and MEMS, Scaling Principles- Materials for micromachining, Micromachining terms- mechanical properties of silicon-native oxides of silicon and other semiconductors-typical silicon wafer types.

Bulk Micro Machining

Surface Micromachining

Bonding Processes
Mem's Actuators And Their Applications


REFERENCES:
5. Tai-Ran-Hsu, MEMS & Microsystems Design and Manufacture, Tata McGrawHill, New Delhi, 2002

COURSE OUTCOMES:
1. Understanding the concept of scaling laws that are used extensively in the design of micro devices and systems.
2. Analyze the basic principles and applications of micro-fabrication processes, such as photolithography, ion implantation, diffusion, oxidation, CVD, PVD, and etching.
3. Provide impart knowledge about thin film process and etchants used for isotropic and anisotropic etching.
5. Understanding the types of bonding process and the techniques used for sacrificial process.

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ANNAMALAI UNIVERSITY FEAT
COURSE OBJECTIVES:
- To understand the image fundamentals and mathematical transforms necessary for image processing.
- To understand about Sampling Techniques.
- To know different transform and various algorithms to evaluate them.
- To know the design of Digital filters.
- To know different coding methods.
- To understand the image segmentation techniques.

Digital Image Fundamentals and Image Transforms

Image Enhancement and Restoration

Image Compression

Image Segmentation
Detection of Discontinuities – Point detection, Line detection, - Edge detection – Edge linking and Boundary Detection - Thresholding – Basic global and adaptive thresholding - Image segmentation by region growing - region splitting and merging - Basic formulation of Region oriented segmentation – Morphological operations - Clustering methods

Application of Image Processing
Image classification – Image understanding- Image recognition – Patterns and pattern classes - Matching by minimum distance classifier - Neural Network applications in image processing – Image fusion – Steganography - Digital image watermarking
REFERENCES:

COURSE OUTCOMES:
1. Explain different transform and various algorithms to evaluate them
2. Implement the design of Digital filters
3. Implement the different coding methods
4. Apply the basic concepts of Image segmentation,
5. Explain image recognitions and the applications

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Mapping with Program Outcomes
COURSE OBJECTIVES:
- To expose the students to the fundamentals of embedded Programming.
- It aims at familiarizing the students in embedded concepts and programming in ‘C’.
- This module covers the advanced topics in ‘C’
- To learn Memory management and Data structures which are of high relevance in embedded software is considered in depth.
- The syllabus also covers the topic ‘scripting languages for embedded systems’.
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills.

Programming Embedded Systems

Embedded C Programming

Embedded Applications Using Data Structures
Linear data structures – Stacks and Queues Implementation of stacks and Queues - Linked List - Implementation of linked list, Sorting, Searching, Insertion and Deletion, Nonlinear structures – Trees and Graphs Object Oriented programming basics using C++ and its relevance in Embedded systems.

Scripting Languages for Embedded Systems

Embedded Software Development Tools
Host and target machines – Linkers / Locators for Embedded Software – Debugging techniques – Instruction set simulators Laboratory tools – Practical example – Source code.
REFERENCES:


COURSE OUTCOMES:

1. The learning process delivers insight into various programming languages / softwares compatible to embedded process development with improved design & programming skills.
2. Develop advanced programs in Embedded C.
3. Get knowledge in data structure and OOP.
4. Develop programs using scripting languages.
5. Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.

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Mapping with Program Outcomes
COURSE OBJECTIVES:

- To introduce the basic concepts, parts of robots and types of robots.
- To make the student familiar with the various drive systems for robot.
- To learn manipulators and their applications in robots and programming of robots.
- To discuss about the various applications of robots, justification and implementation of robot.
- To know about the electronic systems in automation of mechanical operations.
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills.

Introduction


Robot Drives and Power Transmission Systems


Manipulators

Construction of Manipulators, Manipulator Dynamic and Force Control, Electronic and Pneumatic manipulators.

Industrial Automation

Fundamental concepts in manufacturing and automation, definition of automation, reasons for automating. Types of production and types of automation, automation strategies, levels of automation.

Programmable Automation

Special design features of CNC systems and features for lathes and machining centers. Drive system for CNC machine tools. Introduction to CIM; condition monitoring of manufacturing systems.
REFERENCES:


7. COURSE OUTCOMES:

1. Explain the basic concepts of working of robot.
2. Analyze the function of manipulators in the robot.
3. Use robots in different applications.
4. Knowledge of industrial automation by transfer lines and automated assembly lines.
5. Ability to understand the electronic control systems in metal machining and other manufacturing processes.

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COURSE OBJECTIVES:

- To introduce the basic concepts in communication networks and the protocols used in the networks.
- To give an exposure to sensor networks and different architectures of Wireless Sensor Networks.
- To familiarise the students about the various multiple access techniques available in the communication systems and introduce the different clustering algorithms for WSNs.
- To acquire knowledge on security management systems and security protocols for WSN and distributed sensor systems.
- To give an idea about power and energy level management techniques available for WSNs.

Networks Fundamentals


Architecture


Protocols


Security System


Energy Management


REFERENCES:

COURSE OUTCOMES:
1. Describe and explain the working of communication protocols and the evolution of 2G/3G networks.
2. Understand the characteristics, architectures and modeling of WSNs.
3. Explain the concepts of multiple access techniques and the working of various clustering algorithms and their usefulness for routing in WSNs.
4. Describe the different security management techniques and security protocols defined for WSNs.
5. Elucidate the design issues related to the energy and power management techniques for WSNs.

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Mapping with Program Outcomes
COURSE OBJECTIVES:

- Expose the students to the fundamentals of wireless communication technologies.
- Teach the fundamentals of cellular concepts.
- Study the concepts of mobile radio propagation.
- Explore various modulation techniques used.
- Introduce network routing protocols.
- Study the various multiple access techniques.

Introduction

Brief history of wireless communication - elements of wireless communication systems- radio frequency spectrum and bandwidth requirements - Universal Mobile Communication Systems- Personal Communication systems- emerging trends in wireless communications Wireless systems and standards: AMPS and ATACS systems- 2G, 2.5G, 3G and B3G systems and standards.

Cellular Concept


Mobile Radio Propagation


Modulation Technique for Mobile Radio


Multiple Access Techniques

Techniques- Rake Receiver – Interleaving - Frequency Division Multiple Access (FDMA), Spread Spectrum Multiple Access – Space Division Multiple Access (SDMA) - Packet Radio.

REFERENCES:


COURSE OUTCOMES:

1. Fundamental concepts of wireless communication and its standards have been brought out.
2. Cellular concepts and various radio propagation models have been pointed out.
3. Architecture of various mobile radio models have been understood.
4. Various mobile radio modulation techniques have been described.
5. Different access techniques have been learnt.

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COURSE OBJECTIVES:
- Gain knowledge on various processors
- Acquire an exposure on system development.
- Understand the architecture of latest processors.
- Design different application circuits using a single FPGA chip.
- Program the FPGA to do specific work.
- Create embedded systems using FPGA.

ASICS, CMOS Logic and ASIC Library Design

Programmable Logic Cells and I/O Cells
- Digital clock Managers-Clock management- Regional clocks- Block RAM – Distributed RAM-Configurable Logic Blocks-LUT based structures – Phase locked loops- Select I/O resources –Anti fuse - static RAM - EPROM and EEPROM technology – PREP bench marks – Actel ACT – Xilinx LCA – Altera FLEX – Altera MAX DC & AC inputs and outputs – Clock and power inputs – Xilinx I/O blocks.

Architectures
- Architecture - FPGAs, Xilinx XC4000 - ALTERA’s FLEX 8000/10000, ACTEL’s ACT-1,2,3 and their speed performance - Apex, Cyclone FPGAs and Quartus architectures - case studies: Altera MAX 5000 and 7000 - Altera MAX 9000 – Spartan II and Virtex II FPGAs.

Design Entry and Testing

Partitioning and Routing

REFERENCES:
6. Design manuals of Altera, Xilinx and Actel. (From the web).

**COURSE OUTCOMES:**

1. Underlying fundamental concepts of VLSI have been brought out.
2. Memory management and input/output technology of various processors have been pointed out.
3. Architecture of various processors have been understood.
4. Softwares for the processors have been learnt.
5. Some basic design examples using VLSI processors have been described.

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OPEN ELECTIVES

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COURSE OBJECTIVES:

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


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

Trendiness and Regression Analysis: Modeling Relationships and Trends in Data, simple Linear Regression.


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.


REFERENCES:
2. Business Analytics by James Evans, Pearson’sEducation.

COURSE OUTCOMES

Students will be able to
1. Familiarize with the data analytics in Business administration
2. Acquire knowledge for critical thinking in making decisions based on data and deep analytics.
3. Implement organization structure to increase the ability to translate data into clear, action able in sights.
5. Demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.

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Mapping with Program Outcomes
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 and methods.

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-IV: Fault tracing: Fault tracing-concept and importance, decision tree concept, 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

REFERENCES:
COURSE OUTCOMES:

Students will be able to:
1. Familiarize with various methods adopted for industrial safety.
2. Acquire knowledge on the basic concepts on various maintenance schemes for industrial safety.
3. Explore several techniques used to control wear and corrosion prevention in industries.
4. Implement fault tracing mechanism adopted in industries for safety.
5. Understand the need of periodic and preventive maintenance in industrial safety.

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EEESOEXXX  OPERATIONS RESEARCH  L  T  P  C

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Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models
Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming
Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT
Scheduling and sequencing - single server and multiple server models - deterministic inventory models Probabilistic inventory control models - Geometric Programming.
Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

REFERENCES:

COURSE OUTCOMES:
Students will be able to
1. Familiarize with the various optimization techniques
2. Formulate a linear programming problem and carry out sensitivity analysis
3. Acquire knowledge on CPM/PERT
4. Gain knowledge on various types of models and carry out simulation
5. Apply the dynamic programming to solve problems of discreet and continuous variables.

Mapping with Program Outcomes

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ANAMALAI UNIVERSITY  FEAT

73

Project: meaning, Different types, why to manage, cost overruns centers, 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


REFERENCES:
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
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co.Ltd.
COURSE OUTCOMES

Students will be able to:

1. Understand various Strategic Cost Management in Projects
2. Acquire knowledge in developing the optimal methodologies in Engineering Projects
3. Familiarize with Cost Behavior and Profit Planning in Engineering Projects
4. Acquaint with the various schemes of Total Quality Management
5. Develop various methodologies in executing the Engineering Projects using quantitative management techniques/

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Mapping with Program Outcomes


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

REFERENCES:
COURSE OUTCOMES:
Students will be able to:
1. Obtain fundamental knowledge about various classification and characteristics of Composite materials.
2. Become proficient in reinforcements.
3. Familiarize with manufacturing of polymer matrix composites.
4. Gain familiarity in several manufacturing of metal matrix composites.
5. Acquire knowledge in designing composite materials with enhanced failure criteria-strength.

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


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.

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 program in India.

REFERENCES:
Course Outcome:

Students will be able to:
1. Understand the concept of Waste to Energy.
2. Apply the knowledge about the operations of Waste to Energy Plants.
3. Analyse the various aspects of Waste to Energy Management Systems.
4. Apply the knowledge in planning and operations of Waste to Energy plants.

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AUDIT COURSES

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COURSE OBJECTIVES:

Students will be able to:

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

Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness


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

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

Skills that are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills that are needed when writing the conclusion.

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

REFERENCES

COURSE OBJECTIVES:

Students will be able to:

- Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Critically understand the strengths and weaknesses of disaster management approaches, planning and programming.

Introduction Disaster

Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade


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.

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

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.

Risk Assessment

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.

REFERENCES:


2. Sahni, PardeepEt.Al. (Eds.),” Disaster Mitigation Experiences And Reflections”, Prentice Hall Of India, New Delhi.

COURSE OBJECTIVES

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


REFERENCES

1. “Abhyaspustakam” – Dr. Vishwas, Samskrita-Bharti Publication, NewDelhi
2. “Teach Yourself Sanskrit” PrathamaDeeksha VempatiKutumbashastri, RashtriyaSanskritSansthanam, New Delhi Publication

COURSEOUTCOMES:

Students will be able to

1. Understanding basic Sanskrit language
2. Ancient Sanskrit literature about science & technology can be understood.
3. Being a global language, will help to develop logic in students.
COURSE OBJECTIVES

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


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


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

REFERENCES


COURSE OUTCOMES

- Students will be able to
  2. Learn the importance of Human values
  3. Developing the overall personality
CONSTITUTION OF INDIA

COURSE OBJECTIVES:

Students will be able to:

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

HISTORY OF MAKING OF THE INDIAN CONSTITUTION: HISTORY, DRAFTING COMMITTEE, (COMPOSITION&WORKING)

PHILOSOPHY OF THE INDIAN CONSTITUTION PREAMBLE, SALIENT FEATURES

Contours of Constitutional Rights & Duties


Organs of Governance

Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

Local Administration


Election Commission

Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.
REFERENCES:
1. The Constitution of India, 1950 (Bare Act), Government Publication.

COURSE OUTCOMES:
Students will be able to:
1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct.
COURSE OBJECTIVES:
Students will be able to:
1. Review existing evidence on the review topic to inform program design and policy making undertaken by the DFID, other agencies and researchers.
2. Identify critical evidence gaps to guide the development.

Introduction and Methodology

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

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

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

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

REFERENCES:

**COURSE OUTCOMES:**

Students will be able to understand:

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

- To achieve overall health of body and mind
- To overcome stress
  Definitions of Eight parts of yoga. (Ashtanga) Yam and Niyam
- Do’s and Don’t’s in life.
  i) Ahinsa, satya, astheya, bramhacharya and aparigraha
  ii) Shaucha, santosh, tapa, swadhyay, ishwarpardhan

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

REFERENCES:
1. ‘Yogic Asanas for Group Tarining-Part-I’ : Janardan Swami YogabhyasiMandal, Nagpur
2. “Rajayoga or conquering the Internal Nature” by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata.

COURSE OUTCOMES:

Students will be able to:
1. Develop healthy mind in a healthy body thus improving social health also
2. Improve efficiency
COURSE OBJECTIVES:

- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students
  Neetisatakam-Holistic development of personality
- Verses- 19,20,21,22 (wisdom)
- Verses- 29,31,32 (pride & heroism)
- Verses- 26,28,63,65 (virtue)
- Verses- 52,53,59 (do’s)
- Verses- 71,73,75,78 (do’s) Approach to day to day work
- Shrimad Bhagwad Geeta:
  - Chapter 2-Verses 41,47,48,
  - Chapter 3-Verses 13, 21, 27, 35,
  - Chapter 6-Verses 5,13,17, 23,35,
  - Chapter 18-Verses 45, 46, 48.
- Statements of basic knowledge. Shrimad Bhagwad Geeta:
  - Chapter 2-Verses 56, 62,68
  - Chapter 12 -Verses 13, 14, 15, 16,17, 18
  - Personality of Role model. Shrimad Bhagwad Geeta:
  - Chapter 2-Verses 17, Chapter 3-Verses 36,37,42,
  - Chapter 4-Verses 18,38,39
  - Chapter 18 – Verses 37,38,63

REFERENCES:

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

COURSE OUTCOMES:

Students will be able to:

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