RAMAIAH UNIVERSITY OF APPLIED SCIENCES

# Programme Structure and Course Details

## B. Tech. in Electronics and Communication Engineering

## 2022-26

## Faculty of Engineering and Technology

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Bangalore

RAMAIAH UNIVERSITY OF APPLIED SCIENCES

# Programme Structure and Course Details

# of

## B. Tech. (Electronics and Communication Engineering)

**Degree Programme 2022-23**

**Programme Code: 004**

## Faculty of Engineering and Technology

## Batch 2022-2023

# University's Vision, Mission and Objectives

The M. S. Ramaiah University of Applied Sciences (MSRUAS) will focus on student-centric professional education and motivates its staff and students to contribute significantly to the growth of technology, science, economy and society through their imaginative, creative and innovative pursuits. Hence, the University has articulated the following vision and objectives.

## Vision

MSRUAS aspires to be the premier university of choice in Asia for student centric professional education and services with a strong focus on applied research whilst maintaining the highest academic and ethical standards in a creative and innovative environment

## Mission

Our purpose is the creation and dissemination of knowledge. We are committed to creativity, innovation and excellence in our teaching and research. We value integrity, quality and teamwork in all our endeavors. We inspire critical thinking, personal development and a passion for lifelong learning. We serve the technical, scientific and economic needs of our Society.

## Objectives

1. To disseminate knowledge and skills through instructions, teaching, training, seminars, workshops and symposia in Engineering and Technology, Art and Design, Management and Commerce, Health and Allied Sciences, Physical and Life Sciences, Arts, Humanities and Social Sciences to equip students and scholars to meet the needs of industries, business and society
2. To generate knowledge through research in Engineering and Technology, Art and Design, Management and Commerce, Health and Allied Sciences, Physical and Life Sciences, Arts, Humanities and Social Sciences to meet the challenges that arise in industry, business and society
3. To promote health, human well-being and provide holistic healthcare
4. To provide technical and scientific solutions to real life problems posed by industry, business and society in Engineering and Technology, Art and Design, Management and Commerce, Health and Allied Sciences, Physical and Life Sciences, Arts, Humanities and Social Sciences
5. To instill the spirit of entrepreneurship in our youth to help create more career opportunities in the society by incubating and nurturing technology product ideas and supporting technology backed business
6. To identify and nurture leadership skills in students and help in the development of our future leaders to enrich the society we live in
7. To develop partnership with universities, industries, businesses, research establishments, NGOs, international organizations, governmental organizations in India and abroad to enrich the experiences of faculties and students through research and developmental programmes

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**Programme Specifications: B. Tech. (Electronics and Communication Engineering)**

| | |
|---|---|
| **Faculty** | Engineering and Technology |
| **Department** | Electronics and Communication Engineering |
| **Programme Code** | 004 |
| **Programme Name** | B. Tech. (Electronics and Communication Engineering) |
| **Dean of the Faculty** | Dr. Dilip Kumar Mahanty |
| **Head of the Department** | Dr. S. Malathi |

1. **Title of the Award:** B. Tech. (Electronics and Communication Engineering)
2. **Mode of Study:** Full-Time
3. **Awarding Institution /Body:** M. S. Ramaiah University of Applied Sciences, Bengaluru
4. **Joint Award:** Not Applicable
5. **Teaching Institution:** Faculty of Engineering and Technology, M. S. Ramaiah University of Applied Sciences, Bengaluru
6. **Date of Programme Specifications:** July 2022
7. **Date of Programme Approval by the Academic Council of MSRUAS:** 14 July 2022
8. **Next Review Date:** June 2026
9. **Programme Approving Regulating Body and Date of Approval:**
10. **Programme Accredited Body and Date of Accreditation:**
11. **Grade Awarded by the Accreditation Body:**
12. **Programme Accreditation Validity:**
13. **Programme Benchmark:**
14. **Rationale for the Programme**

The theoretical developments that occurred in previous centuries in understanding electromagnetic fields and material properties have ushered the growth in the domain of Electronics and Communication during the first half of twentieth century. The second half has seen innovation and novelty in chip technology and telecommunication. Communication technology has resulted in a major societal revolution in developing countries such as India. There is a need for highly trained manpower in the domain of Electronics and Communication engineering. Good outcome-based undergraduate engineering education is critical in developing human resources.

The National Association of Software and Services Companies (NASSCOM) study, conducted in 2010 and titled "Global Engineering Research and Development: Accelerating Innovation with Indian Engineering", underlined the significance for India as the country has posted a revenue growth of about 40% during 2007-2010 and is expected to grow in coming years.

The Electronics and Communication Engineering programme at Faculty of Engineering and Technology at MSRUAS has been developed by the members of the faculty based on their teaching experience and long-standing interactions with various universities and industries in India and abroad.

The outcome-based curriculum helps students to develop critical thinking abilities and imbibe relevant practical skills for a smooth transition from academics to real-life work environments. Opportunities are provided for the students to do their internship in India or abroad depending on their preferences.

The Global Innovation 1000, reported in 2012, by management consulting firm Booz & Company has indicated that R & D investment in Computing, Electronics, Tele-communication is about 30% by top innovative companies making this sector a leader. The importance of technological advancements in electronics could also be seen in other categories such as Automobile, Process industries, etc. Expertise needs to be built for the design, analysis, simulation, testing and evaluation of analog, digital, control, instrumentation, and communication systems. In the light of above, knowledge of computer architectures and communication protocols is required. Outcome based undergraduate programme along with modern pedagogy is the need of the hour.

The programme provides strong foundation in basic concepts, followed by comprehensive understanding of electrical, electronics, and communication courses. Emphasis is laid on simulation, and larger perspective of systems and sub-systems of electronic products. Students are trained to develop life-long skills to understand, analyse, and develop solutions for challenging technological problems.

There is a shortage of quality electronics and communication graduates despite many institutions offering undergraduate programmes. The FET at MSRUAS would like to offer Electronics and Communication Engineering programme to produce imaginative, creative, and innovative engineers to solve the problems of the society.

## 15. Programme Mission

The purpose of the programme is to create innovative problem solvers in multi-disciplinary settings, entrepreneurs and leaders that apply their knowledge, understanding, cognitive abilities, practical skills and transferable skills gained through systematic, flexible and rigorous learning in the chosen academic domain.

## 16. Gradate Attributes (GAs)

**GA-1. Engineering knowledge:** Ability to apply knowledge of mathematics, science, and Engineering fundamentals to solve complex problems in engineering

**GA-2. Problem Analysis:** Ability to analyse engineering problems, interpret data and arrive at meaningful conclusions involving mathematical inferences

**GA-3. Design and Development of Solutions:** Ability to design an engineering system, component, or process to meet desired needs considering public health and safety, and the cultural, societal, and environmental considerations

**GA-4. Conduct Instigations of Complex Problems:** Ability to understand and solve complex engineering problems by conducting experimental investigations

**GA-5. Modern Tool Usage:** Ability to apply appropriate tools and techniques and understand utilization of resources appropriately to complex engineering activities

**GA-6. The Engineer and Society:** Ability to understand the effect of engineering solutionson legal, cultural, social, and public health and safety aspects

**GA-7. Environment and Sustainability:** Ability to develop sustainable solutions and understand their effect on society and environment

**GA-8. Ethics:** Ability to apply ethical principles to engineering practices and professional responsibilities

**GA-9. Individual and Teamwork:** Ability to work as a member of a team, to plan and to integrate knowledge of various engineering disciplines and to lead teams in multidisciplinary settings

**GA-10. Communication:** Ability to make effective oral presentations and communicate technical ideas to a broad audience using written and oral means

**GA-11. Project Management and Finance:** Ability to lead and manage multidisciplinary teams by applying engineering and management principles

**GA-12. Life-long learning:** Ability to adapt to the changes and advancements in technology and engage in independent and life-long learning

**17. Programme Outcomes (POs)**

B. Tech. graduates will be able to:

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

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

**PO-3.** 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.** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information toprovide valid conclusions

**PO-5.** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations

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**PO-6.** 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.** 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.** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice

**PO-9.** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

**PO-10.** 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.** 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.** 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

## 18. Programme Goal

The programme goal is to produce graduates having critical, analytical and problem-solving skills, and ability to think independently, and to pursue a career in Electronics and Communication Engineering.

## 19. Program Educational Objectives (PEOs)

The objectives of the B. Tech.(Electronics and Communication Engineering) Programme are to:

**PEO-1.** Provide students with a strong foundation in mathematics, science and engineering to enable them to devise and deliver efficient solutions to challenging problems in Electronics, Communications and allied disciplines

**PEO-2.** Impart analytic and cognitive skills required to develop innovative solutions for R&D, Industry, and societal requirements

**PEO-3.** Provide sound theoretical and practical knowledge of Electronics andCommunication Engineering, managerial and entrepreneurial skills to enable students to contribute to the well-being and welfare of the society

**PEO-4.** Inculcate strong human values and social, interpersonal and leadership skills required for professional success in evolving global professional environments

## 20. Programme Specific Outcomes (PSOs)

At the end of the B. Tech. (Electronics and Communication Engineering) program, the graduate will be able to:

**PSO-1.** Apply the knowledge of Electronics Circuits, Communication Systems, Digital Signal Processing, Embedded Systems, Semiconductor Technologies, RF and Microwave Engineering to develop innovative and safe solutions for the real-world problems in Electronics and Communication Engineering.

**PSO-2.** Design, simulate, analyze and implement electronics and communication systems / subsystems by using modern programming languages, simulation packages, EDA tools and solvers to address industry and societal requirements.

**PSO-3.** Demonstrate ethics, leadership qualities, communication, project management, entrepreneurial skills and involvement in lifelong learning for the betterment of organization, environment and society.

## 21. Programme Structure:

| Semester 1 (Physics Cycle) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sl. No. | Code | Course Title | Theory (h/W/S) | Tutorials (h/W/S) | Practical (h/W/S) | Total Credits | Max. Marks |
| 1 | MTB101A | Engineering Mathematics-1 | 3 | 1 | 0 | 4 | 100 |
| 2 | PYB102A | Engineering Physics and Laboratory | 3 | 0 | 2 | 4 | 100 |
| 3 | CEF101A | Engineering Mechanics | 3 | 0 | 0 | 3 | 100 |
| 4 | ECF102A | Elements of Electronics Engineering and Laboratory | 3 | 0 | 2 | 4 | 100 |
| 5 | MEF103A | Engineering Drawing | 2 | 0 | 2 | 3 | 100 |
| 6 | LAN101A | Constitution, Human Rights and Law | 2 | 0 | 0 | 2 | 50 |
| **Total** | | | **16** | **1** | **6** | **20** | **550** |
| **Total number of contact hours per week** | | | **23** | | | | |

| Semester 1 (Chemistry Cycle) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sl. No. | Code | Course Title | Theory (h/W/S) | Tutorials (h/W/S) | Practical (h/W/S) | Total Credits | Max. Marks |
| 1 | MTB101A | Engineering Mathematics - 1 | 3 | 1 | 0 | 4 | 100 |
| 2 | CYB104A | Engineering Chemistry and Laboratory | 3 | 0 | 2 | 4 | 100 |
| 3 | MEF104A | Elements of Mechanical Engineering and Work shop Practice | 2 | 0 | 2 | 3 | 100 |
| 4 | EEF105A | Elements of Electrical Engineering and Laboratory | 3 | 0 | 2 | 4 | 100 |
| 5 | CSF106A | Elements of Computer Science and Engineering and Laboratory | 3 | 0 | 2 | 4 | 100 |
| 6 | TSN101A | Professional Communication | 2 | 0 | 0 | 2 | 50 |
| **Total** | | | **16** | **1** | **8** | **21** | **550** |
| **Total number of contact hours per week** | | | **25** | | | | |

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| Semester 2 (Physics Cycle) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sl. No. | Code | Course Title | Theory (h/W/S) | Tutorials (h/W/S) | Practical (h/W/S) | Total Credits | Max. Marks |
| 1 | MTB102A | Engineering Mathematics-2 | 3 | 1 | 0 | 4 | 100 |
| 2 | PYB102A | Engineering Physics and Laboratory | 3 | 0 | 2 | 4 | 100 |
| 3 | CEF101A | Engineering Mechanics | 3 | 0 | 0 | 3 | 100 |
| 4 | ECF102A | Elements of Electronics Engineering and Laboratory | 3 | 0 | 2 | 4 | 100 |
| 5 | MEF103A | Engineering Drawing | 2 | 0 | 2 | 3 | 100 |
| 6 | LAN101A | Constitution, Human Rights and Law | 2 | 0 | 0 | 2 | 50 |
| **Total** | | | **16** | **1** | **6** | **20** | **550** |
| **Total number of contact hours per week** | | | **23** | | | | |

| Semester 2 (Chemistry Cycle) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sl. No. | Code | Course Title | Theory (h/W/S) | Tutorials (h/W/S) | Practical (h/W/S) | Total Credits | Max. Marks |
| 1 | MTB102A | Engineering Mathematics –2 | 3 | 1 | 0 | 4 | 100 |
| 2 | CYB104A | Engineering Chemistry and Laboratory | 3 | 0 | 2 | 4 | 100 |
| 3 | MEF104A | Elements of Mechanical Engineering and Workshop Practice | 2 | 0 | 2 | 3 | 100 |
| 4 | EEF105A | Elements of Electrical Engineering and Laboratory | 3 | 0 | 2 | 4 | 100 |
| 5 | CSF106A | Elements of Computer Science and Engineering and Laboratory | 3 | 0 | 2 | 4 | 100 |
| 6 | TSN101A | Professional Communication | 0 | 2 | 0 | 2 | 50 |
| **Total** | | | **14** | **3** | **8** | **21** | **550** |
| **Total number of contact hours per week** | | | **25** | | | | |

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| Semester 3 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sl. No. | Code | Course Title | Theory (h/W/S) | Tutorials (h/W/S) | Practical (h/W/S) | Total Credits | Max. Marks |
| 1 | MTF201A | Engineering Mathematics-3 | 3 | 1 | 0 | 4 | 100 |
| 2 | ECC202A | Signals and Systems | 3 | 1 | 0 | 4 | 100 |
| 3 | ECC203A | Electronic Circuits | 3 | 1 | 0 | 4 | 100 |
| 4 | ECC204A | Network Analysis and Synthesis | 3 | 1 | 0 | 4 | 100 |
| 5 | ECC205A | Digital Logic Design | 3 | 1 | 0 | 4 | 100 |
| 6 | ECL206A | Electronic Circuit Design Laboratory | 0 | 0 | 2 | 1 | 50 |
| 7 | ECL207A | Digital Logic Design Laboratory | 0 | 0 | 2 | 1 | 50 |
| 8 | BTN201A | Environmental Studies | 2 | 0 | 0 | 2 | 50 |
| **Total** | | | **17** | **5** | **4** | **24** | **650** |
| **Total Number of Contact Hours per week** | | | **26** | | | | |
| **1** | **MTB103A** | **Additional Mathematics -1** | **3** | **0** | **0** | **3** | **100** |

| Semester 4 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sl. No. | Code | Course Title | Theory (h/W/S) | Tutorials (h/W/S) | Practical (h/W/S) | Total Credits | Max. Marks |
| 1 | MTF202A | Engineering Mathematics-4 | 3 | 1 | 0 | 4 | 100 |
| 2 | ECC208A | Linear Integrated Circuits | 3 | 1 | 0 | 4 | 100 |
| 3 | ECC209A | Electromagnetic Theory | 3 | 1 | 0 | 4 | 100 |
| 4 | ECC210A | Microprocessors and Microcontrollers | 3 | 1 | 0 | 4 | 100 |
| 5 | ECC211A | Measurement and Instrumentation | 4 | 0 | 0 | 4 | 100 |
| 6 | ECL212A | Linear Integrated Circuit Laboratory | 0 | 0 | 2 | 1 | 50 |
| 7 | ECL213A | Microprocessors and Microcontrollers Laboratory | 0 | 0 | 2 | 1 | 50 |
| 8 | BAU201A | Innovation and Entrepreneurship | 3 | 0 | 0 | 3 | 100 |
| | | **Total** | **19** | **4** | **4** | **25** | **700** |
| **Total Number of Contact Hours per week** | | | **27** | | | | |
| | **MTB104A** | **Additional Mathematics -2** | **3** | **0** | **0** | 3 | 100 |

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| Semester 5 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sl. No. | Code | Course Title | Theory (h/W/S) | Tutorials (h/W/S) | Practical (h/W/S) | Total Credits | Max. Marks |
| 1 | ECC301A | Analog Communication | 3 | 1 | 0 | 4 | 100 |
| 2 | ECC302A | Digital Signal Processing | 3 | 1 | 0 | 4 | 100 |
| 3 | ECC303A | Microwave Engineering | 3 | 1 | 0 | 4 | 100 |
| 4 | ECC304A | Control Systems | 3 | 1 | 0 | 4 | 100 |
| 5 | ECC305A | HDL Programming | 3 | 1 | 0 | 4 | 100 |
| 6 | ECH301A | Engineering Economics | 3 | 0 | 0 | 3 | 50 |
| 7 | ECL306A | Analog Communication Laboratory | 0 | 0 | 2 | 1 | 50 |
| 8 | ECL307A | Digital Signal Processing Laboratory | 0 | 0 | 2 | 1 | 50 |
| **Total** | | | **18** | **5** | **4** | **24** | **650** |
| | **Total Number of Contact Hours per week** | | **27** | | | | |

| Semester 6 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sl. No. | Code | Course Title | Theory (h/W/S) | Tutorials (h/W/S) | Practical (h/W/S) | Total Credits | Max. Marks |
| 1 | ECC308A | Information Theory | 3 | 1 | 0 | 4 | 100 |
| 2 | ECC309A | Digital Communication | 3 | 1 | 0 | 4 | 100 |
| 3 | ECC310A | Antenna and Propagation | 3 | 1 | 0 | 4 | 100 |
| 4 | ECC311A | Computer Networks | 4 | 0 | 0 | 4 | 100 |
| 5 | ECE31XA | Professional Core Elective-1 | 3 | 1 | 0 | 4 | 100 |
| 6 | ECL312A | Digital Communication Laboratory | 0 | 0 | 2 | 1 | 50 |
| 7 | ECL313A | Antenna and Microwave Laboratory | 0 | 0 | 2 | 1 | 50 |
| 8 | ECC314A | Seminar | 0 | 0 | 2 | 1 | 50 |
| **Total** | | | **16** | **4** | **6** | **23** | **650** |
| | **Total Number of Contact Hours per week** | | **26** | | | | |

| Semester 7 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sl. No. | Code | Course Title | Theory (h/W/S) | Tutorials (h/W/S) | Practical (h/W/S) | Total Credits | Max. Marks |
| 1 | ECE41XA | Professional Core Elective-2 | 3 | 1 | 0 | 4 | 100 |
| 2 | ECE42XA | Professional Core Elective-3 | 3 | 1 | 0 | 4 | 100 |
| 3 | OEE41XA | Open Elective | 3 | 0 | 0 | 3 | 100 |
| 4 | ECP401A | Project Work-1 **Or** | 0 | 0 | 12 | 6 | 200 |
| | ECI401A | Internship | | | | | |
| | | | | | | | |
| **Total** | | | **9** | **2** | **12** | **17** | **500** |
| | **Total Number of Contact Hours per week** | | **23** | | | | |

| Semester 8 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sl. No. | Code | Course Title | Theory (h/W/S) | Tutorials (h/W/S) | Practical (h/W/S) | Total Credits | Max. Marks |
| 1 | ECP402A | Project Work-2 | 0 | 0 | 24 | 12 | 300 |
| **Total** | | | **0** | **0** | **24** | **12** | **300** |
| | **Total Number of Contact Hours per week** | | **24 Hours** | | | | |
| | | | | | | | |

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| Group | Stream ▸ | Biomedical Signal and Image Processing | VLSI and Embedded Systems | Communication Theory | Signal and Image Processing |
|---|---|---|---|---|---|
| PCE-1, Sem. 6 | Course Code | ECE311A | ECE312A | ECE313A | ECE314A |
| | Course Title | Biomedical Signal Processing | Embedded Systems and IoT | Statistical Signal Processing | Image Processing |
| PCE-2 Sem. 7 | Course Code | ECE411A | ECE412A | ECE413A | ECE414A |
| | Course Title | Biomedical Image Processing | Programmable Logic Design using FPGA | Optical Communication | DSP Architecture |
| PCE-3 Sem.7 | Course Code | ECE421A | ECE422A | ECE423A | ECE424A |
| | Course Title | Principles of Medical Imaging | Electronic Board Design | Wireless Communication | Speech Processing |

**Note:**

1. Students are required to select **one** Professional Core Elective Courses in the 6th Semester, one each from PCE-1,

2. Students are required to select **two** Professional Core Elective course in the 7th Semester from the PCE-2 and PCE-3 Group.

**22. Open Elective Courses**

A number of Open Elective Courses from Faculties of engineering, management and commerce, art and design, hospitality management and catering technology, pharmacy, dental sciences are offered as mentioned in the University's website. Students can choose the Open Electives on their own choice.

**23. Course Delivery:** As per the Timetable

**24. Teaching and Learning Methods**

1. Face to Face Lectures using Audio-Visuals
2. Workshops, Group Discussions, Debates, Presentations
3. Demonstrations
4. Guest Lectures
5. Laboratory work/Field work/Workshop
6. Industry Visit
7. Seminars
8. Group Exercises
9. Project Work
10. Project
11. Exhibitions
12. Technical Festivals

**25. Assessment and Grading (Subject to endorsement of revised unified academic regulations for 2022-23-report submitted)**

**25.1. Components of Grading**

There shall be **two components** of grading in the assessment of each course:

**Component 1, Continuous Evaluation (CE):** This component involves multiple subcomponents (SC1, SC2, etc.) of learning assessment. The assessment of the subcomponents of CE is conducted during the semester at regular intervals. This subcomponent represents the formative assessment of students' learning.

**Component 2, Semester-end Examination (SEE):** This component represents the summative assessment carried out in the form an examination conducted at the end of the semester.

Marks obtained CE and SEE components have equal weightage (CE: 50% and SEE: 50%) in determining the final marks obtained by a student in a Course.

The complete details of Grading are given in the Academic Regulations.

## 25.2. Continuous Evaluation Policies

Continuous evaluation depends on the type of the course as discussed below:

### 25.2.1 Theory Courses

| **Theory Course** | | | | |
|---|---|---|---|---|
| **Sub Component** | SC1 (Midterm Exam) | SC2 (Assignment - 1) | SC3 (Assignment -2 Innovative Component) | SC4 (Optional- Makeup midterm. To be offered with approval) |
| **Weightage** | 25 % | 12.5% | 12.5% | 25% |
| **Marks** | 50 | 25 | 25 | 50 |

For a theory course, there shall be three subcomponents of CE (SC1, SC2 and SC3). Each subcomponent is evaluated individually as indicated in the table. It is mandatory that the first and the second components (SC1 and SC2) have to compulsorily be a midterm exam and an assignment respectively. The third component (SC3) has to be an innovative component and the activities to be spread over the entire semester. The third component can be any of the following types:

a) Online Test
b) Assignments/Problem Solving
c) Field Assignment
d) Open Book Test
e) Portfolio
f) Reports
g) Case Study
h) Group Task
i) Any other

After the three subcomponents are evaluated, the CE component marks are determined as:
CE Component Marks = (Total of the marks obtained in all the three subcomponents) ÷ 2

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### 25.2.2 Laboratory Course

For a laboratory course, the scheme for determining the CE marks is as under:

| Laboratory Course | | | |
|---|---|---|---|
| **Sub Component** | SC1 | SC2 | SC3 (Optional) |
| **Weightage** | 25 % | 25% | 25% |
| **Marks** | 25 | 25 | 25 |

The subcomponents can be of any of the following types:

a) Laboratory / Clinical Work Record
b) Experiments
c) Computer Simulations
d) Creative Submission
e) Virtual Labs
f) Viva / Oral Exam
g) Lab Manual Report
h) Any other (e.g. combinations)

After the subcomponents of CE are evaluated, the CE component Marks are determined as:

CE Component Marks = (Total of the best two subcomponent marks out of the three) ÷ 2

### 25.2.3 Course Having a Combination of Theory and Laboratory

For a course that contains the combination of theory and laboratory sessions, the scheme for determining the CE marks is as under:

| | Theory Course | | | | |
|---|---|---|---|---|---|
| **Sub Component** | SC1 (Midterm Exam) | SC2 (Assignment - 1) | SC3 (Assignment -2 Innovative Component) | LSC4 (Laboratory Component) | SC4 (Optional- Makeup midterm .To be offered with approval from authorities) |
| **Weightage** | 20 % | 10% | 10 % | 10% | 25% |
| **Marks** | 50 | 25 | 25 | 25 | 50 |

For a course having a combination of theory and laboratory, there shall be four subcomponents of CE (SC1, SC2, SC3 and LSC4). Each subcomponent is evaluated individually as indicated in the table. It is mandatory that first and the second components (SC1 and SC2) have to compulsorily be a midterm exam and an assignment respectively. The third component (SC3) has to be an innovative component and the activities to be spread over the entire semester. The fourth subcomponent (LSC4) is mandatory and shall be set to evaluate the students' performance in the laboratory. The third component can be any of the following types:

The theory assignment can be of any of the following types:

a) Online Test
b) Problem Solving
c) Field Assignment

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d) Open Book Test
e) Portfolio
f) Reports
g) Case Study
h) Group Task
i) Any other

The laboratory subcomponent can be of any of the following types:

a) Laboratory / Clinical Work Record
b) Experiments
c) Computer Simulations
d) Creative Submission
e) Virtual Labs
f) Viva / Oral Exam
g) Lab Manual Report
h) Any other (e.g. combinations)

After the four subcomponents are evaluated, the CE component marks are determined as:
CE Component Marks = (Total of the marks obtained in all the four subcomponents) ÷ 2

**26. Minor Programme**

The details of the following aspects of the minor programmes are presented in the **Academic Regulations** for the B. Tech. Degree Programme:

1. Programme Structure
2. Eligibility to Minor Programme
3. Registration to Minor Programme
4. Certification for Minor Programme

**27. Student Support for Learning**

1. Course Notes
2. Reference Books in the Library
3. Magazines and Journals
4. Internet Facility
5. Computing Facility
6. Laboratory Facility
7. Workshop Facility
8. Staff Support
9. Lounges for Discussions
10. Any other support that enhances their learning

**28. Quality Control Measures**

1. Review of Course Notes
2. Review of Question Papers and Assignment Questions
3. Student Feedback
4. Moderation of Assessed Work
5. Opportunities for students to see their assessed work
6. Review by external examiners and external examiners reports
7. Staff Student Consultative Committee meetings
8. Student exit feedback
9. Subject Assessment Board (SAB)
10. Programme Assessment Board (PAB)

## 29. Programme Map (Course-PO-PSO Map)

| Sem. | Course Title | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering Mathematics - 1 | 3 | 3 | 2 | | 2 | | | | | 2 | | | 3 | 2 | 2 |
| 1 | Engineering Chemistry | 3 | 3 | 1 | | | 2 | 2 | | | 1 | | 1 | 3 | 2 | 1 |
| 1 | Elements of Mechanical Engineering and Workshop Practice | 3 | 3 | | | | | | | | | | | 3 | | |
| 1 | Elements of Electrical Engineering | 3 | 3 | 3 | 2 | 2 | 1 | | | | 1 | | 1 | 3 | 2 | 1 |
| 1 | Elements of Computer Science and Engineering | 2 | 1 | 3 | 2 | 2 | 2 | | 1 | | | 1 | 2 | 3 | 2 | 2 |
| 1 | Engineering Chemistry Laboratory | 3 | 1 | 1 | 2 | | | 1 | | | | | | 3 | 1 | |
| 1 | Computer Programming Laboratory | 2 | 1 | 3 | 2 | 2 | 2 | | 1 | | | 1 | 2 | 3 | 2 | 2 |
| 1 | Basic Electrical Engineering Laboratory | 3 | 3 | 2 | 3 | 3 | 2 | | | | | | | 3 | 3 | |
| 1 | Professional Communication | | | | | | | | | 2 | 3 | | | | | 3 |
| 2 | Engineering Mathematics - 2 | 3 | 3 | 2 | | 2 | | | | | 2 | | | 3 | 2 | 2 |
| 2 | Engineering Physics | 3 | 2 | 3 | 2 | 1 | 1 | 1 | | | | | | 3 | 2 | |
| 2 | Engineering Mechanics | 3 | 3 | 2 | 1 | | 1 | | | | | | | | | |
| 2 | Elements of Electronics Engineering | 3 | 2 | 1 | | | | | | | | | | 3 | | |
| 2 | Engineering Drawing | 3 | 2 | | | 3 | | | | | 1 | | | 3 | 3 | 1 |
| 2 | Engineering Physics Laboratory | 3 | 2 | | 2 | | | 1 | | 1 | 1 | | | 3 | 2 | 1 |
| 2 | Basic Electronics Laboratory | 3 | 2 | 2 | | | | | | | | | | 3 | | |
| 2 | Constitution, Human Rights and Law | | | | | | | | 2 | 2 | | | | | | 2 |
| 3 | Engineering Mathematics-3 | 3 | 3 | 2 | 3 | 2 | | | | | 2 | | | 3 | 3 | 2 |
| 3 | Signals and Systems | 3 | 3 | 1 | | | | | | | | | | 3 | | |
| 3 | Electronic Circuits | 3 | 2 | 1 | | | | | | | | | 1 | 3 | | 1 |
| 3 | Network Analysis and Synthesis | 3 | 3 | 2 | 2 | | 2 | | | 2 | 1 | | 2 | 3 | 2 | 2 |
| 3 | Digital Logic Design | 3 | 2 | 1 | | | | | | | | | 1 | 3 | | 1 |
| 3 | Electronic Circuit Design Laboratory | 3 | 3 | 2 | | | | | | | | | | 3 | | |
| 3 | Digital Logic Design Laboratory | 3 | 2 | 1 | | 3 | | | | 3 | 1 | | 2 | 3 | 3 | 3 |
| 3 | Environmental Studies | 1 | | | | | 3 | | 1 | | | | | 1 | 3 | 1 |
| 4 | Engineering Mathematics-4 | 3 | 3 | 2 | 3 | 2 | | | | | 2 | | | 3 | 3 | 2 |
| 4 | Linear Integrated Circuits | 3 | 2 | 3 | 2 | | 2 | | | 3 | | | | 3 | 2 | 3 |
| 4 | Electromagnetic Theory | 3 | 3 | 1 | | | | | | | | | 1 | 3 | | 1 |
| 4 | Microprocessors and Microcontrollers | 3 | 2 | 2 | 1 | | | | | 2 | | | | 3 | 1 | 2 |
| 4 | Measurement and Instrumentation | 3 | 3 | 1 | | | | | | | | | 2 | 3 | | 2 |
| 4 | Linear Integrated Circuit Laboratory | 3 | 3 | 3 | 2 | 2 | 3 | | | 3 | 2 | | 2 | 3 | 3 | 3 |

| Sem | Course Title | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | Microprocessors and Microcontrollers Laboratory | 2 | 3 | 2 | 3 | 3 | | | | 3 | 1 | | | 3 | 2 | |
| 4 | Innovation and Entrepreneurship | 1 | | | | 1 | 1 | 1 | 1 | 2 | 2 | | | | 1 | 3 |
| 5 | Analog Communication | 3 | 3 | 2 | 1 | | 2 | | | 2 | 2 | | 1 | 3 | 2 | |
| 5 | Digital Signal Processing | 3 | 3 | 2 | 1 | | | | | | | | | 3 | 2 | |
| 5 | Microwave Engineering | 3 | 3 | 3 | 1 | 2 | | | | | | | | 3 | 2 | |
| 5 | Control Systems | 3 | 3 | 2 | 2 | | | | | | | | 2 | 3 | 2 | 2 |
| 5 | Engineering Economics | | 3 | 2 | 2 | | | | | | | | 2 | 3 | 2 | 2 |
| 5 | Analog Communication Laboratory | 3 | 2 | 2 | 3 | 2 | | | | 3 | 2 | | 1 | 3 | 3 | 3 |
| 5 | Digital Signal Processing Laboratory | 3 | 2 | 2 | 3 | | | | | | | | | 3 | 3 | |
| 6 | Information Theory | 3 | 3 | 2 | 1 | 2 | | | | | | | | 3 | 2 | |
| 6 | Digital Communication | 3 | 3 | 3 | 1 | 2 | | | | | | | | 3 | 2 | |
| 6 | Antenna and Propagation | 3 | 3 | 3 | 1 | 2 | | | | | | | | 3 | 2 | |
| 6 | Computer Networks | 3 | 2 | 3 | 1 | 2 | | | | | | | | 3 | 2 | |
| 6 | HDL Programming | 3 | 3 | 3 | 1 | 2 | | | | | | | 1 | 3 | 2 | 1 |
| 6 | Digital Communication Laboratory | 3 | 3 | 3 | 2 | 3 | | | | 3 | | | | 3 | 3 | 3 |
| 6 | Antenna and Microwave Laboratory | 3 | 3 | 3 | 2 | 3 | | | | 3 | | | | 3 | 3 | 3 |
| 6 | Seminar | 2 | 2 | 1 | 1 | 2 | | | 2 | 1 | 3 | | 2 | 2 | 2 | 3 |
| 7 | Biomedical Signal Processing | 3 | 3 | 2 | 1 | | | | | | | | | 3 | 1 | |
| 7 | Embedded Systems and IoT | 3 | 3 | 3 | 3 | 2 | | | | 3 | | 3 | 2 | 3 | 3 | 3 |
| 7 | Statistical Signal Processing | 3 | 3 | 2 | 1 | | 2 | | | 2 | | | 1 | 3 | 2 | 2 |
| 7 | Image Processing | 3 | 3 | 3 | 3 | 2 | | | | 3 | | 3 | 2 | 3 | 3 | 3 |
| 7 | Biomedical Image Processing | 3 | 3 | 3 | 1 | | | | | | | | | 3 | 1 | |
| 7 | Programmable Logic Design using FPGA | 3 | 3 | 3 | 1 | 3 | | | | | | | 2 | 3 | 3 | 2 |
| 7 | Optical Communication | 3 | 3 | 3 | | 1 | 2 | | | 2 | | | | 3 | 2 | 2 |
| 7 | DSP Architecture | 2 | 1 | | | | | | | | | | 2 | 2 | | 2 |
| 7 | Principles of Medical Imaging | 3 | 3 | 2 | 2 | 2 | 1 | | | | | | | 3 | 2 | |
| 7 | Electronic Board Design | 3 | 3 | 3 | 2 | 3 | | | | | | | | 3 | 3 | |
| 7 | Wireless Communication | 3 | 3 | 2 | 1 | 2 | | | | | | | | 3 | 2 | |
| 7 | Speech Processing | 2 | 3 | 3 | 3 | 2 | 3 | | | 2 | | 3 | 2 | 3 | 3 | 3 |
| 7 | Project Work-1 | 3 | 3 | 3 | 2 | 3 | 2 | 1 | 2 | 3 | 3 | 1 | 3 | 3 | 3 | 3 |
| 7 | Internship | 3 | 3 | 3 | 2 | 3 | 2 | 1 | 2 | 3 | 3 | 1 | 3 | 3 | 3 | 3 |
| 8 | Project Work-2 | 3 | 3 | 3 | 2 | 3 | 2 | 1 | 2 | 3 | 3 | 1 | 3 | 3 | 3 | 3 |

**30. Co-curricular Activities**

Students are encouraged to take part in co-curricular activities like seminars, conferences, symposia, paper writing, attending industry exhibitions, project competitions and related activities for enhancing their knowledge and networking.

**31. Cultural and Literary Activities**

Annual cultural festivals are held to showcase the creative talents in students. They are involved in planning and organizing the activities.

**32. Sports and Athletics**

Students are encouraged to take part in sports and athletic events regularly. Annual sports meet will be held to demonstrate sportsmanship and competitive spirit.

RAMAIAH UNIVERSITY OF APPLIED SCIENCES

# Course Specifications

## B. Tech. (Electronics and Communication Engineering) Degree Programme 2022-23

## Programme Code: 004

## Faculty of Engineering and Technology

## Batch 2022-2023

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Ramaiah University of Applied Sciences
Bangalore

**Course Specifications: Engineering Mathematics - 1**

| | |
|---|---|
| **Course Title** | Engineering Mathematics - 1 |
| **Course Code** | MTB101A |
| **Course Type** | Core Theory |
| **Department** | Applicable to all Programmes |
| **Faculty** | Engineering and Technology |

**1. Course Summary**

The course introduces students to the basic concepts in real analysis and matrix algebra. Students are taught the concepts of limits, continuity, and differentiation, series expansion for the functions of one and two variables, sequence and series, convergence of series. The mathematical operations in Matrix theory, Eigen value and Eigen vector, Inversion and diagonalization of matrix and matrix solution for linear system of equations.

**2. Course Size and Credits:**

| | |
|---|---|
| **Number of Credits** | 04 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:1:0 |
| **Total Hours of Interaction** | 60 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Mathematics and Statistics |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

**3. Course Outcomes (COs)**

After the successful completion of this course, the student will be able to:

**CO-1.** State and discuss basic concepts related to single, two variable calculus and matrix algebra
**CO-2.** Perform basic operations of matrix algebra and apply them to solve systems of linear equations
**CO-3.** Solve simple mathematical problems associated with linear algebra, single and two variable calculus
**CO-4.** Demonstrate competence with the basic ideas of linear systems, independence, bases and dimension, linear transformations, eigenvalues, eigenvectors and diagonalization
**CO-5.** Solve complex real-world problems associated with linear algebra, single and two variable calculus

**4. Course Contents**

**Unit 1 (Single Variable Calculus):** Functions of single real variable, limit, continuity and differentiation. Rolle's Theorem and Lagrange's mean value theorem and their applications. Fundamental theorem of integral calculus. Improper integrals - classification and convergence, gamma and beta functions. Sequence of real numbers, Series, Tests for convergence of series: integral test, comparison test, ratio test and root test. Power series, Taylor and Maclaurin series.
**Unit 2 (Two Variable Calculus):** Functions of two variables, limits, continuity and partial differentiation. Total differential, errors and approximations, tangent plane approximation of a surface. Partial differentiation of composite and implicit functions, Taylor's theorem. Unconstrained and constrained extrema.

**Unit 3 (Linear Algebra):** Matrix algebra, elementary row operations, row and reduced row echelon forms. Linear system of equations, existence and uniqueness of solution. Vector spaces, subspaces, linear independence, basis and dimension. Row, column and null space of a matrix. Linear transformations. Eigenvalues, eigenvectors and diagonalization.

## 5. Course Map (CO-PO-PSO Map)

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | 3 | 2 | | | | | | | 1 | | | 3 | | 1 |
| CO-2 | 3 | 3 | 1 | | | | | | | 1 | | | 3 | | 1 |
| CO-3 | 3 | 3 | 2 | 3 | | | | | | 2 | | | 3 | 3 | 2 |
| CO-4 | 3 | 3 | 2 | 2 | | | | | | 2 | | | 3 | 2 | 2 |
| CO-5 | 3 | 3 | 2 | 2 | | | | | | 2 | | | 3 | 2 | 2 |
| | | | 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | |

## 6. Course Teaching and Learning Methods

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 45 |
| **Demonstrations** | | 00 |
| 1. Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 15 |
| 1. Solving Numerical Problems | 15 | |
| **Practical Work** | | 00 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 00 |
| 1. Case Study Presentation | 00 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **70** |

## 7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B. Tech. Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2 or SC3), COs are assessed as illustrated in the following Table.

| For Theory Courses Only | | | |
|---|---|---|---|
| Focus of COs on each Component or Subcomponent of Evaluation | | | |
| | Component 1: CE (50% Weightage) | | Component 2: SEE (50% Weightage) |
| Subcomponent ▸ | | | |
| Subcomponent Type ▸ | Term Tests | Assignments | 100 Marks |
| Maximum Marks ▸ | 50 | 50 | |
| CO-1 | X | | X |
| CO-2 | X | | X |
| CO-3 | X | | X |
| CO-4 | | X | X |
| CO-5 | | X | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shallprovide the focus of COs in each component of assessment in the above template at the beginning of the semester.
Course reassessment policies are presented in the Academic Regulations document.

**8. Achieving COs**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures |
| 2. | Understanding | Classroom lectures, Self-study |
| 3. | Critical Skills | Assignment |
| 4. | Analytical Skills | Assignment |
| 5. | Problem Solving Skills | Assignment, Examination |
| 6. | Practical Skills | Assignment |
| 7. | Group Work | -- |
| 8. | Self-Learning | Self-study |
| 9. | Written Communication Skills | Assignment, Examination |
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | -- |
| 13. | Information Management | Assignment |
| 14. | Personal Management | -- |
| 15. | Leadership Skills | -- |

**9. Course Resources**

**a. Essential Reading**

1. James Stewart, 2015, Calculus: Early Transcendentals, 8th edition, Boston,Cengage Learning
2. Steven Leon, 2014, Linear Algebra with Application, 9th edition, New Jersey, Pearson

**b. Recommended Reading**

**Course Specifications: Engineering Physics and Laboratory**

| | |
|---|---|
| Course Title | Engineering Physics and Laboratory |
| Course Code | PYB102A |
| Course Type | Core Theory and Laboratory |
| Department | Applicable to all Programmes |
| Faculty | Engineering and Technology |

**f. Course Summary:**

The aim of this course is to impart concepts of Physics and its application to solve engineering problems. The students are taught the basic topics in modern physics which include wave particle duality, uncertainty principle, Schrodinger's wave equation, lasers and fiber optics. Electrical and mechanical properties of materials will be discussed in relation to the crystal structure. This course also intends to expose the students to the challenges and rewards related to experimental physics. Students gain hands-on experience by conducting experiments in a controlled laboratory environment. Students are trained to conduct experiments related to mechanics, optics and electric circuits. They are trained to analyze the measurements, results and infer appropriate conclusions based on fundamental concepts of physics

**g. Course Size and Credits:**

| | |
|---|---|
| **Number of credits** | 04 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:0:1 |
| **Total hours of interaction** | 75 |
| **Number of Weeks in a Semester** | 15 |
| **Department responsible** | Physics |
| **Total Course Marks** | 100 |
| **Pass requirement** | As per the Academic Regulations |
| **Attendance requirement** | As per the Academic Regulations |

**h. Course Objectives (CO)**

**After the successful completion of this course, the student will be able to:**

| | |
|---|---|
| **CO - 1** | State, explain the concepts of mechanics, electrical conductivity, quantum mechanics, crystal structure and material science, laser and fiber optics |
| **CO - 2** | Derive standard relationships in mechanics, electrical conductivity, quantum mechanics, crystal structure and material science, laser & fiber optics, and interpret them |
| **CO - 3** | Discuss the applications of mechanics, electrical conductivity, quantum mechanics, crystal structure and material science, laser and fiber optics |
| **CO - 4** | Solve problems in mechanics, electrical conductivity, quantum mechanics, crystal structure, material science, laser and fiber optics |
| **CO - 5** | Plan the experimental set-up, conduct experiments, calculate and plot the graphs to obtain the results and write a laboratory report as per the prescribed format. |

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1. Maurice D. Weir and Joel Hass, 2017, Thomas Calculus, 13th edition, New Jersey, Pearson
2. Gilbert Strang, 2016, Introduction to Linear Algebra, 5th edition, Massachusetts, Cambridge Press

**c. Magazines and Journals**

**d. Websites**

1. https://www.coursera.org/
2. http://nptel.ac.in/

**e. Other Electronic Resources**

1. https://ocw.mit.edu/index.htm
2. https://www.khanacademy.org/
3. tutorial.math.lamar.edu/

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**i. Course Contents**

**Unit 1 – (Elasticity):** Review of Elasticity — Expression for Y, h and K in terms of linear and lateral strains (Deformation of a cube)—Poisson's ratio—Twisting couple on a cylinder—Expression for couple per unit twist—Torsion Pendulum -- determination of rigidity modulus of a wire using torsion pendulum—Bending of beams— Geometrical moment of inertia of circular and rectangular cross sections—Single cantilever—Expression for Young's modulus of a cantilever beam

**Unit 2 – (Rigid body dynamics):** Review of Rigid body dynamics — Expressions for moments of inertia of a circular disc and rectangular plate about different axes—MI of Flywheel

**Unit 3 – (Quantum theory of radiation):** Blackbody spectrum—Wien's law—Raleigh-Jeans law—Stefan-Boltzmann law—Planck's quantum theory—Reduction of Planck's formula to Raleigh Jeans and Wien's formulae—Compton effect—Wave particle dualism—de Broglie hypothesis and matter waves—Phase velocity and group velocity of matter waves

**Unit 4 – (Quantum Mechanics):** Heisenberg's uncertainty principle—Applications of Heisenberg's uncertainty principle—wave function and its properties - Setting up of Schrodinger's one-dimensional time independent wave equation—Application of Schrodinger's equation to a particle in an infinite potential well to determine eigen values and eigen functions

**Unit 5 – (Lasers):** Interaction of radiation with matter - Absorption, spontaneous emission and stimulated emission - Characteristics of laser light - Expression for the energy density of electromagnetic radiation – Requisite conditions for production of a laser beam—Helium-Neon laser—Semiconductor laser—Applications of lasers—Lidar—laser isotope separation—laser fusion

**Unit 6 – (Optical Fibers):** Principle-- Angle of acceptance—Expression for Numerical aperture--condition for propagation—Intermodal dispersion-- material dispersion—Refractive index profiles of step index and graded index fibers(GRIN)—Modal propagation in step index and GRIN fibers –Attenuation—Different types of loss mechanisms--Fiber optic communication system

**Unit 7 – (Crystal structure):** Space lattice—Bravais lattice—Lattice parameters—unit cell and primitive cell—Crystal systems - Miller indices - Indexing directions and planes in a crystal - Atomic packing fraction and coordination number for simple, body centered and face centered cubic Crystals - Expression for inter planar Spacing - Structures of NaCl and diamond crystals—Bragg's law—Identification of cubic crystals using Bragg's law

**Unit 8 – (Electrical conductivity of metals):** Review of Classical free electron theory - Failure of classical free electron - Quantum free electron theory—Density of States (Qualitative) – Fermi energy – Fermi factor - Effect of temperature on Fermi-Dirac Distribution functio

**Unit 9 – (Lab Experiments)**

1 Determination of the relationship between the torque and angular acceleration of aflywheel

2 Determination of the (i) the moment of inertia of the given disc and (ii) the rigiditymodulus of the material of a wire by torsional oscillations

3 Analysis of Powder X-ray diffraction pattern.

4 Determination of Young's modulus of material of a beam by uniform bending method.

5 Determination of radius of curvature of a plano-convex lens by setting up Newton's rings.

6 Determination of the wavelength of prominent spectral lines of Hg source using diffraction grating with minimum deviation method.

7 Determination of thickness of paper by air wedge experiment.
8 Determination of efficiency of Solar cell.
9 Determination of Planck's constant using LED.
10 Study of I-V characteristics of Zener diode
11 Determination of the frequency response of series and parallel resonance circuit and to find the resonant frequency and quality factor.
12 Determination the width of the forbidden energy gap in a semiconductor diode.
13 Determination of dielectric constant of a material by charging and discharging a capacitor.

### j. Course Map (CO-PO-PSO Map)

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | | 2 | | 1 | | | | | | | | 3 | 1 | 0 |
| CO-2 | 2 | 1 | 3 | 3 | | 1 | 1 | | | | | | 3 | 2 | 0 |
| CO-3 | 3 | 2 | | | | | | | | | | | 3 | 0 | 0 |
| CO-4 | 3 | 2 | 2 | 1 | | | | | | | | | 3 | 1 | 0 |
| CO-5 | 3 | 2 | | 3 | | | 2 | | 1 | 2 | | | 3 | 3 | 2 |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

### k. Course Teaching and Learning Methods

| Teaching and Learning Methods | Duration in | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 30 |
| **Demonstrations** | | 02 |
| 1. Demonstration using Videos | 02 | |
| 2. Demonstration using Physical Models / Systems | | |
| 3. Demonstration on a Computer | | |
| **Numeracy** | | 13 |
| 1. Solving Numerical Problems | 13 | |
| **Practical Work** | | 30 |
| 1. Course Laboratory | 30 | |
| 2. Computer Laboratory | | |
| 3. Engineering Workshop / Course Workshop / Kitchen | | |
| 4. Clinical Laboratory | | |
| 5. Hospital | | |
| 6. Model Studio | | |
| **Others** | | 00 |
| 1. Case Study Presentation | | |
| 2. Guest Lecture | | |
| 3. Industry / Field Visit | | |
| 4. Brain Storming Sessions | | |
| 5. Group Discussions | | |
| 6. Discussing Possible Innovations | | |
| Mid Terms, Written Examination | | 10 |
| Total Duration in Hours | | 85 |

## I. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment is presented in the Programme Specifications document pertaining to the B. Tech. Programmes. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (TSC1, TSC2, TSC3 or LSC4), COs are assessed as illustrated in the following Table.

| For Combined Courses (Theory + Laboratory) | | | | | |
|---|---|---|---|---|---|
| Focus of COs on each Component or Subcomponent of Evaluation | | | | | |
| Course Outcome | CE (Weightage: 50 %) | | | SEE (Weightage: 35 %) | Lab (Weightage: 15 %) |
| | Tests | Assignments | Lab CE | Written exam | LSEE: SEE |
| | 50 marks | 25 Marks | 25 Marks | 70 Marks | 30 Marks |
| CO-1 | X | | | X | |
| CO-2 | X | X | | X | |
| CO-3 | X | X | | X | |
| CO-4 | X | X | | X | |
| CO-5 | | | X | | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.
Course reassessment policies are presented in the Academic Regulations document.

## 8 Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No. | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures |
| 2. | Understanding | Class room lectures, and demonstrations |
| 3. | Critical Skills | Assignment |
| 4. | Analytical Skills | Class room, assignment |
| 5. | Problem Solving Skills | Class room, assignment |
| 6. | Practical Skills | Class room, assignment |
| 7. | Group Work | Classroom |
| 8. | Self-Learning | Assignment |
| 9. | Written Communication Skills | Assignment, examination |
| 10. | Verbal Communication Skills | Presentation |
| 11. | Presentation Skills | Presentation |
| 12. | Behavioral Skills | Course |
| 13. | Information Management | Assignment, examination |

| | | |
|---|---|---|
| 14. | Personal Management | Assignment, examination |
| 15. | Leadership Skills | Effective management of learning, time management, achieving the learning |

## 9. Course Resources

### a. Essential Reading

1. Class Notes
2. Rajendran, V. (2011) Engineering Physics, TMH
3. Srinivasan M. R. (2011) Physics for Engineers, 3rd Ed, New Age International
4. Gyan Prakash, (2012) Experimental Physics,
5. Michael Sayer, Abhai Mansingh, (1999) Measurement, Instrumentation and Experiment Design in Physics and Engineering, PHI

### b. Recommended Reading

1. Halliday, I.D., Resnick, R and Walker, J (2010) Fundamentals of Physics, 9th Ed, Wiley
2. Richtmeyer, F. K., Kennard, E.H. and Cooper, J.N (2007) Modern Physics, 6th Ed, TMH
3. Beisser, A. (2009) Concepts of Modern Physics, 6th Ed, TMH
4. Kittel, C. (2010) Introduction to Solid State Physics, 8th Ed, Wiley
5. S.O. Pillai (2011), A Textbook of Solid State Physics, 6th Ed, New Age International
6. Srinivasan M.R. (2011) Applied Solid State Physics, 1st Ed, New Age International
7. Giri, P.K., (2005) Physics Laboratory Manual for Engineering Undergraduates, Department of Physics, Indian Institute of Technology Guwahati

### c. Magazines and Journals

### d. Websites

1. http://nptel.ac.in/
2. Other Electronic Resources

### e. Electronic resources on the subject area are available on MSRUAS library

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**Course Specifications: Engineering Mechanics**

| | |
|---|---|
| **Course Title** | Engineering Mechanics |
| **Course Code** | CEF101A |
| **Course Type** | Core Theory |
| **Department** | Applicable to all Programmes |
| **Faculty** | Engineering and Technology |

## 1. Course Summary

This subject deals with laws of engineering mechanics for static and dynamics equilibrium of rigid bodies. They will be trained on application of engineering mechanics to solve practical problems pertaining to static and dynamic equilibrium of rigid bodies. In addition, effects of friction, energy methods for analyzing static and dynamic analysis of rigid bodies will be dealt.

## 2. Course Size and Credits

| | |
|---|---|
| **Number of Credits** | 03 |
| **Credit Structure (Lecture:Tutorial:Practical)** | 3:0:0 |
| **Total Hours of Interaction** | 45 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Civil Engineering |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

## 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** State and describe the laws of Statics, Friction and Dynamics and their contexts of application.
**CO-2.** Interpret standard mathematical relationships and apply for solving simple static and dynamic problems in engineering mechanics
**CO-3.** Calculate moment of inertia, determine centroid, centre of gravity for the structural members
**CO-4.** Apply the laws of statics and dynamics for the equilibrium analysis of rigid bodies with and without friction
**CO-5.** Apply energy methods in analyzing of static and dynamic aspects of engineering structures made of rigid bodies

## 4. Course Contents

**Unit 1 (Engineering Mechanics)**: Branches of mechanics and its importance: Engineering Design , Mechanics in engineering, Introduction to SI units , Basic idealisations - Particle, Continuum, Rigid body and Point force with examples, principles of mechanics with examples- laws of parallelogram, law of transmissibility, gravitation, Classification of force and force systems; Principle of physical independence of forces, Principle of superposition of forces; constraints on rigid bodies and corresponding reactions, Moment of a force, couple, moment of a couple, characteristics of couple,

Equivalent force - couple system; Resolution of forces, composition of forces; Numerical problems on moment of forces and couples, equivalent force and couples.

**Unit 2 (Analysis of Coplanar Concurrent and Non-Concurrent System of Forces):** Varignon's theorem, resultant of Concurrent and non-concurrent force systems. Equilibrium of Structural Systems: Types of forces acting on a body, Free Body diagram Analysis, Lami's Theorem, Equilibrium of connected bodies, types of supports in beams, determination of support reactions, Applications to engineering problems. Classification of Structures –Axial force members, trusses, frames, beams and cables, Numerical Examples.

**Unit 3 (Centroid of planes and Moment of inertia of area):** Differences between centre of gravity and Centroid, use of axis of symmetry, Centroid of simple built-up sections by integration, Moment of Inertia of planes, radius of gyration, Theorems of moment of inertia, moments of inertia of standard sections by integration, Numerical Examples.

**Unit 4 (Friction in Engineering Systems):** Laws of friction, angle of friction, angle of repose, cone of friction, Analysis of blocks resting on horizontal and inclined planes, rolling friction, rope friction, Application to wedge and ladder problems, problems involving non concurrent force systems.

**Unit 5 (Energy methods in engineering mechanics):** Application of principle of virtual work and Castigliano's theorem. Energy relations in rigid bodies- conservation of energy principle, examples on kinetic energy, potential energy and total energy, power as applied to rigid bodies.

**Unit 6 (Introduction to dynamics):** General principles and types of motions and D'Alembets principle with examples, Newton's laws of motion. Linear motions and projectiles -Motion with uniform velocity and acceleration, motion with varying acceleration, motion of bodies projected horizontally, projection on inclined planes, Numerical examples.

## 5. Course Map (CO-PO-PSO Map)

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | | | | | | | | | | | | 3 | | |
| CO-2 | 3 | | | | | | | | | | | | 3 | | |
| CO-3 | 3 | 3 | | | | | | | | | | | 3 | | |
| CO-4 | 3 | 2 | 1 | | | | | | | | | | 2 | | |
| CO-5 | | 2 | 3 | | | | | | | | | | 3 | | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

## 6. Course Teaching and Learning Methods

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 30 |
| **Demonstrations** | | 0 |
| 1.Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |

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| | | |
|---|---|---|
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 15 |
| 1. Solving Numerical Problems | 30 | |
| **Practical Work** | | 00 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 00 |
| 1. Case Study Presentation | 00 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **55** |

## 7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B. Tech. Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3), COs are assessed as illustrated in the following Table.

| **For Theory Courses Only** | | | |
|---|---|---|---|
| **Focus of COs on each Component or Subcomponent of Evaluation** | | | |
| | **Component 1: CE (50% Weightage)** | | **Component 2: SEE (50% Weightage)** |
| **Subcomponent ▸** | | | |
| **Subcomponent Type ▸** | **Term Tests** | **Assignments** | **100 Marks** |
| **Maximum Marks ▸** | **50** | **50** | |
| **CO-1** | X | | X |
| **CO-2** | X | X | X |
| **CO-3** | X | X | X |
| **CO-4** | X | X | X |
| **CO-5** | X | X | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

**8. Achieving COs**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures, Assignment |
| 2. | Understanding | Classroom lectures, Assignment, Self-study |
| 3. | Critical Skills | Classroom lectures, Assignment |
| 4. | Analytical Skills | Classroom lectures, Assignment |
| 5. | Problem Solving Skills | Assignment, Examination |
| 6. | Practical Skills | -- |
| 7. | Group Work | -- |
| 8. | Self-Learning | Assignment, Self-study |
| 9. | Written Communication Skills | Assignment, Examination |
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | Course work |
| 13. | Information Management | Assignment, Examination |
| 14. | Personal Management | Course work |
| 15. | Leadership Skills | -- |

**9. Course Resources**

**a. Essential Reading**

1. Class notes
2. Satheesh Gopi (2010), Basic Civil Engineering, Dorling Kindersley (India) Pvt.Ltd
3. R K Rajput (2011), A Text Book of Applied Mechanics, 3rd Edn, LaxmiPublications
4. Richard H. McCuen, Edna Z. Ezzell (2011), "Fundamentals of CivilEngineering: An Introduction to the ASCE Body of Knowledge", CRC press

**b. Recommended Reading**

1. S. S. Bhavikatti, K. G. Rajashekarappa (2004), Engineering Mechanics, NewAge International
2. C. Lakshamanarao, J. Lakshinarashiman, Raju Sethuraman, Srinivasan M. Sivakumar (1993), Engineering Mechanics: Statics and Dynamics, PHI, NewDelhi

**c. Magazines and Journals**

**d. Websites**

**e. Other Electronic Resources**

1. https://nptel.ac.in/

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**4. Course Contents**

**Unit 1 (Basic concepts in Electronics):** Semiconductor: p-type, n-type; p-n junction diode, its characteristics, half wave, full wave and bridge type rectifiers, basic filter circuits, Diode as voltage multiplier, clipper and clamper circuit, Zener diode characteristics, Zener diode as a voltage regulator.

**Unit 2 (Transistor- BJT):** Transistor configurations: CB, CE and CC; Transistor parameters: alpha, beta and gamma, working of transistor as a switch, Amplifier; Transistor biasing – Base, Collector-to-base and Voltage Divider Bias.

**Unit 3 (Amplifiers):** Differential amplifiers and their transfer characteristics, IC Op-Amps, their ideal and practical characteristics, Op-Amp in different modes as inverting amplifier, non-inverting amplifier, summing amplifier, scale changer, differentiator and integrator.

**Unit 4 (Power Supplies):** Introduction and working of Switched Mode Power Supply (SMPS), Voltage Regulator, Introduction to Inverters and UPS.

**Unit 5 (Digital Electronics):** Binary, Octal and Hexadecimal number systems and conversions, Boolean Algebra, Truth table of logic gates- AND, OR, NOT, NAND, NOR; Universal gates; Generation of Integrated Circuits- SSI, MSI, LSI and VLSI.

**Unit 6 (Laboratory): List of Experiments**

| | |
|---|---|
| 1 | Forward and Reverse bias V-I Characteristics of a P-N Junction diode |
| 2 | Forward and Reverse bias V-I Characteristics of Zener diode |
| 3 | Half wave and Full wave Rectifier circuits:<br>a) Output of half/full wave rectifier with and without capacitor filter. |
| 4 | Bridge Rectifier circuits:<br>a) Output of bridge rectifier with and without capacitor filter |
| 5 | Clipping circuits (Shunt clippers)<br>Clipping circuits (Series clippers) |
| 6 | Clamping circuits |
| 7 | Characteristics of Op-amp inverting and non- inverting amplifiers |
| 8 | Logic Gates circuits: Verification of the truth tables of AND, OR, NOT, NAND, NOR, and EX-OR gates. |

**5. Course Map (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | | | | | | | | | | | | 3 | | |
| CO-2 | 3 | | | | | | | | | | | | 3 | | |
| CO-3 | | 3 | 2 | | | | | | | | | | 3 | | |
| CO-4 | | 3 | 2 | | | | | | | | | | 3 | | |
| CO-5 | | 3 | | | | | | | | | | | 3 | | |
| CO-6 | | 3 | | 2 | | | | | | | | | 3 | 2 | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

**Course Specifications: Elements of Electronics Engineering and Laboratory**

| | |
|---|---|
| **Course Title** | Elements of Electronics Engineering and Laboratory |
| **Course Code** | ECF102A |
| **Course Type** | Core Theory and Laboratory |
| **Department** | Applicable to all Programmes |
| **Faculty** | Engineering and Technology |

## 1. Course Summary

The aim of this course is to create a strong foundation of Digital Electronics. The students are taught the basic components of digital systems and the process of their implementation. The students are also taught Boolean algebra, logic gates, basics of memories, and implementation of combinational and sequential digital circuits using logic gates. This course also emphasizes on different types of memories and logic designing platforms and their merits and demerits. Students are trained to employ the principles of digital electronics to implement digital design for the given problem. Basic electronics laboratory deals with practical applications of electronic circuits and their theoretical concepts.

## 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 04 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:0:2 |
| **Total Hours of Interaction** | 75 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

## 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Explain working principles of PN junction diode, Zener diode, transistors, amplifier configurations, Op-Amps, power supply, logic gates and electronic displays
**CO-2.** Derive mathematical relationships for electronic devices and circuits
**CO-3.** Solve simple numerical and design problems related to analog / digital circuits as well as devices
**CO-4.** Design and analyse operation of standard analog / digital circuits for a given application
**CO-5.** Conduct experiments as per the standard procedures and tabulate/calculate/plot the measured values
**CO-6.** Interpret and compare with standard results, and draw conclusions and Write report as per the prescribed format

## 6. Course Teaching and Learning Methods

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 33 |
| **Demonstrations** | | 02 |
| 1. Demonstration using Videos | 02 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 10 |
| 1. Solving Numerical Problems | 10 | |
| **Practical Work** | | 30 |
| 1. Course Laboratory | 30 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 00 |
| 1. Case Study Presentation | 00 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **85** |

## 7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B. Tech. Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (TSC1, TSC2, TSC3 and LSC4), COs are assessed as illustrated in the following Table.

| **For Combined Courses (Theory + Laboratory)** | | | | | |
|---|---|---|---|---|---|
| **Focus of COs on each Component or Subcomponent of Evaluation** | | | | | |
| **Course Outcome** | **CE (Weightage: 50 %)** | | | **SEE (Weightage: 35 %)** | **Lab (Weightage: 15 %)** |
| | **Tests** | **Assignments** | **Lab CE** | **Written exam** | **LSEE: SEE** |
| | **50 marks** | **25 Marks** | **25 Marks** | **70 Marks** | **30 Marks** |
| **CO-1** | X | | | X | |
| **CO-2** | X | X | | X | |
| **CO-3** | X | X | | X | |
| **CO-4** | X | X | | X | |
| **CO-5** | X | X | | X | |
| **CO-6** | | | X | | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

**8. Achieving COs**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Class room lectures, Assignments, Laboratory instruction |
| 2. | Understanding | Class room lectures, Assignments, Laboratory instructions and experiments |
| 3. | Critical Skills | Class room lectures, Assignments |
| 4. | Analytical Skills | Class room lectures, Assignments |
| 5. | Problem Solving Skills | Class room lectures, Assignments |
| 6. | Practical Skills | Laboratory Work |
| 7. | Group Work | Laboratory Work |
| 8. | Self-Learning | Assignment |
| 9. | Written Communication Skills | Assignment, examination, Laboratory work |
| 10. | Verbal Communication Skills | Laboratory work |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | Course work |
| 13. | Information Management | Assignment, examination, Laboratory |
| 14. | Personal Management | Course work |
| 15. | Leadership Skills | -- |

**9. Course Resources**

**a. Essential Reading**

1. Class Notes
2. Millman and Halkias, 2001, Integrated Electronics, Tata McGraw-HillEducation
3. Robert Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory,7th Ed. Prentice Hall
4. Dale R. Patrick, 1989, Electricity and Electronics Laboratory, The Good heart-willcox Company Inc, Illinois

**b. Recommended Reading**

1. Albert Malvino, 2006, Electronic Principles, Tata McGraw - Hill Education
2. Donald L. Shilling & Charles Belowl, 1968, Electronic Circuits, New York:McGraw-Hill
3. Tocci R J and Widmer N S, 2001, Digital Systems – Principles and Applications,8th Ed., Pearson Education India, New Delhi
4. Cooper and Helfrick, 1996, Modern Electronic Instrumentation and Measuring Techniques, 4th print Prentice Hall of India, New Delhi

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5. H S Kalsi, 2007, Electronic Instrumentation, TMH, 2nd Edition
6. R A Gaikwad, 2001, Op-Amps and Linear Integrated Circuits, PHI, 4th edition
7. Millman and Grabel, 1999, Microelectronics, 2nd Ed. Tata McGraw-Hill
8. Louis R. Nardizzi, 1973, Basic circuits and electronics experiments, Van Nostrand
9. George B. Rutkowski, 1984, Basic electricity for electronics, Bobbs-Merrill Educational Pub.
10. Russell L. Meade, 2003, Foundations of Electronics: Circuits and Devices, Delmar learning, a division of Thomson learning, Inc.

**c. Magazines and Journals**

1. Electronics For You
2. IEEE Transaction on Circuits and System I and II

**d. Websites**

1. http://www.electronics-lab.com
2. http://www.labmanager.com
3. http://electronicsforu.com
4. http://www.lifescienceleader.com

**e. Other Electronic Resources**

1. https://ocw.mit.edu/index.htm MultiSim software
2. Analog trainer kit
3. Digital trainer kit
4. Discrete electronic components

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**Course Specifications: Engineering Drawing**

| | |
|---|---|
| **Course Title** | Engineering Drawing |
| **Course Code** | MEF103A |
| **Course Type** | Core Theory and Laboratory |
| **Department** | Applicable to all Programmes |
| **Faculty** | Engineering and Technology |

## 1. Course Summary

This course deals with graphical representation of geometrical entities in various views for visualization and communication. The students will be taught orthographic and isometric projection of points, lines, planes and solids. The students will be taught sections and development of solids. The students will be equipped to visualize and apply principles of orthographic projection to given application. The students will also be trained to use CAD tool to carry out these geometric projections.

## 2. Course Size and Credits

| | |
|---|---|
| **Number of Credits** | 03 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 2:0:1 |
| **Total Hours of Interaction** | 60 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Mechanical and Manufacturing Engineering |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

## 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Describe the conventions used in projections of geometric entities and interpret the same

**CO-2.** Draw orthographic projections for the geometric entities in specified positions

**CO-3.** Develop lateral surfaces of un-sectioned and sectioned regular solids

**CO-4.** Develop orthographic projections for given applications

**CO-5.** Draw isometric projections for the solids and their combinations

**CO-6.** Demonstrate competency in using CAD tool for drawing projections of geometric entities

## 4. Course Contents

**Unit 1 (Introduction to Engineering Drawing and CAD Tool):** Drawing Instruments and their uses, BIS conventions and specifications, Dimensioning and Significance of Lettering, Graphical User Interface (GUI), Co-ordinate system and reference planes. Definitions of Horizontal Plane (HP), Vertical Plane (VP), Right Profile Plane (RPP) & Left Profile Plane (LPP). Creation of 2D/3D environment. Selection of drawing size and scale. Creation of geometric entities and text.

Modification and editing of geometric entities. Dimensioning, line conventions and material conventions

**Unit 2 (Orthographic Projections- Points and Lines):** Definitions - Planes of projection, reference line and conventions employed. Projections of points in all the four quadrants, Projections of straight lines (located in First quadrant, first angle projection), True and apparent lengths, True andapparent inclinations to reference planes (simple problems).

**Unit 3 (Orthographic Projections - Planes (First Angle Projection):** Definitions–projections of plane surfaces–triangle, square, rectangle, pentagon, hexagon and circle. Planes in different positions by change of position method only.

**Unit 4 (Orthographic Projections – Solids (First Angle Projection):** Definitions – Projections of solids–cube, prisms, cylinder, pyramids, cones and tetrahedron in different positions.

**Unit 5 (Orthographic Projections – Section of Solids and Development of Surfaces (First Angle Projection):** Section planes, Sections, Section views, Apparent shapes and True shapes of sections of right regular prisms, pyramids, cylinders and cones resting in simple positions.

**Unit 6 (Isometric Projections using Isometric Scale) :** Section planes, Sections, Section views, Apparent shapes and True shapes of sections of right regular prisms, pyramids, cylinders and cones resting in simple positions. Application of Projection of points and lines to given situation.

## 5. Course Map (CO-PO-PSO Map)

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | | | | | | | | | | | | 3 | | |
| CO-2 | 3 | 2 | | | | | | | | 1 | | | 3 | | 1 |
| CO-3 | 3 | 2 | | | | | | | | 1 | | | 3 | | 1 |
| CO-4 | 3 | 2 | | | | | | | | 1 | | | 3 | | 1 |
| CO-5 | 3 | 2 | | | | | | | | 1 | | | 3 | | 1 |
| CO-6 | | | | | 2 | | | | | | | | | 2 | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

## 6. Course Teaching and Learning Methods

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 30 |
| **Demonstrations** | | 00 |
| 1. Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 00 |
| 1. Solving Numerical Problems | 00 | |
| **Practical Work** | | 30 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 30 | |
| 3. Engineering Workshop / Course/Workshop / | 00 | |

| | | |
|---|---|---|
| Kitchen | | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | |
| 1. Case Study Presentation | 00 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | 00 |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **70** |

### 7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B. Tech. Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3), COs are assessed as illustrated in the following Table.

| **For Theory Courses Only** | | | |
|---|---|---|---|
| **Focus of COs on each Component or Subcomponent of Evaluation** | | | |
| | **Component 1: CE (50% Weightage)** | | **Component 2: SEE (50% Weightage)** |
| **Subcomponent ▸** | | | |
| **Subcomponent Type ▸** | **Term Tests** | **Assignments** | **100 Marks** |
| **Maximum Marks ▸** | **50** | **50** | |
| **CO-1** | X | X | X |
| **CO-2** | X | X | X |
| **CO-3** | | | X |
| **CO-4** | X | X | X |
| **CO-5** | | | X |
| **CO-6** | X | | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

### 8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures, Assignments |

| | | |
|---|---|---|
| 2. | Understanding | Classroom lectures, Assignments |
| 3. | Critical Skills | Classroom lectures, Assignments |
| 4. | Analytical Skills | Classroom lectures, Assignments |
| 5. | Problem Solving Skills | Classroom lectures, Assignments |
| 6. | Practical Skills | Assignment |
| 7. | Group Work | Assignments |
| 8. | Self-Learning | Assignments |
| 9. | Written Communication Skills | Assignment, Examination |
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | Assignment |
| 12. | Behavioral Skills | -- |
| 13. | Information Management | Assignment, Examination |
| 14. | Personal Management | Course Work |
| 15. | Leadership Skills | -- |

## 9. Course Resources

### a. Essential Reading

1. Course notes
2. **K. R. Gopalakrishna, 2005, Engineering Graphics, 32nd Edition, Shubhash**Publishers

### b. Recommended Reading

1. W. J. Luzadder, 2006, Fundamentals of Engineering Drawing, 11th Edition, Prentice Hall India
2. N. D. Bhatt and V. M. Panchal, 2006, Engineering Drawing, 49th Edition, Charotar Publishing House
3. CAD Tool Users Manuals

### c. Magazines and Journals

### d. Websites

1. http://nptel.ac.in

### e. Other Electronic Resources

1. Electronic resources on the course area are available on MSRUAS library

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**Course Specifications: Constitution, Human Rights and Law**

| | |
|---|---|
| **Course Title** | Constitution, Human Rights and Law |
| **Course Code** | LAN101A |
| **Course Type** | Ability Enhancement Compulsory Course |
| **Department** | Applicable to all Programmes |
| **Faculty** | Engineering and Technology |

**1. Course Summary**

This course aims at enabling students understand the key principles of Indian Constitution, Human Rights and Law. The course facilitates the understanding of the framework of Indian constitution and the judicial and the legal systems that guides Indian citizens. It aims at building awareness about the application of Human Right principles and Law. It allows students to work towards the formulating realistic solutions for protection of human rights.

**2. Course Size and Credits**

| | |
|---|---|
| **Number of Credits** | 02 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 2:0:0 |
| **Total Hours of Interaction** | 30 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | School of Law |
| **Total Course Marks** | 50 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

**3. Course Outcomes (COs)**

After the successful completion of this course, the student will be able to:

**CO-1.** Explain the key principles of the Indian Constitution
**CO-2.** Explain Indian legal system and judicial structure that govern the citizens
**CO-3.** Discuss UN Declaration of Human Rights
**CO-4.** Discuss the scope and application of Human Rights Principles and Law
**CO-5.** Suggest strategies for protection of human rights and resolving legal issues in compliance with applicable laws

**4. Course Contents**

**Unit 1 (Constitution of India ):** The framework of Constitution of India, Constituent Assembly, The Constitution and the government, The constitution and the judiciary, The constitution and the legislature.

**Unit 2 (Introduction to Law):** Indian Legal System and Judicial Structure, Liability under the Law, Issues relating to Good Corporate Governance, Company Law.

**Unit 3 (Concept of Human Rights and Duties):** Inherent, inalienable, universal, indivisible, values, dignity, liberty, equality, justice, unity in diversity, classification of rights, classification of duties, correlation of rights and duties, need for balance between rights and duties, freedom and responsibility.

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**Unit 4 (International Human Rights Standards and UN)**: Universal declaration of human rights 1948, international covenant on civil and political rights 1966, international covenant on economic, social and cultural rights 1966, UN system and human rights, convention on elimination of all forms of racial discrimination 1965, convention on elimination of all forms of discrimination against women 1979, convention on the rights of the child 1989, UN declaration and duties and responsibilities of individuals 1997, UN agencies to monitory compliance such as UN high commission for human rights.

**Unit 5 (Contract Law and Disputes):** Formation of Contract: offer and acceptance, Terms of Contract: avoidance, representation, illegality, Breach of Contract and Remedies, Industrial Disputes Act, Negligence, Trespass and Breach of Statutory Duty, Litigation, Arbitration, Judicial Remedies.

**Unit 6 (Intellectual Property Law):** Copyright, Protection and Infringement of Copyright, TradeMarks, Protection of Trade Marks and Passing-off, Patents, Ownership and Protection of Patents, Product Liability, Government Schemes for IPR Protection.

## 5. Course Map (CO-PO-PSO Map)

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | | | | | | | | | | | | 3 | | |
| CO-2 | 3 | | | | | | | | | | | | 3 | | |
| CO-3 | 3 | | | | | | | | | 2 | | | 3 | | 2 |
| CO-4 | 3 | 2 | | | | | | | | | | | 3 | | |
| CO-5 | | | | | | | | | | 3 | | | | | 3 |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

## 6. Course Teaching and Learning Methods

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 30 |
| **Demonstrations** | | 0 |
| 1.Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 0 |
| 1. Solving Numerical Problems | 00 | |
| **Practical Work** | | 00 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |

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| | | |
|---|---|---|
| 6. Model Studio | 00 | |
| **Others** | | 00 |
| 1. Case Study Presentation | 00 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **40** |

**7. Course Assessment and Reassessment**

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B. Tech Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2), COs are assessed as illustrated in the following Table.

| **For Theory Courses Only** | | | |
|---|---|---|---|
| **Focus of COs on each Component or Subcomponent of Evaluation** | | | |
| | **Component 1: CE (50% Weightage)** | | **Component 2: SEE (50% Weightage)** |
| **Subcomponent ▸** | | | |
| **Subcomponent Type ▸** | **Term Tests** | **Assignments** | **50 Marks** |
| **Maximum Marks ▸** | **25** | **25** | |
| **CO-1** | X | X | X |
| **CO-2** | | | X |
| **CO-3** | | X | X |
| **CO-4** | X | | |
| **CO-5** | X | X | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

**8. Achieving COs**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Face to face lectures |
| 2. | Understanding | Face to face lectures, group discussions |
| 3. | Critical Skills | |
| 4. | Analytical Skills | Face to face lectures, activities, group discussions, assignments |
| 5. | Problem Solving Skills | |
| 6. | Practical Skills | Face to face lectures, activities, group discussions, course work |
| 7. | Group Work | Course work, practice, assignment, group discussion |

| | | |
|---|---|---|
| 8. | Self-Learning | Course work, practice, assignment, group discussion |
| 9. | Written Communication Skills | Face to face lectures, Course work, practice, assignment, group discussion |
| 10. | Verbal Communication Skills | Face to face lectures, Course work, practice, assignment, group discussion |
| 11. | Presentation Skills | |
| 12. | Behavioral Skills | Course work, practice, assignment, group discussion, presentation practice, role plays |
| 13. | Information Management | Assignment |
| 14. | Personal Management | Face to face lectures |
| 15. | Leadership Skills | Face to face lectures, group discussions |

**9. Course Resources**

**a. Essential Reading**

1. Course notes
2. Tulsian, PC. (2008) Business Law, Tata McGraw Hill, New Delhi
3. Donnelly, J. (1998) International Human Rights, 2nd edn, Westview Press

**b. Recommended Reading**

1. Gulshan , S. S and Kapoor, G. K. (2005) Business Law including Corporate Laws, New Age International (P) Ltd. Publishers, New Delhi
2. Perry, M. (1998) The Idea of Human Rights, Oxford University Press
3. K Swamyraj (2017), Law of Contract (General Principles), God's Grace Publication, New Delhi
4. D D Basu (1983), Constitutional Law of India, Lexis Nexis Butterworths Publication, Nagpur
5. Introduction to Intellectual Property Theory and Practice (1997), World Intellectual Property Organisation, Geneva
6. Smith, R. (2007) Textbook on international human rights 3rd edn, Oxford University Press

**c. Magazines and Journals**

**d. Websites**

1. http://industrialrelations.naukrihub.com/industrial-relation-policy.htm
2. http://labour.nic.in/
3. http://whitepapers.businessweek.com/tlist/Legal-Environment.html
4. http://nptel.ac.in/

**e. Other Electronic Resources**

1. Electronic resources on the course area are available on MSRUAS library

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**Course Specifications: Engineering Mathematics - 2**

| | |
|---|---|
| **Course Title** | Engineering Mathematics – 2 |
| **Course Code** | MTB102A |
| **Course Type** | Core Theory |
| **Department** | Applicable for all programmes |
| **Faculty** | Engineering and Technology |

## 1. Course Summary

This course deals with analytical solutions of ordinary differential equations and Laplace transform. Students are taught the concepts of fundamentals of ordinary differential equations and Laplace transform. The solution procedures for certain standard forms of ordinary differential equations are illustrated. The role, relevance of ordinary differential equations in modelling some of the real world problems are emphasized and this course also covers the underlying principles and applications of transform techniques in various engineering disciplines.

## 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 04 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:1:0 |
| **Total Hours of Interaction** | 60 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Mathematics and Statistics |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

## 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Describe the fundamentals of ordinary differential equations and Laplace transform

**CO-2.** Solve standard forms of ordinary differential equations

**CO-3.** Solve simple problems in ordinary differential equations and Laplace transform

**CO-4.** Model real world problems using ordinary differential equations and solve complex problems associated with ordinary differential equations using Laplace transform

**CO-5.** Apply Laplace transform in solving complex real world engineering problems

## 4. Course Contents

**Unit 1 (First Order Differential Equation):** First order differential equations - Introduction, basic concepts and geometrical meaning. Separable, linear and exact differential equations. Integrating factors and transformations. Applications of first order ordinary differential equations: orthogonal trajectories, growth/decay problems and mixture problems

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**Unit 2 (Higher Order Differential Equation):** Introduction, initial and boundary value problems. Linear homogenous/nonhomogeneous differential equations with constant coefficients, method of undetermined coefficients and variation of parameters. Cauchy-Euler equations. Application of second order linear differential equations with constant coefficients, mass-spring-dashpot system, electric circuits. System of linear differential equations of first order, solutions by matrix method.

**Unit 3 (Laplace Transform):** Definition, properties and theorems, transform of derivatives, integrals, periodic functions, unit step function, Dirac's delta function and time shifting property. Inverse Laplace transform, convolution theorem, solution of initial value problems

**5. Course Map (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | 3 | 2 | | | | | | | 1 | | | 3 | | 1 |
| CO-2 | 2 | 3 | 2 | | | | | | | 1 | | | 3 | | 1 |
| CO-3 | 3 | 3 | 1 | | | | | | | 1 | | | 3 | | 1 |
| CO-4 | 3 | 3 | 2 | 2 | 2 | | | | | 1 | | | 3 | 2 | 1 |
| CO-5 | 3 | 3 | 2 | 2 | 2 | | | | | 1 | | | 3 | 2 | 1 |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 45 |
| **Demonstrations** | | 00 |
| 1. Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 15 |
| 1. Solving Numerical Problems | 15 | |
| **Practical Work** | | 00 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 00 |
| 1. Case Study Presentation | 00 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **70** |

## 7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B. Tech. Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2 or SC3), COs are assessed as illustrated in the following Table.

| **For Theory Courses Only** | | | |
|---|---|---|---|
| **Focus of COs on each Component or Subcomponent of Evaluation** | | | |
| | **Component 1: CE (50% Weightage)** | | **Component 2: SEE (50% Weightage)** |
| **Subcomponent ▸** | | | |
| **Subcomponent Type ▸** | **Term Tests** | **Assignments** | **100 Marks** |
| **Maximum Marks ▸** | **50** | **50** | |
| **CO-1** | X | | X |
| **CO-2** | X | | X |
| **CO-3** | X | | X |
| **CO-4** | | X | |
| **CO-5** | | X | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

## 8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures |
| 2. | Understanding | Classroom lectures, Self-study |
| 3. | Critical Skills | Assignment |
| 4. | Analytical Skills | Assignment |
| 5. | Problem Solving Skills | Assignment, Examination |
| 6. | Practical Skills | Assignment |
| 7. | Group Work | -- |
| 8. | Self-Learning | Self-study |
| 9. | Written Communication Skills | Assignment, Examination |
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | -- |
| 13. | Information Management | Assignment |
| 14. | Personal Management | -- |
| 15. | Leadership Skills | -- |

## 9. Course Resources

### a. Essential Reading

5. Glyn James, 2016, Advanced Modern Engineering Mathematics, 4th edition, Pearson Dennis Zill, 2012,
6. A First Course in Differential Equations, 10th edition, Massachusetts, Brooks/Cole
7. Shepley Ross, 2007, Introduction to Ordinary Differential Equations, 4th edition, New York, John Wiley & sons

### b. Recommended Reading

1. George Simmons, 2017, Differential Equations with Applications and Historical Notes, 2nd edition, New Jersey, McGraw Hill
2. Dennis Zill and Warren Wright, 2011, Advanced Engineering Mathematics, 4th edition, Jones and Bartlet
3. Erwin Kreyszig, 2015, Advanced Engineering Mathematics, tenth edition, John Wiley & Sons Inc.

### c. Magazines and Journals

### d. Websites

1. http://nptel.ac.in/
2. https://ocw.mit.edu/index.htm

### e. Other Electronic Resources

1. https://www.khanacademy.org/
2. tutorial.math.lamar.edu/

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**Course Specifications: Engineering Chemistry and Laboratory**

| | |
|---|---|
| **Course Title** | Engineering Chemistry and Laboratory |
| **Course Code** | CYB104A |
| **Course Type** | Core Theory and Laboratory |
| **Department** | Applicable to all Programmes |
| **Faculty** | Engineering and Technology |

## 1. Course Summary

This subject aims at enhancing the basic understanding of chemistry with reference to engineering systems and to train students to perform quantitative analysis related to Engineering Chemistry.
This subject deals with topics on electrochemistry, energy stage devices, fuels, chemical kinetics, corrosion science, metal finishing, polymers and nanomaterials.
Students are trained to determine physical and chemical properties of a given sample experimentally. They are trained to analyze the results and infer appropriate conclusions based on concepts of Engineering Chemistry.

## 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 04 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:0:1 |
| **Total Hours of Interaction** | 75 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Chemistry |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

## 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Explain the basic concepts of electrochemistry, conversion of chemical energy into electrical energy, theory of corrosion and principles of metal finishing
**CO-2.** Differentiate renewable - nonrenewable fuels, primary - secondary electrodes & primary - secondary batteries, batteries - fuel cells, electroplating – electroless plating, thermosetting – thermoplastic polymers and dry corrosion - wet corrosion
**CO-3.** Discuss the reaction chemistry and stoichiometry of combustion of fuels, remedial measures to control oxides of nitrogen, sulphur and carbon, polymerization – methods, mechanism, preparation, properties and applications of some polymers, concepts of nano science and nanotechnology
**CO-4.** Identify the types of corrosion and methods to prevent corrosion, suitable polymers and nanocomposite materials for engineering applications
**CO-5.** Derive kinetic rate equations for various chemical systems and equation for electromotive force
**CO-6.** Analyze the suitability of polymers & composites for various applications and solve problems related to storage devices, chemical kinetics, electro chemistry, corrosion and metal finishing
**CO-7.** Plan the experimental set up, conduct experiments, calculate and plot the graphs to obtain results, and write a laboratory report as per the prescribed format

## 4. Course Contents

**Unit 1 Electrochemistry:** Electrochemical cell, Electrode Potential and EMF. Construction of Galvanic cell, Types of Electrodes. Numerical on Electrode Potential of cell using Nernst equation. Construction and working of reference electrodes: calomel and silver-silver chloride electrode. Construction, working and application of Ion-selective electrode: Glass electrode. Determination of pH using glass electrode

**Unit 2 Storage and Conversion devices – Batteries:** Storage devices – Batteries: Primary batteries, Secondary batteries, reserve batteries and super capacitors. Construction, working and application of dry cell, lead acid, Nickel-Cadmium, Nickel-Metal hydride, Zinc –Air, Lithium-ion batteries, Lithium polymer batteries.
Conversion devices: Fuel cells, Construction, working and application of: Hydrogen-Oxygen, Methanol-Oxygen cells.

**Unit 3 Corrosion and its Control:** Types of corrosion. Electrochemical theory of corrosion. Factors affecting, Corrosion control: Metal coating, cathodic protection, organic coating, corrosion-inhibitors.

**Unit 4 Metal Finishing:** Technological importance of metal finishing, Polarization and factors influencing polarization, Principle of electroplating, factors affecting electrodeposition, Electroplating of Chromium and Gold. Electro-less Plating of Copper and Nickel.

**Unit 5 Chemical Kinetics:** Order of Reactions, Derivation of second, third, consecutive reactions, rate equations, Steady State Concept, numerical problems with suitable examples of different kinds of reactions.

**Unit 6 Combustion Chemistry:** Introduction to Fuels, types and classification, Sources of Fuels, Characteristics of a good fuel, Proximate and ultimate analysis, Petroleum cracking, Mechanism of Knocking and its effect, Anti-knocking agents, Octane and Cetane numbers, Functioning of Catalytic converter, Introduction to Biofuels, Flue gases and control measures.

**Unit 7 Polymers and polymerization:** Introduction & Classification of polymers, Addition, condensation and co- ordination polymerizations, mechanism of free radical addition polymerization with ethylene as example, Techniques of polymerization (Bulk, Solution, suspension, emulsion), Tg, factors affecting Tg, effect of structure on properties of polymers, fundamentals of biodegradable polymers, preparation, properties and technical applications of thermoplastics ( PVC, PVA, Teflon), thermosets (PF, UF), elastomers (natural rubber, SBR) & adhesives (epoxy and acrylics) Introduction to polymeric composites.

**Unit 8 Introduction to nanoscience and nanotechnology:** Basic concepts of Nanoscience and Nanotechnology – Graphene – Carbon nanotubes – Material processing by top down and down top synthesis; chemical vapor deposition and physical vapor deposition– Potential uses of nanomaterials in electronics, robotics, computers, sensors, vehicles and transportation – Medical applications of nanomaterials.

| **Unit 9 – (Lab Experiments)** | |
|---|---|
| 1 | Determination of Viscosity Coefficient of a given liquid using Ostwald's Viscometer |
| 2 | Conductometric estimation of an acid using standard NaOH solution |

| | |
|---|---|
| 3 | Determination of pKa of the given weak acid using Glass electrode-Ag/AgCl electrode assembly |
| 4 | Potentiometric estimation of FAS using standard $K_2Cr_2O_7$ solution |
| 5 | Colorimetric estimation of Copper |
| 6 | Determination of total hardness of a given water sample |
| 7 | Determination of percentage of Cu from the given brass sample |
| 8 | Determination of percentage of Fe in the rust solution by external indicator Method |
| 9 | Determination of first order reaction constant for acid hydrolysis of ethyl acetate |
| 10 | Electroplating of copper* |
| 11 | Determination of composition of brass alloy using UV-Vis spectroscope* |
| 12 | Measurement of voltage in a hydrogen-oxygen fuel cell* |
| 13 | Preparation of printed circuit board* |
| 14 | Construction and operation of lead acid battery cell* |
| 15 | Determination of empirical formula of a fuel using exhaust gas analyzer* |

* Demo experiments

## 5. Course Map (CO-PO-PSO Map)

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | | | | | | | | | | | | 3 | | |
| CO-2 | | | | | | 3 | | | | | | | | 3 | |
| CO-3 | | | | | | | 3 | | | | | | | 3 | |
| CO-4 | | | 3 | | | | | | | | | | 3 | | |
| CO-5 | | | | | | | 1 | | | | | | | 1 | |
| CO-6 | | 3 | | 2 | | | | | | 3 | | | 3 | 2 | 3 |
| CO-7 | 3 | 2 | | 3 | | | 2 | | 1 | 3 | | | 3 | 3 | 3 |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

## 6. Course Teaching and Learning Methods

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 35 |
| **Demonstrations** | | 00 |
| 1. Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 10 |
| 1. Solving Numerical Problems | 10 | |
| **Practical Work** | | 30 |
| 1. Course Laboratory | 30 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |

| | | |
|---|---|---|
| 6. Model Studio | 00 | |
| **Others** | | |
| 1. Case Study Presentation | 00 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | 00 |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **85** |

## 7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B. Tech. Programmes. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (TSC1, TSC2, TSC3, LSC4 or LSC5), COs are assessed as illustrated in the following Table.

| **For Combined Courses (Theory + Laboratory)** | | | | | |
|---|---|---|---|---|---|
| **Focus of COs on each Component or Subcomponent of Evaluation** | | | | | |
| **Course Outcome** | **CE (Weightage: 50 %)** | | | **SEE (Weightage: 35 %)** | **Lab (Weightage: 15 %)** |
| | **Tests** | **Assignments** | **Lab CE** | **Written exam** | **LSEE: SEE** |
| | **50 marks** | **25 Marks** | **25 Marks** | **70 Marks** | **30 Marks** |
| **CO-1** | X | | | X | |
| **CO-2** | X | | | X | |
| **CO-3** | X | | | X | |
| **CO-4** | X | X | | X | |
| **CO-5** | X | | | X | |
| **CO-6** | | X | | X | |
| **CO-7** | | | X | | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

## 8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures |
| 2. | Understanding | Classroom lectures, Self-study |
| 3. | Critical Skills | Assignment |

| | | |
|---|---|---|
| 4. | Analytical Skills | Assignment |
| 5. | Problem Solving Skills | Assignment, Examination |
| 6. | Practical Skills | Assignment |
| 7. | Group Work | -- |
| 8. | Self-Learning | Self-study |
| 9. | Written Communication Skills | Assignment, Examination |
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | -- |
| 13. | Information Management | Assignment |
| 14. | Personal Management | -- |
| 15. | Leadership Skills | -- |

## 9. Course Resources

### a. Essential Reading

1. Class Notes
2. Gadag, R.V. and Nityananda Shetty A., (2010), Engineering Chemistry, Second Edition, New Delhi, I.K. International Publishing House
3. O.G. Palanna, (2011), Engineering Chemistry, New Delhi, Tata McGraw Hill Education Pvt Ltd.
4. Gurudeep Raj, (2014), Advanced Physical Chemistry, Meerut-Uttar Pradesh, Krishnan Prakashana
5. Pradeep. T, (2012) "A Text Book of Nanoscience and Nanotechnology", New Delhi, Tata McGraw Hill Company Ltd.

### b. Recommended Reading

1. Pletcher, D. and Walsh, F.C., (1993), Industrial Electrochemistry, Second edition, UK, Blackie Academic and Professional
2. Kuriacose, J.C. & Rajaram, J., (1998), Chemistry in Engineering & Technology (Vol I & II), Third reprint, New Delhi, Tata McGrahill Company
3. C. N. R. Rao, Achim Muller and A.K. Cheetham, (2004), The Chemistry of Nanomaterials, Vol I & II, Weinheim, Wiley VCH.

### c. Magazines and Journals

### d. Websites

### e. Other Electronic Resources

1. http://nptel.ac.in/
2. Electronic resources on the subject area are available on MSRUAS library

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**Course Specifications: Elements of Mechanical Engineering and Workshop Practice**

| | |
|---|---|
| **Course Title** | Elements of Mechanical Engineering and Workshop Practice |
| **Course Code** | MEF104A |
| **Course Type** | Core Theory |
| **Department** | Applicable to all Programmes |
| **Faculty** | Engineering and Technology |

## 1. Course Summary

This course is aimed at preparing the students to understand the concepts and underlying principles of mechanical engineering. The students are taught various types of energy sources, power generation, energy conversion methods and types of power plants. Students are taught the working of IC engines, refrigeration and air-conditioning and power transmission elements. Students are also exposed to basic operations and applications of machine tools.

## 2. Course Size and Credits

| | |
|---|---|
| **Number of Credits** | 03 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 2:0:1 |
| **Total Hours of Interaction** | 60 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Mechanical and Manufacturing Engineering |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

## 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Demonstrate the understanding on Classification of energy sources, energy conversion systems, mechanical power transmission systems, machine tools and processes
**CO-2.** Describe various energy conversion systems, mechanical power transmission systems and machine tools
**CO-3.** Explain the working principle of refrigeration systems, biomass conversion technologies and machining operations
**CO-4.** Solve numerical problems on IC engines and mechanical power transmission systems
**CO-5.** Apply principles of energy conversion systems, power transmission systems, machining processes and mechanical joints to practical applications

## 4. Course Contents

**Unit 1 (Energy Sources and its Conversion Devices):** Energy sources and their classification, Fuels and their properties. Bio-mass energy, OTEC, Solar energy, Wind energy, Geo-thermal energy, Tidal energy, Nuclear Energy. Demonstration of Gas Turbine

**Unit 2 (Boilers and Accessories):** Steam boilers – classification, Lancashire boiler, Babcock and Wilcox boiler; working and function of boiler mountings and accessories. Demonstration of Steam Turbine

**Unit 3 (Hydraulic Pumps and IC engines):** Classification, Principles and operations of Reciprocating and rotary types of pumps and compressors.
Internal Combustion Engines: Classification of IC Engines, engines components, 2 and 4–Stroke Petrol and diesel engines, P-V diagrams for Otto and Diesel cycles, IC engine performance-numerical on IC engines, electric and Hybrid vehicles. Demonstration of Pumps, Blower Compressors and Multi-cylinder Engine.

**Unit 4 (Refrigeration and Air Conditioning):** Properties of refrigerants, Performance of Refrigeration System - Refrigerating effect, Ton of Refrigeration, Ice making capacity, COP, Relative COP, Unit of Refrigeration, Energy Efficiency Ratio (EER). Principle and working of vapour compression refrigeration, vapour absorption refrigeration, comparison of vapour compression and vapour absorption refrigeration. Principles and applications of air conditioners, Room air conditioner, automotive air conditioning system

**Unit 5 (Mechanical Power Transmission):** Belt Drives - Classification and applications, Length of belt, Velocity ratio, Creep and slip, Idler pulley, stepped pulley and fast and loose pulley, beltand pulley construction. Demonstration of Open and Cross Belt drive. Applications of chain drive and rope drives. Gear Drives: Definitions, Terminology, types and uses, Gear Drives and Gear Trains – Simple problems on gear drives. Demonstration of Simple and Compound Gear Trains. Importance of machining and machine tools

**Unit 6 (Machine Tools and Mechanical Joints):** Lathe - Principle of working of a Centre Lathe, Parts of a lathe, Lathe Operations. Drilling Machine – Principle of working and classification of drilling machines, types of drilling machines, drilling operations. Demonstration of working of Lathe and drilling machines along with different operations performed. Mechanical Joints: Temporary and permanent fasteners- Threaded fasteners, Riveted joints, welded joints, Knuckle joint, cotter and pin joints, couplings. Demonstration of Fitting operations, Sheet Metal operations, Arc Welding, Fasteners and Couplings.

## 5. Course Map (CO-PO-PSO Map)

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | | | | | | | | | | | | 3 | | |
| CO-2 | 3 | | | | | | | | | | | | 3 | | |
| CO-3 | 3 | | | | | | | | | | | | 3 | | |
| CO-4 | | 3 | | | | | | | | | | | 3 | | |
| CO-5 | | 3 | | | | | | | | | | | 3 | | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

## 6. Course Teaching and Learning Methods

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 40 |
| **Demonstrations** | | 00 |
| 1. Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |

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| | | |
|---|---|---|
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 00 |
| 1. Solving Numerical Problems | 00 | |
| **Practical Work** | | 20 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 30 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 00 |
| 1. Case Study Presentation | 00 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **70** |

## 7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B. Tech. Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2 or SC3), COs are assessed as illustrated in the following Table.

| **For Theory Courses Only** | | | |
|---|---|---|---|
| **Focus of COs on each Component or Subcomponent of Evaluation** | | | |
| | **Component 1: CE (50% Weightage)** | | **Component 2: SEE (50% Weightage)** |
| **Subcomponent ▸** | | | |
| **Subcomponent Type ▸** | **Term Tests** | **Assignments** | **100 Marks** |
| **Maximum Marks ▸** | **50** | **50** | |
| **CO-1** | X | | X |
| **CO-2** | X | X | X |
| **CO-3** | X | X | X |
| **CO-4** | X | X | X |
| **CO-5** | X | X | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

## 8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures |
| 2. | Understanding | Classroom lectures, Self-study |
| 3. | Critical Skills | Assignment |
| 4. | Analytical Skills | Assignment |
| 5. | Problem Solving Skills | Assignment, Examination |
| 6. | Practical Skills | Assignment |
| 7. | Group Work | -- |
| 8. | Self-Learning | Self-study |
| 9. | Written Communication Skills | Assignment, Examination |
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | -- |
| 13. | Information Management | Assignment |
| 14. | Personal Management | -- |
| 15. | Leadership Skills | -- |

## 9. Course Resources

### a. Essential Reading

1. Class Notes
2. V. K. Manglik, 2013, Elements of Mechanical Engineering, PHI Learning
3. K. R. Gopalakrishna, 2008, Elements of Mechanical Engineering, Subhash Publishers

### b. Recommended Reading

1. G.D. Gokak, J.K. Kittur, 2014, Elements of Mechanical Engineering, Wiley publications
2. G. S. Sawhney, 2003, Fundamental of Mechanical Engineering, Prentice Hall of India Publication
3. S. Trymbaka Murthy, 2006, A Text Book of Elements of Mechanical Engineering, 3rd Revised Edition, I .K. International Publishing House Pvt. Ltd.
4. K. P. Roy and S. K. Hajra Chaudhary, 2005, Elements of Mechanical Engineering, Media Promoters and Publishers Pvt. Ltd.

### c. Magazines and Journals

1. ASME Mechanical Engineering Magazine
2. Machine Tools

### d. Websites

1. https://www.coursera.org/
2. http://nptel.ac.in/
3. www.asme.org

### e. Other Electronic Resources

1. Electronic resources on the course area are available on RUAS library

**Course Specifications: Elements of Electrical Engineering and Laboratory**

| | |
|---|---|
| **Course Title** | Elements of Electrical Engineering and Laboratory |
| **Course Code** | EEF105A |
| **Course Type** | Core Theory and Laboratory |
| **Department** | Applicable to all Programmes |
| **Faculty** | Engineering and Technology |

1. **Course Summary**

This course deals with basic principles and concepts of electric and magnetic circuits. Students are taught construction, principle of operation, working, characteristics of DC machines, transformers and AC rotating machines. They are introduced to fractional-kW motors, special purpose machines and facilitated to understand measuring instruments, domestic wiring and earthing techniques. Basic electrical laboratory deals with practical applications of circuits and their theoretical concepts.

2. **Course Size and Credits:**

| | |
|---|---|
| **Number of Credits** | 04 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:0:1 |
| **Total Hours of Interaction** | 75 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electrical Engineering |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

3. **Course Outcomes (COs)**

After the successful completion of this course, the student will be able to:

**CO-1.** State and explain various laws of electric circuits, magnetic circuits and their significance, phasor diagrams for electrical elements
**CO-2.** Explain construction, principle of operation, working and characteristics of DC machines, transformers, AC rotating machines and their applications
**CO-3.** Derive equations for electrical circuits, magnetic circuits and performance of various AC and DC machines
**CO-4.** Solve problems on electric circuits, magnetic circuits, DC machines, transformers and AC rotating machines
**CO-5.** Conduct experiments as per the standard procedures and tabulate/calculate/plot the measured values
**CO-6.** Interpret and compare with standard results, and draw conclusions and Write report as per the prescribed format

4. **Course Contents**

**Unit 1 (Circuit Analysis Technique-I):** DC Fundamentals: Circuit elements, voltage and current division, Ohm's law and Kirchhoff's laws, mesh analysis, nodal analysis, source transformations, application of star delta transformation, Thevenin's theorem, maximum power transfer theorem, superposition theorem.

**Unit 2 (Circuit Analysis Technique-II):** A.C. Fundamentals: Sinusoidal voltage and currents, period, frequency, instantaneous, peak, average, r.m.s. values, peak factor and form factor, phase difference, lagging, leading and in phase quantities. Simple R, L and C circuits.

**Unit 3 (Magnetic Circuits):** Magnetic effect of electrical current, cross and dot convention, right hand thumb rule and cork screw rule, Fleming's right hand rule, Fleming's left hand rule, Faraday's law of electromagnetic induction, statically and dynamically induced EMF's, concepts of m.m.f, flux, flux density, reluctance, permeability and field strength, basic analogy between electric and magnetic circuits.

**Unit 4 (DC Machines):** Constructional details, working principle and methods of excitation of DC machine as a generator and a motor. EMF equation of generator, relation between inducedEMF and terminal voltage with brush contact drop, back EMF, torque equation of a DC motor.

**Unit 5 (Transformers and AC Rotating Machines):** Single Phase Transformers: Necessity of transformer, Constructional Details (core and shell types), Principle of operation, Ideal Transformer and Practical Transformer. EMF equation, Losses, Transformer Test, Circuit Model of Transformer, Determination of Parameters of Circuit Model of Transformer, Impedance shifting, Efficiency and Regulation Calculations
Three phase induction machine: Constructional details, principle of operation, slip and rotor frequency.

**Unit 6 (Domestic Wiring):** Domestic wiring, concealed conduit wiring, two-way and three-way control

**Unit 7 (Laboratory): List of Experiments**

| No. | Course Content for Laboratory |
|---|---|
| 1 | Verification of KVL and KCL for DC circuits |
| 2 | Verification of superposition theorem |
| 3 | Verification of Thevenin's theorem |
| 4 | Verification of maximum power transfer theorem |
| 5 | Verification of mesh analysis |
| 6 | Verification of node analysis |
| 7 | Determination of relationship between phase and line voltages;<br>Phase and line currents in a three phase system |
| 8 | Determination of efficiency of a single phase transformer |
| 9 | Analysis of load characteristics of DC shunt motor |
| 10 | Wiring of two-way and three-way switching of lamp |

## 5. Course Map (CO-PO-PSO Map)

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | 2 | | | | 2 | 2 | | | 1 | | 1 | 3 | 2 | 1 |
| CO-2 | 3 | 2 | | | | 2 | 2 | | | | | 1 | 3 | 2 | 1 |
| CO-3 | 3 | 2 | 2 | | | | | | | | | 1 | 3 | | 1 |
| CO-4 | 3 | 3 | 2 | | 2 | | | | 1 | 1 | | 1 | 3 | 2 | 1 |
| CO-5 | 3 | 3 | 3 | 2 | 2 | 2 | | | 1 | 1 | 1 | 1 | 3 | 2 | 1 |
| CO-6 | 3 | 3 | 3 | 2 | 2 | | | | 1 | 1 | 1 | | 3 | 2 | 1 |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |



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## 6. Course Teaching and Learning Methods

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 30 |
| **Demonstrations** | | 00 |
| 1. Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 15 |
| 1. Solving Numerical Problems | 30 | |
| **Practical Work** | | 30 |
| 1. Course Laboratory | 20 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 00 |
| 1. Case Study Presentation | 00 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **85** |

## 7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B. Tech. Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (TSC1, TSC2, TSC3 and LSC4), COs are assessed as illustrated in the following Table.

| **For Combined Courses (Theory + Laboratory)** | | | | | |
|---|---|---|---|---|---|
| **Focus of COs on each Component or Subcomponent of Evaluation** | | | | | |
| **Course Outcome** | **CE (Weightage: 50 %)** | | | **SEE (Weightage: 35 %)** | **Lab (Weightage: 15 %)** |
| | **Tests** | **Assignments** | **Lab CE** | **Written exam** | **LSEE: SEE** |
| | **50 marks** | **25 Marks** | **25 Marks** | **70 Marks** | **30 Marks** |
| **CO-1** | X | | | X | |
| **CO-2** | X | | | X | |
| **CO-3** | X | | | X | |
| **CO-4** | X | X | | X | |
| **CO-5** | X | X | | X | |
| **CO-6** | | X | X | | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

## 8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures |
| 2. | Understanding | Classroom lectures, Self-study |
| 3. | Critical Skills | Assignment |
| 4. | Analytical Skills | Assignment |
| 5. | Problem Solving Skills | Assignment, Examination |
| 6. | Practical Skills | Assignment |
| 7. | Group Work | -- |
| 8. | Self-Learning | Self-study |
| 9. | Written Communication Skills | Assignment, Examination |
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | -- |
| 13. | Information Management | Assignment |
| 14. | Personal Management | -- |
| 15. | Leadership Skills | -- |

## 9. Course Resources

### a. Essential Reading

1. Course notes
2. Edward Hughes, 2011, Electrical and Electronics Technology, 10th edition, Dorling Kindersley India Pvt. Ltd.
3. Del Toro V. 2008, Electrical Engineering Fundamentals, PHI

### b. Recommended Reading

1. Mittle V. and Arvind Mittle, 2007, Basic Electrical and Electronics Engineering, Tata McGraw Hill, New Delhi
2. Delton Horn T. 1993, Basic Electricity and Electronics, McGraw-Hill Limited, Europe

### c. Magazines and Journals

1. IEEE Circuits and Designs magazine

### d. Websites

1. https://www.coursera.org/
2. http://nptel.ac.in/

### e. Other Electronic Resources

1. MULTISIM/ PROTEUS

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**Course Specifications: Elements of Computer Science and Engineering**

| | |
|---|---|
| **Course Title** | Elements of Computer Science and Engineering and Laboratory |
| **Course Code** | CSF106A |
| **Course Type** | Core Theory and laboratory |
| **Department** | Applicable to all Programmes |
| **Faculty** | Engineering and Technology |

**1. Course Summary**

This course is intended to provide an understanding of the elements of computer science and engineering and development of computer programs using algorithmic and programming constructs, for students across streams. Elements and methods of computer science and engineering and their applications to engineering computational problems are discussed using illustrative examples. Students are taught the methodology of solving computational problems algorithmically, programming concepts and constructs, basic algorithms and data structures. They are also exposed tothe practice of software development, modern computing systems and their scope for engineering applications.

**2. Course Size and Credits**

| | |
|---|---|
| **Number of Credits** | 03 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:0:1 |
| **Total Hours of Interaction** | 75 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Computer Science and Engineering |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

**3. Course Outcomes (COs)**

After the successful completion of this course, the student will be able to:

**CO-1.** Describe the elements and methodology of Computer Science and Engineering
**CO-2.** Explain the basic principles and techniques of algorithms and programming
**CO-3.** Select appropriate approach to solve a computational problem
**CO-4.** Design an algorithmic solution and draw a flow chart of the solution
**CO-5.** Develop computer programs for moderately complex problems
**CO-6.** Test and validate developed computer programs

**4. Course Contents**

**Unit 1 (Introduction):** Computers and other computing devices, interface between Computer Science and Engineering (CSE) and other disciplines, idea of computing, nature and purpose of CSE, software and computer programs, practice of CSE. Relationship between data, information and knowledge.

**Unit 2 (Problem Solving using Computers):** Algorithmic problem solving. Flowcharts: symbols and meaning. Drawing flowcharts for simple problems. Fundamental algorithms, efficiency. Example of algorithms in practice: Illustration of algorithms for numerical computation, simulation and data processing in engineering domains. Lab Exercises on Problem Solving Using Computers.

**Unit 3 (Building Blocks of Computer Programs):** Programming languages and process of compiling and program execution. Data representation and storage. Python programming language, IDEs and Workbooks. Data types, variables and keywords. Program structure. Simple data manipulation and logical statements, lists, tuples, sets and dictionaries, conditional and looping control statements, functions, nested expressions, recursion. Plotting and other utility libraries. Lab Exercises on Building Blocks of Computers.

**Unit 4 (Elements of Computer Programming):** Elements of good programming style, decomposing problems, moving from algorithm to code, random number generation, testing and validation of programs. Lab Exercises on Problem Solving Using random number generation.

**Unit 5 (Basic Algorithms and Data Structures):** Iterative and recursive algorithms, algorithms for search, sorting algorithms, idea of a data structure, basic data structures and algorithms, and their use. Lab Exercises on Problem Solving Using Iterative and recursive algorithms.

**Unit 6 (Algorithm Design):** Recursion, Brute force, Divide and conquer, Greedy approaches. Introduction to Backtracking and Dynamic programming.

**Unit 7 (Modern Computing Systems):** Software development process, operating systems, network of computers, distributed computing, high performance computing, Internet and Web technology, cloud computing.

**5. Course Map (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 2 | 1 | 3 | 2 | 2 | 2 | | 1 | | | 1 | 2 | 3 | 2 | 2 |
| CO-2 | 2 | 1 | 3 | 2 | 2 | 2 | | 1 | | | 1 | 2 | 3 | 2 | 2 |
| CO-3 | 2 | 1 | 3 | 2 | 2 | 2 | | 1 | | | 1 | 2 | 3 | 2 | 2 |
| CO-4 | 2 | 1 | 3 | 2 | 2 | 2 | | 1 | | | 1 | 2 | 3 | 2 | 2 |
| CO-5 | 2 | 1 | 3 | 2 | 2 | 2 | | 1 | | | 1 | 2 | 3 | 2 | 2 |
| CO-6 | 2 | 1 | 3 | 2 | 2 | 2 | | 1 | | | 1 | 2 | 3 | 2 | 2 |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 45 |
| **Demonstrations** | | 00 |
| 1. Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 00 |
| 1. Solving Numerical Problems | 00 | |
| **Practical Work** | | 30 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 30 | |

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| | | |
|---|---|---|
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | |
| 1. Case Study Presentation | 00 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | 00 |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **85** |

**7. Course Assessment and Reassessment**

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B. Tech. Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2 or SC3), COs are assessed as illustrated in the following Table.

| **For Combined Courses (Theory + Laboratory)** | | | | | |
|---|---|---|---|---|---|
| **Focus of COs on each Component or Subcomponent of Evaluation** | | | | | |
| **Course Outcome** | **CE (Weightage: 50 %)** | | | **SEE (Weightage: 35 %)** | **Lab (Weightage: 15 %)** |
| | **Tests** | **Assignments** | **Lab CE** | **Written exam** | **LSEE: SEE** |
| | **50 marks** | **25 Marks** | **25 Marks** | **70 Marks** | **30 Marks** |
| **CO-1** | X | | | X | |
| **CO-2** | X | | | X | |
| **CO-3** | X | | | X | |
| **CO-4** | X | X | | X | |
| **CO-5** | X | X | | X | |
| **CO-6** | | X | X | | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

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## 8. Achieving Cos

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures |
| 2. | Understanding | Classroom lectures, Self-study |
| 3. | Critical Skills | Assignment |
| 4. | Analytical Skills | Assignment |
| 5. | Problem Solving Skills | Assignment, Examination |
| 6. | Practical Skills | Assignment |
| 7. | Group Work | -- |
| 8. | Self-Learning | Self-study |
| 9. | Written Communication Skills | Assignment, Examination |
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | -- |
| 13. | Information Management | Assignment |
| 14. | Personal Management | -- |
| 15. | Leadership Skills | -- |

## 9. Course Resources

**Essential Reading**

1. Class notes

Dromey, R. G., 1982, How to Solve It by Computer, New Delhi: PearsonEducation.

**b. Recommended Reading**

1. Downey, A. B., 2016, Think Python: How to Think Like a Computer Scientist, O'Rielly.
2. Polya, G., 1990, How to Solve It: A New Aspect of Mathematical Method, 2nd edn. New Delhi: Penguin Books.
3. Aho, A. V., Hopcropt, J. E., and Ulman, J. D., 1974, The Design and Analysis of Computer Algorithms, New Delhi: Pearson Education.

**c. Magazines and Journals**

1. Quanta Magazine Computer Science Section, http://www.quantamagazine.org/ computerscience
2. Dr. Dobb's Journal, http://drdobbs.com/
3. Lifehacker, https://lifehacker.com/

**d. Websites**

1. Association of Computing Machinery (ACM), http://www.acm.org/
2. IEEE Computer Society, http://www.computer.org/

**e. Other Electronic Resources**

1. Electronic resources on the course area available on MSRUAS library
2. Think Python online: http://openbookproject.net/thinkcs/python/english2e/

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**Course Specifications: Professional Communication**

| | |
|---|---|
| **Course Title** | Professional Communication |
| **Course Code** | TSN101A |
| **Course Type** | Ability Enhancement Compulsory Course |
| **Department** | Applicable to all Programmes |
| **Faculty** | Engineering and Technology |

## 1. Course Summary

This course aims at equipping students with the skills required for effective communication in professional context. The students will be guided through professional practices of written and oral communication. Students will be sensitized to the importance of professional etiquette. Students will be taught to apply oral and written communication skills in a given situation.

## 2. Course Size and Credits

| | |
|---|---|
| **Number of Credits** | 02 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 2:0:0 |
| **Total Hours of Interaction** | 30 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Directorate of Transferable Skills and Leadership Development |
| **Total Course Marks** | 50 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

## 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Apply the concepts of grammar for communication
**CO-2.** Compose precise paragraphs
**CO-3.** Demonstrate professional etiquette
**CO-4.** Demonstrate appropriate verbal and non-verbal communication in the given context
**CO-5.** Develop professional written document

## 4. Course Contents

**Unit 1 (Grammar for Effective Communication):** Sentence formation, sentence types, different parts of speech, adjectives and articles, verbs and preposition, present and past tense, future tense,use of participles in different tenses, usage of tenses, rules of subject verb agreement, Direct and indirect sentences, usage of direct and indirect sentences

**Unit 2 (Communication – Verbal: Written):** Paragraph Writing: Structure of a paragraph – topic sentence, supporting sentence, conclusion sentence, functions of paragraph, paragraph patterns, paragraph writing principles – coherence, unity, order, length; Précis Writing: Paraphrasing techniques, Usage of appropriate words;

Report Writing: Purpose of report writing, report format, use of language while report writing

**Unit 3 (Communication-Nonverbal):** Meaning, Nature and importance, Kinesics, Proxemics, Time, Paralanguage, Touching Behavior, Body Language, effects of nonverbal communication on verbal communication

**Unit 4 (Professional Etiquette):** Etiquette and its importance, types of etiquette - email etiquette, telephone etiquette, conversation; Body language in conversation, tones in conversation, conversation manners, stages of conversation – introduction, feed forward, close, order of introduction, conversation barriers

**Unit 5 (Presentation):** The importance of presentation skills, various stages of presentation planning – Development of structure and style, interpersonal sensitivity, presentation accessories and equipment, time management during presentation, stages of presentation – introduction, body and conclusion, presentation etiquette

## 5. Course Map (CO-PO-PSO Map)

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | | | | | | | | | | 2 | | | | | 2 |
| CO-2 | | | | | | | | | | 3 | | | | | 3 |
| CO-3 | | | | | | | | | 3 | | | | | | 3 |
| CO-4 | | | | | | | | | 3 | 3 | | | | | 3 |
| CO-5 | | | | | | | | | | 3 | | | | | 3 |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

## 6. Course Teaching and Learning Methods

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 20 |
| **Demonstrations** | | 0 |
| 1.Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 0 |
| 1. Solving Numerical Problems | 00 | |
| **Practical Work** | | 04 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 04 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |



4/20

| | | |
|---|---|---|
| 9. | Written Communication Skills | Face to face lectures, Course work, practice, assignment, group discussion |
| 10. | Verbal Communication Skills | Face to face lectures, Course work, practice, assignment, group discussion |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | Course work, practice, assignment, group discussion, presentation practice, role plays |
| 13. | Information Management | Assignment |
| 14. | Personal Management | -- |
| 15. | Leadership Skills | -- |

## 9. Course Resources

### a. Essential Reading

1. Class Notes
2. Raman M and Sharma S (2004) Technical Communication: Principles and Practice. New Delhi: Oxford University Press
3. Hory Sankar Mukherjee, (2013), Business Communication, Oxford University Press
4. Kroehnert, Gary (2004), Basic Presentation Skills, Tata McGraw Hill

### b. Recommended Reading

1. Sathya Swaroop Debashish and Bhagaban Das, (2014), Business Communication, PHI, New Delhi
2. Young, Dona J (2006) Foundations of Business Communications:
3. An Integrated Approach, Tata McGraw Hill
4. Kaul, Asha (2007) Effective Business Communication, Prentice Hall India
5. Bienvenu, Sherron (2008) The Presentation Skills Workshop, Prentice Hall
6. KavitaTyagi and Padma Misra (2011) Professional Communication, PHI Learning Private Limited, New Delhi

### c. Magazines and Journals

### d. Websites

1. www.myenglishpages.com
2. www.britishcouncil.com
3. www.englishmagazine.com
4. www.justenglishmagazine.com

### e. Other Electronic Resources

1. Electronic resources on the course area are available on RUAS library

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| | | |
|---|---|---|
| **Others** | | |
| 1. Case Study Presentation | 02 | 06 |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 02 | |
| 5. Group Discussions | 02 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **40** |

### 7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment is presented in the Programme Specifications document pertaining to the B. Tech. Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2), COs are assessed as illustrated in the following Table.
Focus of CO's on each Component or Subcomponent of Evaluation:

| **For Theory Courses Only** | | | |
|---|---|---|---|
| **Focus of COs on each Component or Subcomponent of Evaluation** | | | |
| | **Component 1: CE (50% Weightage)** | | **Component 2: SEE (50% Weightage)** |
| **Subcomponent ▸** | | | |
| **Subcomponent Type ▸** | **Term Tests** | **Assignments** | **50 Marks** |
| **Maximum Marks ▸** | **25** | **25** | |
| **CO-1** | X | X | X |
| **CO-2** | | | X |
| **CO-3** | | X | X |
| **CO-4** | X | | |
| **CO-5** | X | X | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.
Course reassessment policies are presented in the Academic Regulations document.

### 8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Face to face lectures |
| 2. | Understanding | Face to face lectures, group discussions |
| 3. | Critical Skills | -- |
| 4. | Analytical Skills | Face to face lectures, activities, , group discussions, assignment |
| 5. | Problem Solving Skills | -- |
| 6. | Practical Skills | Face to face lectures, activities, , group discussions, course work |
| 7. | Group Work | Course work, practice, assignment, group discussion |
| 8. | Self-Learning | Course work, practice, assignment, group discussion |

**Course Specifications:** Engineering Mathematics - 3

| | |
|---|---|
| **Course Title** | Engineering Mathematics - 3 |
| **Course Code** | MTF201A |
| **Course Type** | Core Theory |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

1. **Course Summary**

This course deals with vector calculus, various transform techniques in the context of engineering problems. The rudimentary principles and important theorems in vector calculus are taught in this course. The assumptions, principles and distinguishing features of Fourier series, Fourier transform and Laplace transform are emphasized. This course also covers the underlying principles and applications of transform techniques in various engineering disciplines. This course also aims at solving engineering problems associated with Fourier series, Fourier transform and Laplace transform methods using MATLAB.

2. **Course Size and Credits:**

| | |
|---|---|
| **Number of Credits** | 04 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:1:0 |
| **Total Hours of Interaction** | 60 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Mathematics and Statistics |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

3. **Course Outcomes (COs)**

After the successful completion of this course, the student will be able to:

**CO-1.** State and explain the important theorems in Fourier series, transforms and vector integral calculus
**CO-2.** Solve simple problems in Fourier series, transforms and vector calculus
**CO-3.** Apply Fourier series, transforms and vector calculus in solving complex real world engineering problems
**CO-4.** Implement the programs to solve system of linear equations and non-linear equations of single variable using MATLAB
**CO-5.** Apply interpolation and numerical integration method in analyzing some real world problems

4. **Course Contents**

**Unit 1 (Fourier Series and Fourier Transform):** Periodic functions, Dirichlet's conditions for convergence of Fourier series, Fourier series for a periodic function of period T, half range Fourier series, complex Fourier series. Fourier Transform - Definition, Fourier transform of elementary functions, properties. Inverse Fourier transform, solution of initial value problems.

**Unit 2 (Vector Calculus):** Review of vector algebra, vector and scalar fields, derivatives of vector valued functions, curves, tangents, arc length. Gradient of a scalar field, directional derivatives, divergence and curl of a vector field. Polar, Cylindrical and Spherical coordinates systems. Line integral, double integral and triple integral, Green's theorem, Stokes' theorem, Gauss divergence

theorem.

**Unit 3 (MATLAB):** Introduction to MATLAB, Basic algebraic and matrix operations, built-in and command line functions, Plots Scripts and functions. Interpolation - Lagrange interpolation, Newton's divided difference interpolation, Newton-Raphson method and Numerical solution of system of linear equations by Gauss Seidel method, MATLAB function for real Fourier series, complex Fourier series and harmonic series, Newton-Cotes' quadrature, trapezoidal, Simpson's 1/3 and Simpson's 3/8 rules, and Gaussian quadrature.

**5. Course Map (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | 3 | | 2 | | | | | 1 | 1 | | | 3 | 2 | 1 |
| CO-2 | 3 | 3 | | | | | | | | | | | 3 | | |
| CO-3 | 3 | 3 | | | | | | | | | | | 3 | | |
| CO-4 | 3 | 3 | 3 | | 2 | | | | 1 | 1 | | | 3 | 2 | 1 |
| CO-5 | 3 | 3 | 3 | | 2 | | | | 1 | 1 | | | 3 | 2 | 1 |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 45 |
| **Demonstrations** | | 00 |
| 1. Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 00 |
| 1. Solving Numerical Problems | 00 | |
| **Practical Work** | | 15 |
| 1. Course Laboratory | | |
| 2. Computer Laboratory | 15 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 00 |
| 1. Case Study Presentation | 00 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **70** |

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**7. Course Assessment and Reassessment**

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B. Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3), COs are assessed as illustrated in the following Table.

| **For Theory Courses Only** | | | |
|---|---|---|---|
| **Focus of COs on each Component or Subcomponent of Evaluation** | | | |
| | **Component 1: CE (50% Weightage)** | | **Component 2: SEE (50% Weightage)** |
| **Subcomponent ▸** | | | |
| **Subcomponent Type ▸** | **Term Tests** | **Assignments** | **100 Marks** |
| **Maximum Marks ▸** | **50** | **50** | |
| **CO-1** | X | | X |
| **CO-2** | X | | X |
| **CO-3** | X | | X |
| **CO-4** | | X | X |
| **CO-5** | | X | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

**8. Achieving COs**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures |
| 2. | Understanding | Classroom lectures, Self-study |
| 3. | Critical Skills | Assignment |
| 4. | Analytical Skills | Assignment |
| 5. | Problem Solving Skills | Assignment, Examination |
| 6. | Practical Skills | Assignment |
| 7. | Group Work | -- |
| 8. | Self-Learning | Self-study |
| 9. | Written Communication Skills | Assignment, Examination |
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | -- |
| 13. | Information Management | Assignment |
| 14. | Personal Management | -- |
| 15. | Leadership Skills | -- |

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9. **Course Resources**

a. **Essential Reading**

1. Glyn James, 2016, Advanced Modern Engineering Mathematics, 4th edition, Pearson
2. Dennis Zill and Warren Wright, 2011, Advanced Engineering Mathematics, 4th edition, Jones and Bartlet
3. Erwin Kreyszig, 2015, Advanced Engineering Mathematics, tenth edition, John Wiley & Sons Inc.

b. **Recommended Reading**

1. L. Chanparro, 2010, Signals and Systems using MATLAB, Academic Press
2. S.D. Stearns and D. R. Hush, 2011, Digital Signal Processing with Examples in MATLAB, CRC Press

c. **Magazines and Journals**

d. **Websites**

1. http://nptel.ac.in/
2. https://ocw.mit.edu/index.htm

e. **Other Electronic Resources**

1. https://www.khanacademy.org/
2. tutorial.math.lamar.edu/

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## Course Specifications: Signals and Systems

| | |
|---|---|
| **Course Title** | Signals and Systems |
| **Course Code** | ECC202A |
| **Course Type** | Core Theory |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

### 1. Course Summary

This course deals with continuous-time and discrete-time signals and systems. Students are taught the various continuous-time and discrete-time signals and systems, the underlying mathematics required for analysis and understanding of signals and systems including Fourier and z-transforms. Students are also taught to perform time and frequency domain analysis of systems including stability and are exposed to software tools for solving signals and systems problems.

### 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 04 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:1:0 |
| **Total Hours of Interaction** | 60 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

### 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Describe the signals and systems, their classification and perform the basic operations on signals
**CO-2.** Evaluate the time response of continuous-time and discrete-time systems LTI systems for specified inputs and impulse response
**CO-3.** Compute the Fourier series of periodic signals, Fourier transform of aperiodic signals and z-transform of discrete-time signals
**CO-4.** Solve problems on signal generation, signal manipulation, classification of signals and systems
**CO-5.** Analyse signals and systems in both time and transformed domains
**CO-6.** Use standard software tools to analyse and perform time and frequency domain analysis of signals and systems

### 4. Course Contents

**Unit 1 (Signals and Systems):** Basic definitions, continuous and discrete time signals, transformation of the independent variable, classification of signals, operations on signals, continuous-time and discrete-time systems, classification of systems

**Unit 2 (Linear and Time-invariant Systems):** Convolution sum and convolution integral, Singularity functions, impulse response of LTI systems, properties of convolution, Causal LTI systems described by differential and difference equations, Solution of differential and difference equations, Block diagram representation.

**Unit 3 (Fourier Series Representation of Periodic Signals):** The response of LTI systems for complex exponentials, Fourier series representation of continuous time and discrete time periodic signals,Convergence of Fourier series, Properties of continuous time and discrete time Fourier series.

**Unit 4 (Continuous–Time Fourier Transform):** Sampling Theorem, Reconstruction of signal from its samples

and Aliasing Continuous-time Fourier transform, properties of CTFT, CTFT pairs, Systems characterized by linear constant coefficient differential equations.

**Unit 5 (Discrete–Time Fourier Transform):** Discrete-time Fourier transform, properties of DTFT, DTFT pairs, Systems characterized by linear constant coefficient difference equations.

**Unit 6 (The z-Transform):** Definition of z-transform, Region of convergence for z-Transforms, Properties of the z-Transform, z-Transform pairs, Inverse z-Transform, Solution of difference equations, Analysis and characterization of LTI systems using z-Transform, System function algebra and block diagram representation, Unilateral z-transform and properties, solving difference equations using unilateral z- transform

**5. Course Map (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO- |
| CO-1 | 3 | 2 | | | | | | | | | | | 3 | | |
| CO-2 | 3 | 3 | 1 | 2 | 2 | | | | | | | | 3 | 3 | |
| CO-3 | 2 | 3 | 2 | 3 | 3 | 2 | | | | | | | 2 | 3 | |
| CO-4 | 1 | 3 | 2 | 3 | 3 | 2 | 2 | | | | | | 3 | 3 | |
| CO-5 | 1 | 1 | 2 | 3 | 3 | 3 | 2 | | | | | | 3 | 3 | |
| CO-6 | 1 | 1 | 3 | 3 | 3 | 3 | 2 | | | | | | 1 | 3 | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 40 |
| **Demonstrations** | | 05 |
| 1. Demonstration using Videos | 05 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 15 |
| 1. Solving Numerical Problems | 15 | |
| **Practical Work** | | 00 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 00 |
| 1. Case Study Presentation | 00 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **70** |

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**7. Course Assessment and Reassessment**

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B. Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the Cos. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3), Cos are assessed as illustrated in the following Table.

| For Theory Courses Only | | | |
|---|---|---|---|
| Focus of COs on each Component or Subcomponent of Evaluation | | | |
| | Component 1: CE (50% Weightage) | | Component 2: SEE (50% Weightage) |
| Subcomponent ▸ | | | |
| Subcomponent Type ▸ | Term Tests | Assignments | 100 Marks |
| Maximum Marks ▸ | 50 | 50 | |
| CO-1 | X | | X |
| CO-2 | X | | X |
| CO-3 | X | | X |
| CO-4 | X | | X |
| CO-5 | | X | X |
| CO-6 | | X | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

**8. Achieving COs**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom Lectures |
| 2. | Understanding | Classroom Lectures, Self-study |
| 3. | Critical Skills | Assignment |
| 4. | Analytical Skills | Assignment |
| 5. | Problem Solving Skills | Assignment and Exam |
| 6. | Practical Skills | Assignment |
| 7. | Group Work | Assignment |
| 8. | Self-Learning | Self-learning |
| 9. | Written Communication Skills | Assignment |
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | Assignment |
| 12. | Behavioral Skills | -- |
| 13. | Information Management | Assignment |
| 14. | Personal Management | -- |
| 15. | Leadership Skills | -- |

**9. Course Resources**

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**a. Essential Reading**

1. Course Notes
2. Simon Haykins and Van Veen, 2004, Signals and Systems. John Wiley and Sons

**b. Recommended Reading**

1. Gordon E. Carlson, 1998, Signal and Linear System Analysis. 2nd Edition. Wiley
2. Alan V. Oppenheim, Alan Willsky and Hamid Nawab, 2007, Signals and Systems. Pearson Education

**c. Magazines and Journals**

1. IEEE Signal Processing Magazine

**d. Websites**

1. https://signalprocessingsociety.org

**e. Other Electronic Resources**

1. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/

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**Course Specifications: Electronic Circuits**

| | |
|---|---|
| **Course Title** | Electronic Circuits |
| **Course Code** | ECC203A |
| **Course Type** | Core Theory |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

**1. Course Summary**

This course deals with the analysis and design of basic transistor amplifier circuits, feedback amplifiers and large signal amplifiers. The students are taught the methods of biasing transistors and the design of simple amplifier circuits. Mid-band analysis of amplifier circuits using small - signal equivalent circuits are also emphasized in this course. Students are trained to design and analyse LC oscillators and power amplifiers.

**2. Course Size and Credits:**

| | |
|---|---|
| **Number of Credits** | 04 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:1:0 |
| **Total Hours of Interaction** | 60 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

**3. Course Outcomes (COs)**

After the successful completion of this course, the student will be able to:

**CO-1.** Explain the principles of biasing the transistors, small and large signal amplifier configurations
**CO-2.** Describe working principles of feedback amplifiers, power amplifiers and oscillators
**CO-3.** Solve problems on stability factors, gain, impedance, efficiency, distortion of amplifiers,resonance frequency of oscillators and performance parameters of feedback amplifiers
**CO-4.** Design transistor biasing circuits and small signal amplifier circuits
**CO-5.** Analyse the stability aspects of amplifiers, performance of feedback amplifiers
**CO-6.** Simulate and analyse the designs using standard circuit simulation tool

**4. Course Contents**

**Unit 1 (Transistor Analysis):** BJT – Need for biasing – Stability factor - Fixed bias circuit, Load line and quiescent point. Variation of quiescent point due to FE h variation within manufacturers tolerance - Stability factors - Different types of biasing circuits - Method of stabilizing the Q point - Advantage of Self bias (voltagedivider bias) over other types of biasing, Bias compensation – Diode, Thermistor and Sensistor compensations, Principles of biasing the FET. Simulation using standard circuit simulation tools.

**Unit 2 (Mid-band Analysis of Small Signal Amplifiers):** Small-signal equivalent circuit of diode, Small-signal equivalent circuits of transistor amplifier in CE, CC and CB configurations - Midband analysis of various types of single stage amplifiers to obtain gain, input impedance and output impedance - Miller's theorem - Comparison of CB, CE and CC amplifiers and their uses - Methods of increasing input impedance using Darlington connection and bootstrapping, Analysis of Multistage amplifiers. Simulation using standard circuit simulation tools.

**Unit 3 (Frequency Response Of Amplifiers):** General shape of frequency response of amplifiers - Definition of cutoff frequencies and bandwidth - Low frequency analysis of amplifiers to obtain lower cutoff frequency Hybrid – equivalent circuit of BJTs - High frequency analysis of BJT amplifiers to obtain upper cutoff

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frequency – Gain Bandwidth Product - High frequency equivalent circuit of FETs – High frequency analysis of FET amplifiers - Gain-bandwidth product of FETs - General expression for frequency response of multistage amplifiers - Calculation of overall upper and lower cutoff frequencies of multistage amplifiers - Amplifier rise time and sag and their relation to cutoff frequencies.

**Unit 4 (Large Signal Amplifiers):** Classification of amplifiers, Class A large signal amplifiers, second harmonic distortion, higher order harmonic distortion, transformer-coupled class A audio power amplifier – efficiency of Class A amplifiers. Class B amplifier – efficiency - push-pull amplifier - distortion in amplifiers - complementary-symmetry (Class B) push-pull amplifier, Class C tuned amplifiers, Significance of heat sink.

**Unit 5 (Feedback Amplifiers):** Block diagram, Loop gain, Gain with feedback, Effects of negative feedback – Sensitivity and de-sensitivity of gain, Cut-off frequencies, distortion, noise, input impedance and output impedance with feedback, Four types of negative feedback connections – voltage series feedback, voltage shunt feedback, current series feedback and current shunt feedback, Method of identifying feedback topology and feedback factor, Nyquist criterion for stability of feedback amplifiers.

**Unit 6 (Oscillators):** Classification, Barkhausen Criterion – Mechanism for start of oscillation and stabilization of amplitude, General form of an Oscillator, Analysis of LC oscillators – Hartley, Colpitts, RC oscillators –phase shift – Wien bridge –, Electrical equivalent circuit of Quartz Crystal, Miller and Pierce Crystal oscillators, frequency stability of oscillators.

**5. Course Map (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | | | | | | | | | | | 1 | 3 | | 1 |
| CO-2 | 3 | | | | | | | | | | | 1 | 3 | | 1 |
| CO-3 | 2 | 2 | | | | | | | | | | 1 | 2 | | 1 |
| CO-4 | 2 | 2 | 1 | | | | | | | | | 1 | 2 | | 1 |
| CO-5 | 1 | 2 | 1 | | | | | | | | | 1 | 2 | | 1 |
| CO-6 | | 2 | 1 | | | | | | | | | 1 | 2 | | 1 |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 35 |
| **Demonstrations** | | 05 |
| 1. Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 05 | |
| **Numeracy** | | 15 |
| 1. Solving Numerical Problems | 15 | |
| **Practical Work** | | 00 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |

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| | | |
|---|---|---|
| 6. Model Studio | 00 | |
| **Others** | | 05 |
| 1. Case Study Presentation | 00 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 05 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **70** |

**7. Course Assessment and Reassessment**

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B. Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3), COs are assessed as illustrated in the following Table.

| **For Theory Courses Only** | | | |
|---|---|---|---|
| **Focus of COs on each Component or Subcomponent of Evaluation** | | | |
| | **Component 1: CE (50% Weightage)** | | **Component 2: SEE (50% Weightage)** |
| **Subcomponent ▸** | | | |
| **Subcomponent Type ▸** | **Term Tests** | **Assignments** | **100 Marks** |
| **Maximum Marks ▸** | **50** | **50** | |
| **CO-1** | X | | X |
| **CO-2** | X | | X |
| **CO-3** | X | | X |
| **CO-4** | X | X | X |
| **CO-5** | | X | X |
| **CO-6** | | X | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

**8. Achieving COs**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures, Assignments |
| 2. | Understanding | Classroom lectures, Assignments |
| 3. | Critical Skills | Classroom lectures, Assignments |
| 4. | Analytical Skills | Classroom lectures, Assignments |
| 5. | Problem Solving Skills | Classroom lectures, Assignments |
| 6. | Practical Skills | -- |
| 7. | Group Work | Assignment |

| | | |
|---|---|---|
| 8. | Self-Learning | Assignment |
| 9. | Written Communication Skills | Assignment, examination |
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | Course work |
| 13. | Information Management | Assignment, examination |
| 14. | Personal Management | Course work |
| 15. | Leadership Skills | -- |

**9. Course Resources**

**a. Essential Reading**

1. Class Notes
2. J. Millman and C Halkias, 2007, Electronic Devices and Circuits. 2nd Edition. Tata McGraw- Hill

**b. Recommended Reading**

1. Charles Alexander and Matthew Sadiku, 2004, Fundamentals of Electric Circuits, McGraw-Hill
2. Richard Jaeger, 1997, Microelectronic Circuit Design, McGraw-Hill
3. John Hayes, 1993, Introduction to Digital Logic Design, Addison Wesley

**c. Magazines and Journals**

1. IEEE Circuits and Devices Magazine

**d. Websites**

1. http://www.electronicsforu.com/electronicsforu/lab/

**e. Other Electronic Resources**

1. MULTISIM/ PROTEUS
2. Data sheets of general-purpose transistors: http://www.farnell.com/datasheets/661741.pdf

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**Course Specifications: Network Analysis and Synthesis**

| | |
|---|---|
| **Course Title** | Network Analysis and Synthesis |
| **Course Code** | ECC204A |
| **Course Type** | Core Theory |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

**1. Course Summary**

The aim of this course is to present the fundamentals concepts of network analysis and synthesis. Students are taught basic network concepts and network theorems, Two-Port Networks, Elements of Realizability Theory, Synthesis of One-Port Network and Elements of transfer function synthesis.

**2. Course Size and Credits:**

| | |
|---|---|
| **Number of Credits** | 04 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:1:0 |
| **Total Hours of Interaction** | 60 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

**3. Course Outcomes (COs)**

After the successful completion of this course, the student will be able to:

**CO-1.** Explain network concepts, network theorems and Two-Port networks.
**CO-2.** Describe the elements of realizability Theory, synthesis of One-Port network with two kinds Of Elements and elements of transfer function synthesis
**CO-3.** Solve simple problems related to network analysis and synthesis
**CO-4.** Apply network concepts, network theorems and Two-Port networks.
**CO-5.** Model a system using the realizability Theory, One-Port network synthesis and transfer function synthesis
**CO-6.** Solve complex problems related to network analysis and synthesis

**4. Course Contents**

**Unit 1 (Basic Network Concepts):** Introduction to network analysis, Network elements, General characteristics and descriptions of signals , step, ramp and impulse functions and convolution integral, Network equations, Initial and final conditions, Solution of network equations for step and impulse inputs, Signal analysis

**Unit 2 (Network Theorems):** Thevinin's, Norton's, Max Power Transfer theorems, Milliman's Theorem, duality, Tellegens, Superposition, Reciprocity

**Unit 3 (Two-Port Networks):** Characterization of linear time-invariant two-port networks, open-circuit impedance parameters, short-circuit admittance parameters, transmission parameters, inverse transmission

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parameters, hybrid parameters, inverse hybrid parameters, interrelationship between the parameters, interconnection of two port networks, two-port symmetry, input impedance in terms of two-port parameters, output impedance, image impedance

**Unit 4 (Elements of Realizability Theory):** Causality and stability, Hurwitz polynomials, Positive real functions, Elementary synthesis procedures

**Unit 5 (Synthesis of One-Port Network with Two Kinds Of Elements):** Properties of L-C immittances functions, synthesis of L-C Driving –point immittances, properties of R-C Driving-point impedances, synthesis of R-C Impedances or R-L admittances, Properties of R-L impedances and RC admittances, synthesis of certain R-L-C functions

**Unit 6 (Elements of transfer function synthesis):** Properties of transfer functions, Zeroes of transmission, synthesis of Y21 and Z21 with a 1-Ω termination, synthesis of constant-resistance networks

**5. Course Map (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | | | | | | | | | | | | 2 | 1 | |
| CO-2 | 3 | | | | | | | | | | | | 2 | 1 | |
| CO-3 | 3 | 3 | 3 | 3 | 2 | | | | | | | | 3 | 3 | |
| CO-4 | 3 | 3 | 3 | 3 | 2 | | | | | | | | 3 | 3 | |
| CO-5 | 2 | 3 | 3 | 2 | 3 | | | | | | | | 3 | 3 | |
| CO-6 | 2 | 3 | 3 | 2 | 3 | | | | | | | | 3 | 3 | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 45 |
| **Demonstrations** | | |
| 1. Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 15 |
| 1. Solving Numerical Problems | 15 | |
| **Practical Work** | | 00 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 00 |
| 1. Case Study Presentation | 00 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |

| | | |
|---|---|---|
| 12. | Behavioral Skills | -- |
| 13. | Information Management | Assignment |
| 14. | Personal Management | -- |
| 15. | Leadership Skills | -- |

**9. Course Resources**

**a. Essential Reading**

1. Course notes
2. M. E. Van Valkenburg, 2006, Network Analysis, 3rd Edition, Pearson Education
3. Kuo, F.F. 2006, Network Analysis and Synthesis, 2nd Edition John Wiley & Sons
4. William Hayt and Jack E Kemmerly, 2013, Engineering Circuit Analysis. 8th Edition. McGraw Hill

**b. Recommended Reading**

1. Ravish R Singh, 2013, Network Analysis and Synthesis, Mumbai, McGraw Hill Education India Private Limited
2. Roy Choudhury, 2006, Networks and systems, 2nd Edition, New Age International
3. N.C.Jagan and C. Lakshminarayana (2006) Network Analysis. B.S. Publications

**c. Magazines and Journals**

1. Electronics for You' magazine.
2. 'Electronic Design' magazine.

**d. Websites**

1. https://www.edx.org/
2. https://www.coursera.org/

**e. Other Electronic Resources**

1. http://nptel.ac.in/

| | | |
|---|---|---|
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **70** |

**7. Course Assessment and Reassessment**

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B.Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3), COs are assessed as illustrated in the following Table.

| **For Theory Courses Only** | | | |
|---|---|---|---|
| **Focus of COs on each Component or Subcomponent of Evaluation** | | | |
| | **Component 1: CE (50% Weightage)** | | **Component 2: SEE (50% Weightage)** |
| **Subcomponent ▸** | | | |
| **Subcomponent Type ▸** | **Term Tests** | **Assignments** | **100 Marks** |
| **Maximum Marks ▸** | **50** | **50** | |
| **CO-1** | X | | X |
| **CO-2** | X | | X |
| **CO-3** | X | X | X |
| **CO-4** | | X | X |
| **CO-5** | | X | X |
| **CO-6** | | X | |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

**8. Achieving COs**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures |
| 2. | Understanding | Classroom lectures, self-study |
| 3. | Critical Skills | Assignment |
| 4. | Analytical Skills | Assignment |
| 5. | Problem Solving Skills | Assignment, Examination |
| 6. | Practical Skills | Assignment |
| 7. | Group Work | -- |
| 8. | Self-Learning | Self-study |
| 9. | Written Communication Skills | Assignment, examination |
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | -- |

5. **Course Map (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | 1 | | | | | | | | | | | 3 | 2 | |
| CO-2 | 3 | 1 | | | | | | | | | | | 3 | 2 | |
| CO-3 | 3 | 3 | 3 | 3 | 2 | | | | | | | | 3 | 3 | |
| CO-4 | 3 | 3 | 3 | 3 | 2 | | | | | | | | 3 | 3 | |
| CO-5 | 3 | 3 | 3 | 3 | 1 | | | | | | | | 3 | 3 | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

6. **Course Teaching and Learning Methods**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 40 |
| **Demonstrations** | | 05 |
| 1. Demonstration using Videos | 01 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 04 | |
| **Numeracy** | | 15 |
| 1. Solving Numerical Problems | 15 | |
| **Practical Work** | | 00 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 00 |
| 1. Case Study Presentation | 00 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **70** |

7. **Course Assessment and Reassessment**

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B. Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3), COs are assessed as illustrated in the following Table.

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**Course Specifications: Digital Logic Design**

| | |
|---|---|
| **Course Title** | Digital Logic Design |
| **Course Code** | ECC205A |
| **Course Type** | Core Theory |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

**1. Course Summary**

The aim of this course is to create a strong foundation of Digital Electronics. The students are taught the basic components of digital systems and the processes of their implementation. The students are also taught Boolean algebra, logic gates, basics of memories, and implementation of combinational and sequential digital circuits using logic gates. Students are trained to employ the principles of digital electronics to implement digital design for the given problem.

**2. Course Size and Credits:**

| | |
|---|---|
| **Number of Credits** | 04 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:1:0 |
| **Total Hours of Interaction** | 60 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

**3. Course Outcomes (COs)**

After the successful completion of this course, the student will be able to:

**CO-1.** Explain basic concepts of digital electronics such as Boolean algebra, logic functions
**CO-2.** Describe and Classify different types of digital circuit implementations
**CO-3.** Solve problems on logic design and logic minimization, and also incorporate them in software tools
**CO-4.** Analyze a practical problem and develop a logic design to solve the problem
**CO-5.** Apply digital design concepts for complex digital circuits

**4. Course Contents**

**Unit 1 (Introduction and Boolean Algebra):** Introduction to digital electronics, Boolean algebra, Boolean Operations and Expressions, Laws and Rules of Boolean Algebra, DeMorgan's Theorem, Boolean Analysis of Logic Circuits, Simplification using Boolean Algebra, Standard Forms of Boolean Expressions, Boolean Expressions and Truth Tables, 2,3,4 and 5 variable Karnaugh Maps, SOP and POS Minimization using Karnaugh Maps

**Unit 2 (Combinational Digital Circuits):** Introduction to combinational circuits, realization of logic expressions using AOI, NOR, and NAND gates. Adders, Subtractors, Multiplexers, De-multiplexers, Encoders, Decoders, Priority encoders, Arithmetic circuits, such as multipliers, Ripple adders, Code-convertors

**Unit 3 (Sequential Digital Circuits):** Introduction to sequential circuits, Moore and Mealy machine, Flip-flops and Latches, realization of flip-flops using S-R flip-flop, master slave flip-flop, JK flip-flop, T and D flip-flops, Realization of flip-flops using logic gates, introduction to shift registers, realization of different types of shift registers, introduction to counters, realization of different types of counters

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| For Theory Courses Only | | | |
|---|---|---|---|
| Focus of COs on each Component or Subcomponent of Evaluation | | | |
| | Component 1: CE (50% Weightage) | | Component 2: SEE (50% Weightage) |
| Subcomponent ▸ | | | |
| Subcomponent Type ▸ | Term Tests | Assignments | 100 Marks |
| Maximum Marks ▸ | 50 | 50 | |
| CO-1 | X | | X |
| CO-2 | X | | X |
| CO-3 | X | X | X |
| CO-4 | | X | X |
| CO-5 | | X | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.
Course reassessment policies are presented in the Academic Regulations document.

**8. Achieving COs**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures |
| 2. | Understanding | Classroom lectures, Self-study |
| 3. | Critical Skills | Assignment |
| 4. | Analytical Skills | Assignment |
| 5. | Problem Solving Skills | Assignment, Examination |
| 6. | Practical Skills | Assignment |
| 7. | Group Work | -- |
| 8. | Self-Learning | Self-study |
| 9. | Written Communication Skills | Assignment, Examination |
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | -- |
| 13. | Information Management | Assignment |
| 14. | Personal Management | -- |
| 15. | Leadership Skills | -- |

**9. Course Resources**

**a. Essential Reading**

1. Course notes
2. Mano, M.M. and Ciletti, M.D., 2007, Digital Design, 4th Ed., Prentice-Hall.

**b. Recommended Reading**

1. Jain, R.P., 2010, Modern Digital Electronics, 3rd Ed., Tata McGraw-Hill.
2. Floyd, T.L., 2007, Digital Fundamentals, 8th Ed., Pearson Education.
3. Ananda Kumar, A., 2009, Switching Theory and Logic Design, Prentice Hall of India.

**c. Magazines and Journals**

1. IEEE transaction on Very Large-Scale Integration (VLSI) Systems
2. International Journal of VLSI Design

**d. Websites**

1. https://www.coursera.org/
2. http://nptel.ac.in/

**e. Other Electronic Resources**

1. https://ocw.mit.edu/

**Course Specifications: Electronic Circuit Design Laboratory**

| | |
|---|---|
| **Course Title** | Electronic Circuit Design Laboratory |
| **Course Code** | ECL206A |
| **Course Type** | Laboratory |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

**1. Course Summary**

This course deals with the experimental aspects of Electronic Circuits. The students are taught to design, model, simulate and build electronic circuits using active and passive components. Students are trained to conduct experiments related to analog circuits using discrete electronic components. Students are trained to analyse the experimental results and draw important conclusions related to Electronic Circuits. Students are also trained to simulate electronic circuits such as rectifiers, amplifiers and oscillators using appropriate software.

**2. Course Size and Credits:**

| | |
|---|---|
| **Number of Credits** | 01 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 0:0:1 |
| **Total Hours of Interaction** | 30 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 50 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

**3. Course Outcomes (COs)**

After the successful completion of this course, the student will be able to:

**CO-1.** Explain the significance of the electronic circuit considered.
**CO-2.** Design the electronic circuit for the given circuit specifications using appropriate electronic device and electronic components
**CO-3.** Debug the electronic circuit considered and demonstrate corresponding output parameters using appropriate electronic equipment.
**CO-4.** Analyze the electronic circuit with respect to the obtained output parameters and given specifications.
**CO-5.** Write laboratory report as per the prescribed format

**4. Course Contents**

| | |
|---|---|
| 1 | Design of fixed and voltage-divider biasing circuits |
| 2 | Design and Mid-bandanalysis of amplifier circuits |
| 3 | Study of frequency response of amplifiers using BJT |
| 4 | Design and analysis of Darlington amplifier |
| 5 | Design and analysis of Bootstrapped Darlington amplifier |
| 6 | Designandanalysisof Hartleyoscillatorcircuit |
| 7 | Designandanalysisof Colpittsoscillatorcircuit |

**5. Course Map (CO-PO-PSO Map)**

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| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | 2 | | | | | | | | | | | 3 | | |
| CO-2 | 3 | 2 | 3 | | | | | | | | | | 3 | | |
| CO-3 | 3 | 2 | 2 | | | | | | | | | | 3 | | |
| CO-4 | 3 | 3 | 1 | | | | | | | | | | 3 | | |
| CO-5 | 1 | | | | | | | | | | | | 1 | | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 00 |
| **Demonstrations** | | 00 |
| 1. Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 00 |
| 1. Solving Numerical Problems | 00 | |
| **Practical Work** | | 30 |
| 1. Course Laboratory | 15 | |
| 2. Computer Laboratory | 15 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 00 |
| 1. Case Study Presentation | 00 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **40** |

**7. Course Assessment and Reassessment**

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B. Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3), COs are assessed as illustrated in the following Table.

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| For Laboratory Courses Only | | | |
|---|---|---|---|
| Focus of COs on each Component or Subcomponent of Evaluation | | | |
| | Component 1: CE (50% Weightage) | | Component 2: SEE (50% Weightage) |
| Subcomponent ▸ | | | |
| Subcomponent Type ▸ | Conduct of Experiments | Laboratory Report + Viva | Laboratory SEE |
| Maximum Marks ▸ | 25 | 25 | 50 |
| CO-1 | X | X | X |
| CO-2 | X | X | X |
| CO-3 | X | X | X |
| CO-4 | X | X | X |
| CO-5 | | X | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

**8. Achieving COs**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Lab Demonstrations |
| 2. | Understanding | Lab Demonstrations, Performing |
| 3. | Critical Skills | Experiments |
| 4. | Analytical Skills | Performing Experiments |
| 5. | Problem Solving Skills | Performing Experiments |
| 6. | Practical Skills | Performing Experiments |
| 7. | Group Work | Performing Experiments |
| 8. | Self-Learning | -- |
| 9. | Written Communication Skills | Self-Study |
| 10. | Verbal Communication Skills | Lab Report |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | -- |
| 13. | Information Management | -- |
| 14. | Personal Management | Lab Report |
| 15. | Leadership Skills | -- |

**9. Course Resources**

**a. Essential Reading**

1. Lab Manual
2. Charles Alexander and Matthew Sadiku, 2004, Fundamentals of Electric Circuits, McGraw Hill

**b. Recommended Reading**

1. Richard Jaeger, 1997, Microelectronic Circuit design, McGraw Hill

2. John Hayes, 1993, Introduction to Digital Logic Design, Addison Wesley

**c. Magazines and Journals**

3. IEEE Circuits and Devices Magazine

**d. Websites**

1. https://www.coursera.org/
2. http://nptel.ac.in/

**e. Other Electronic Resources**

1. MULTISIM/ PROTEUS
2. Data sheets of general-purpose transistors: http://www.farnell.com/datasheets/661741.pdf

**Course Specifications: Digital Logic Design Laboratory**

| | |
|---|---|
| **Course Title** | Digital Logic Design Laboratory |
| **Course Code** | ECL207A |
| **Course Type** | Laboratory |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

**1. Course Summary**

The aim of this course is to create a strong foundation of Digital Electronics. The students are taught the basic components of digital systems and the process of their implementation. The students are also taught Boolean algebra, logic gates, basics of memories, and implementation of combinational and sequential digital circuits using logic gates. This course also emphasizes on different types of memories and logic designing platforms and their merits and demerits. Students are trained to employ the principles of digital electronics to implement digital design for the given problem.

**2. Course Size and Credits:**

| | |
|---|---|
| **Number of Credits** | 01 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 0:0:1 |
| **Total Hours of Interaction** | 30 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 50 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

**3. Course Outcomes (COs)**

After the successful completion of this course, the student will be able to:

**CO-1.** Simulate digital logic circuits using standard software
**CO-2.** Plan an experimental setup to test and verify the truth tables of logic gates
**CO-3.** Construct digital circuits such as latches, multiplexers and counters to verify their functionalities
**CO-4.** Design and construct various code converters
**CO-5.** Write a laboratory report in a prescribed format

**4. Course Contents**

| | |
|---|---|
| 1 | Verification of De Morgan's Theorem, sum-of product and product-of-sum expressions using basic and universal gates |
| 2 | Design and implementation of Full Adder and Full Subtractor using basic and NAND gates |
| 3 | Design, construction and verification of a BCD to Excess-3 and Excess-3 to BCD code converters |
| 4 | Design, construction and verification of a Binary to Gray and Gray to Binary code converters |
| 5 | Design and implementation of Multiplexer and De-multiplexer circuits using ICs and verification of their functions |
| 6 | Design and implementation of an encoder and decoder circuit using ICs |
| 7 | Design and construction of Magnitude Comparator using appropriate IC |
| 8 | Construction and verification of the functions of S-R latch, S-R, J-K, T and D Flip-Flops using NAND and NOR gates |

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5. **Course Map (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | 2 | 1 | | 3 | | | | | | | 2 | 3 | 3 | 2 |
| CO-2 | 2 | 2 | | | | | | | 3 | | | 2 | 2 | 3 | 2 |
| CO-3 | 3 | 1 | 1 | | | | | | 2 | | | 2 | 3 | 2 | 2 |
| CO-4 | 3 | 2 | 1 | | | | | | 1 | | | 2 | 3 | 1 | 2 |
| CO-5 | 1 | | | | | | | | | 1 | | 1 | 1 | | 1 |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

6. **Course Teaching and Learning Methods**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 00 |
| **Demonstrations** | | 00 |
| 1. Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 00 |
| 1. Solving Numerical Problems | 00 | |
| **Practical Work** | | 30 |
| 1. Course Laboratory | 30 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 00 |
| 1. Case Study Presentation | 00 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **40** |

7. **Course Assessment and Reassessment**

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B. Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3), COs are assessed as illustrated in the following Table.

| For Laboratory Courses Only | | | |
|---|---|---|---|
| Focus of COs on each Component or Subcomponent of Evaluation | | | |
| | Component 1: CE (50% Weightage) | | Component 2: SEE (50% Weightage) |
| Subcomponent ▸ | | | |
| Subcomponent Type ▸ | Conduct of Experiments | Laboratory Report + Viva | Laboratory SEE |
| Maximum Marks ▸ | 25 | 25 | 50 |
| CO-1 | X | X | X |
| CO-2 | X | X | X |
| CO-3 | X | X | X |
| CO-4 | X | X | X |
| CO-5 | | X | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

**8. Achieving COs**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Laboratory Demonstration |
| 2. | Understanding | Laboratory Demonstration, Performing |
| 3. | Critical Skills | Experiments |
| 4. | Analytical Skills | Performing Experiments |
| 5. | Problem Solving Skills | Performing Experiments |
| 6. | Practical Skills | Performing Experiments |
| 7. | Group Work | Performing Experiments |
| 8. | Self-Learning | -- |
| 9. | Written Communication Skills | Self-Study |
| 10. | Verbal Communication Skills | Lab Report |
| 11. | Presentation Skills | Viva-Voce |
| 12. | Behavioral Skills | -- |
| 13. | Information Management | Performing Experiments |
| 14. | Personal Management | Laboratory Report |
| 15. | Leadership Skills | Laboratory Report |

**9. Course Resources**

**a. Essential Reading**

1. Course notes
2. Mano, M.M. and Ciletti, M.D., 2007, Digital Design, 4th Ed., Prentice-Hall.

**b. Recommended Reading**

3. Floyd, Floyd Thomas, L (2007) Digital fundamentals, Eighth edition, Pearson Education Pvt. Ltd

**c. Magazines and Journals**

4. IEEE Transactions on Circuits and Systems
5. IEEE proceedings on computers and digital techniques.

d. **Websites**

1. http://electronics-course.com/

e. **Other Electronic Resources**

1. https://ocw.mit.edu/index.htm

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lakes, rivers, ocean estuaries).

**Unit 3 (Biodiversity and its conservation):** Introduction – Definition: genetic, species and ecosystem diversity, Biogeographical classification of India, Value of biodiversity: consumptive use, productive use, social, ethical aesthetic and option values. Biodiversity at global, national and local levels, India as a mega- diversity nation, Hot-spots of biodiversity, and Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts, Endangered and endemic species of India, Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

**Unit 4 (Environmental Pollution and Disaster Management):** Definition, Causes, effects and control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear pollution, Solid waste management: Causes, effects and control measures of urban and industrial wastes, Role of an individual in prevention of pollution, Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides.

**Unit 5 (Social Issues, Human Population and Environmental Ethics):** Social Issues and the Environment: From unsustainable to sustainable development, Urban problems and related to energy, Water conservation,rain water harvesting, watershed management, Resettlement and rehabilitation of people; its problems and concerns. Case studies. Environmental ethics: Issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, Case studies, Wasteland reclamation, Consumerism and waste products, Environmental Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public awareness. Human Population and the Environment: Population growth, variation among nations, Population explosion – Family Welfare Programmes, Environment and human health, Human Rights, Value Education, Role of Information Technology in Environment and Human Health, Case Studies.

**Field Work:** Visit to a local area to document environmental assets river/ forest/ grassland/ hill/ mountain, Visit to a local polluted site – Urban / Rural / Industrial / Agricultural, Study of common plants, Insects, birds, Study of simple ecosystems-pond, river, hill slopes, etc (Field work equal to 5 lecture hours).

**5. Course Map (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 1 | | | | | 3 | | | | | | | 1 | 3 | |
| CO-2 | 1 | | | | | 3 | | | | | | | 1 | 3 | |
| CO-3 | 1 | | | | | 3 | | | | | | | 1 | 3 | |
| CO-4 | 1 | | | | | 3 | | 1 | | | | | 1 | 3 | 1 |
| CO-5 | 1 | | | | | 3 | | | | | | | 1 | 3 | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods**

| Teaching and Learning Methods | Duration in hours | Total Duration In Hours |
|---|---|---|
| **Face to Face Lectures** | | 22 |
| **Demonstrations** | | 05 |
| 1. Demonstration using Videos | 05 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 00 |
| 1. Solving Numerical Problems | 00 | |
| **Practical Work** | | |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |

**Course Specifications: Environmental Studies**

| | |
|---|---|
| **Course Title** | Environmental Studies |
| **Course Code** | BTN201A |
| **Course Type** | Ability Enhancement Compulsory Course |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

**1. Course Summary**

This course deals with essential aspects of environment and ecosystem with relevance to engineering and technology. The course exposes the students to various problems associated with abuse of natural resources. The concepts of ecosystems, biodiversity and its conservation and environmental pollution will be discussed. The course emphasizes social issues associated with the environment, and the impact of human population on the environment.

**2. Course Size and Credits:**

| | |
|---|---|
| **Number of Credits** | 02 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 2:0:0 |
| **Total Hours of Interaction** | 30 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Civil Engineering |
| **Total Course Marks** | 50 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

**3. Course Outcomes (COs)**

After the successful completion of this course, the student will be able to:

- **CO-1.** Define the multidisciplinary nature of environmental studies and recognize the need for public awareness
- **CO-2.** Classify and explain the various natural resources and their associated problems, ecosystem and environmental pollution
- **CO-3.** Describe biodiversity at local, national and global levels
- **CO-4.** Discuss various social issues pertaining to environment including sustainable development and energy issues
- **CO-5.** Assess the impact of human population on the environment

**4. Course Contents**

**Unit 1 (Introduction and natural resources):** The multidisciplinary nature of environmental studies, Definition, scope and importance, Need for public awareness. Natural resources and associated problems. Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

**Unit 2 (Ecosystems):** Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams,

| | | |
|---|---|---|
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | 00 |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 03 |
| 1. Case Study Presentation | 03 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **40** |

**7. Course Assessment and Reassessment**

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B. Tech. (Mechanical Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1 or SC2), COs are assessed as illustrated in the following Table.

| **For Theory Courses Only** | | | |
|---|---|---|---|
| **Focus of COs on each Component or Subcomponent of Evaluation** | | | |
| | **Component 1: CE (50% Weightage)** | | **Component 2: SEE (50% Weightage)** |
| **Subcomponent ▸** | | | |
| **Subcomponent Type ▸** | **Term Tests** | **Assignments** | **50 Marks** |
| **Maximum Marks ▸** | **25** | **25** | |
| **CO-1** | X | | X |
| **CO-2** | X | | X |
| **CO-3** | X | X | X |
| **CO-4** | | X | X |
| **CO-5** | | X | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

**8. Achieving COs**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures |
| 2. | Understanding | Classroom lectures, Self-study |
| 3. | Critical Skills | Assignment |
| 4. | Analytical Skills | Assignment |

| | | |
|---|---|---|
| 5. | Problem Solving Skills | Assignment, Examination |
| 6. | Practical Skills | Assignment |
| 7. | Group Work | -- |
| 8. | Self-Learning | Self-study |
| 9. | Written Communication Skills | Assignment, Examination |
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | – |
| 13. | Information Management | Assignment |
| 14. | Personal Management | – |
| 15. | Leadership Skills | – |

**9. Course Resources**

**a. Essential Reading**

1. Class notes
2. Bharucha, E., 2004, Environmental Studies, New Delhi, University Grants Commission

**b. Recommended Reading**

1. Jadhav, H. and Bhosale, V. M., 1995, Environmental Protection and Laws, New Delhi, Himalaya Publishing House

**c. Magazines and Journals**

1. The Green Guide, Natural Geographic Society
2. Sanctuary Asia
3. Xover
4. Indian Journal of Environmental Protection

**d. Websites**

1. http://www.indiaenvironmentportal.org.in/
2. http://envfor.nic.in/
3. https://earthdirectory.net/India

**e. Other Electronic Resources**

1. Electronic resources on the course area are available on RUAS library

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**Course Specifications: Additional Mathematics - 1**

| | |
|---|---|
| **Course Title** | Additional Mathematics - 1 |
| **Course Code** | MTB103A |
| **Course Type** | Core Theory |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

**1. Course Summary**

The course introduces students to the basic concepts in real analysis, MATLAB programing and matrix algebra. Students are taught the concepts of limits, continuity, differentiation, series expansion for the functions of one and two variable, indefinite and definite integrals of single real variable functions. Basic concepts of vectors with necessary properties and operations are taught. The mathematical operations in Matrix theory, Eigen value and Eigen vector, Inversion and diagonalization of matrix and matrix solution for linear system of equations and implementation of the same using MATLAB are discussed in this course.

**2. Course Size and Credits:**

| | |
|---|---|
| **Number of Credits** | 03 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:0:0 |
| **Total Hours of Interaction** | 45 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Mathematics and Statistics |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

**3. Course Outcomes (COs)**

After the successful completion of this course, the student will be able to:

**CO-1.** State and explain the important theorems and solve simple mathematical problems in one variable calculus and vector algebra
**CO-2.** State theorems and solve simple problems in two variable calculus
**CO-3.** Solve complex real world problems associated with one and two real analysis
**CO-4.** Illustrate fundamentals of MATLAB programming and write simple programs
**CO-5.** Solve complex mathematical problems associated with linear algebra and compare the results with that of solutions obtained using MATLAB

**4. Course Contents**

**Unit 1 (Single Variable Calculus):** Functions of single real variable, limit, continuity and differentiation. Mean value theorems and their applications. Taylor's Theorem, Taylor and Maclaurin series. Indefinite integrals, methods of integration - integration by parts, integration by substitution, integration by method of partial fractions. Definite integral and its properties, the fundamental theorem of Calculus, areas between curves.

**Unit 2 (Two Variable Calculus):** Functions of two variables, limits, continuity and partial differentiation. Total differential, errors and approximations, tangent plane approximation of a surface. Partial differentiation of composite functions, unconstrained and constrained extrema

**Unit 3 (Vector Algebra):** Vectors, properties, vector components, magnitude and argument, dot and cross products.

**Unit 4 (MATLAB fundamentals):** Introduction to MATLAB, Basic algebraic and matrix operations, built-in and command line functions. Graphics using MATLAB, 2D and 3D plots. Scripts and functions. Relational and logical operators, conditional statements and looping structures, simple programs.

**Unit 5 (Linear Algebra):** Matrix algebra, elementary row operations, row and reduced row echelon forms. Linear system of equations, existence and uniqueness of solution. Vector spaces, subspaces, linear independence, basis and dimension. Row, column and null space of a matrix. Linear transformations. Eigenvalues, eigenvectors and diagonalization

**5. Course Map (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | 3 | 2 | | | | | | | 1 | | | 3 | | 1 |
| CO-2 | 3 | 3 | 2 | | | | | | | 1 | | | 3 | | 1 |
| CO-3 | 3 | 3 | 2 | 1 | | | | | | 1 | | | 3 | 1 | 1 |
| CO-4 | 3 | 3 | 2 | 3 | | | | | | 2 | | | 3 | 3 | 2 |
| CO-5 | 3 | 3 | 2 | 3 | | | | | | 2 | | | 3 | 3 | 2 |
| | | | 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 30 |
| **Demonstrations** | | 00 |
| 1. Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 00 |
| 1. Solving Numerical Problems | 00 | |
| **Practical Work** | | 15 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 15 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 00 |
| 1. Case Study Presentation | 00 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **55** |

**7. Course Assessment and Reassessment**

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B. Tech. (Mechanical Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3 ), COs are assessed as illustrated in the following Table.

| For Theory Courses Only | | | |
|---|---|---|---|
| Focus of COs on each Component or Subcomponent of Evaluation | | | |
| | Component 1: CE (50% Weightage) | | Component 2: SEE (50% Weightage) |
| Subcomponent ▸ | | | |
| Subcomponent Type ▸ | Term Tests | Assignments | 100 Marks |
| Maximum Marks ▸ | 50 | 50 | |
| CO-1 | X | | X |
| CO-2 | X | | X |
| CO-3 | X | | X |
| CO-4 | | X | X |
| CO-5 | | X | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

**8. Achieving COs**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures |
| 2. | Understanding | Classroom lectures, Self-study |
| 3. | Critical Skills | Assignment |
| 4. | Analytical Skills | Assignment |
| 5. | Problem Solving Skills | Assignment, Examination |
| 6. | Practical Skills | Assignment |
| 7. | Group Work | -- |
| 8. | Self-Learning | Self-study |
| 9. | Written Communication Skills | Assignment, Examination |
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | -- |
| 13. | Information Management | Assignment |
| 14. | Personal Management | -- |
| 15. | Leadership Skills | -- |

**9. Course Resources**

**a. Essential Reading**

1. James Stewart, 2015, Calculus: Early Transcendentals, 8th edition, Boston, Cengage Learning
2. Steven Leon, 2014, Linear Algebra with Application, 9th editlon, New Jersey, Pearson

3. Rudra Pratap, 2013, Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers, New York, Oxford University Press

**b. Recommended Reading**

1. Maurice D. Weir and Joel Hass, 2017, Thomas Calculus, 13th edition, New Jersey, Pearson
2. Gilbert Strang, 2016, Introduction to Linear Algebra, 5th edition, Massachusetts, Cambridge Press

**c. Magazines and Journals**

**d. Websites**

1. https://www.coursera.org/
2. http://nptel.ac.in/

**e. Other Electronic Resources**

1. https://ocw.mit.edu/index.htm
2. https://www.khanacademy.org/
3. tutorial.math.lamar.edu/

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**Course Specifications: Engineering Mathematics - 4**

| | |
|---|---|
| **Course Title** | Engineering Mathematics - 4 |
| **Course Code** | MTF202A |
| **Course Type** | Core Theory |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

**1. Course Summary**

The course introduces the basic concepts of complex analysis and partial differential equations. The course encompasses the essentials of statistics, probability theory and numerical solution of differential equations. Students are taught the probability theory and statistical distributions needed to quantify uncertainty and accuracy of information. The significance and use of numerical methods for solution of ordinary and partial differential equations are emphasized in this course. The utility of complex analysis to solve complex engineering problems and that of partial differential equations in modeling real world problems are highlighted. The students will be able to implement probabilistic /numerical technique to solve a diverse range of applied mathematical problems using MATLAB.

**2. Course Size and Credits:**

| | |
|---|---|
| **Number of Credits** | 04 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:1:0 |
| **Total Hours of Interaction** | 60 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Mathematics and Statistics |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

**3. Course Outcomes (COs)**

After the successful completion of this course, the student will be able to:

**CO-1.** Define and explain the concepts of correlation, regression, random variables, probability distribution, partial differential equations and complex analysis
**CO-2.** State theorems and solve simple problems in partial differential equations, complex analysis, probability, probability distributions
**CO-3.** Apply numerical methods to solve ordinary and partial differential equations using MATLAB
**CO-4.** Solve complex engineering problems associated with numerical methods using MATLAB
**CO-5.** Analyze real world problems associated with probability, probability distributions, partial differential equations and complex analysis
**CO-6.** Construct the Bar chart, pie chart, Histogram, Box-plot and fitting of curves by using MATLAB

**4. Course Contents**

**Unit 1 (Partial differential equations):** Basic concepts, classification of first order partial differential equations. Solutions by Lagrange's method. Classification of second order linear partial differential equations. Solutions of heat, wave and Laplace's equations by method of separation of variables.

**Unit 2 (Probability and Probability distribution):** Review of basics of probability, conditional probability and Bayes' theorem. Random variables, probability distributions. Probability density function and cumulative density function. Mean and variance of distributions. Binomial, exponential and normal distributions.

**Unit 3 (Complex analysis):** Complex valued functions, limits, continuity and differentiability. Analytic functions and Cauchy-Riemann equations. Construction of analytic functions, Harmonic functions. Complex line integral, Cauchy's integral theorem and integral formula. Taylor and Laurent series. Singularities and residues, Cauchy's residue theorem.

**Unit 4 (Correlation and Regression):** Review of statistics. Contingency, correlation and regression Curve fitting: Least squares method - polynomial, exponential and power fit.

**Unit 5 (Numerical Methods):** Types of errors, numerical solution of ordinary differential equations by single- step methods – Euler's, modified Euler's and Runge-Kutta methods. Multi-step methods – Milne's and Adams' methods. Solution by MATLAB built-in function ode45.

**Unit 6 (Finite Difference Method):** Finite differences, explicit methods for one dimensional heat and wave equations, stability conditions. Implicit method for one dimensional heat equation. Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain.

**5. Course Map (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | 3 | | | | | | | | | | | 3 | | |
| CO-2 | 2 | 2 | 2 | | | | | | | | | | 2 | | |
| CO-3 | 3 | 3 | 2 | | | | | | | 1 | | | 3 | | 1 |
| CO-4 | 3 | 3 | 2 | | 2 | | | | 1 | 1 | | | 3 | 2 | 1 |
| CO-5 | 3 | 3 | 2 | | 2 | | | | | 1 | | | 3 | 2 | 1 |
| CO-6 | 3 | 3 | | | 1 | | | | 1 | 1 | | | 3 | 1 | 1 |

**6. Course Teaching and Learning Methods**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 45 |
| **Demonstrations** | | 00 |
| 1. Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 00 |
| 1. Solving Numerical Problems | 00 | |
| **Practical Work** | | 15 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 15 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 00 |
| 1. Case Study Presentation | 00 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | 70 |

**7. Course Assessment and Reassessment**

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B. Tech. Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3), COs are assessed as illustrated in the following Table.

| For Theory Courses Only | | | |
|---|---|---|---|
| Focus of COs on each Component or Subcomponent of Evaluation | | | |
| | Component 1: CE (50% Weightage) | | Component 2: SEE (50% Weightage) |
| Subcomponent ▸ | | | |
| Subcomponent Type ▸ | Term Tests | Assignments | 100 Marks |
| Maximum Marks ▸ | 50 | 50 | |
| CO-1 | X | | X |
| CO-2 | X | | X |
| CO-3 | X | | X |
| CO-4 | | X | X |
| CO-5 | | X | X |
| CO-6 | | X | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

**8. Achieving COs**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures |
| 2. | Understanding | Classroom lectures, Self-study |
| 3. | Critical Skills | Assignment |
| 4. | Analytical Skills | Assignment |
| 5. | Problem Solving Skills | Assignment, Examination |
| 6. | Practical Skills | Assignment |
| 7. | Group Work | -- |
| 8. | Self-Learning | Self-study |
| 9. | Written Communication Skills | Assignment, Examination |
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | -- |
| 13. | Information Management | Assignment |
| 14. | Personal Management | -- |
| 15. | Leadership Skills | -- |

**9. Course Resources**

**a. Essential Reading**

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1. Dennis Zill and Patrick Shanahan, 2013, Complex Analysis, 3rd edition, Jones and Bartlett
2. Richard Burden and Douglas Faires, 2017, Numerical Analysis, 9th edition, Massachusetts, Brooks/Cole
3. Erwin Kreyszig, 2015, Advanced Engineering Mathematics, 10th edition, John Wiley & Sons Inc

**b. Recommended Reading**

1. Rao V. Dukkipati, 2011, Applied Numerical Methods using MATLAB, 1st edition, New Delhi, New Age
2. M. K. Jain, S.R.K. Iyengar and R.K. Jain, 2008, Numerical Methods, New Delhi, New Age
3. James Brown and Ruel Churchill, 2017, Complex Variables and Applications, 8th edition, McGraw Hill Education
4. Sheldon Ross, 2013, A first course in probability, 9th edition, Pearson education
5. Richard A. Johnson, 2011, Miller and Freund's – Probability and Statistics for Engineers, 8th edition, Prentice hall India

**c. Magazines and Journals**

**d. Websites**

1. http://nptel.ac.in/
2. https://ocw.mit.edu/index.htm

**e. Other Electronic Resources**

1. https://www.khanacademy.org/
2. tutorial.math.lamar.edu/

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**Course Specifications: Linear Integrated Circuits**

| | |
|---|---|
| **Course Title** | Linear Integrated Circuits |
| **Course Code** | ECC208A |
| **Course Type** | Core Theory |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

**1. Course Summary**

This course deals with linear integrated circuits fabrication and applications in electronic circuits. The students are taught fundamentals, characteristics, and application of Linear ICs. The students are taught to solve numerical problems on fundamentals and applications. Students are trained to design, model, simulate and analyze active filters and multi-vibrators. Application of linear ICs in building ADCs, DACs, PLLs and filters is emphasized.

**2. Course Size and Credits:**

| | |
|---|---|
| **Number of Credits** | 04 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:1:0 |
| **Total Hours of Interaction** | 60 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

**3. Course Outcomes (COs)**

After the successful completion of this course, the student will be able to:

**CO-1.** Explain Integrated Circuit fabrication processes, op-amp fundamentals and characteristics
**CO-2.** Discuss the various linear and non-linear applications of op-amps
**CO-3.** Design, compute and analyse op-amp based circuits
**CO-4.** Analyse the functionalities of linear and nonlinear ICs for various applications
**CO-5.** Design, model and analyse active filters, waveform generators, A/D and D/A converters

**4. Course Contents**

**Unit 1 (Introduction to Integrated Circuits):** Classification of ICs, IC chip size and circuit complexity, fabrication processes of ICs, fabrication of a typical circuit, active and passive components of ICs: Transistors, diodes, resistors, capacitors, inductors; Fabrication of Field Effect Transistors, Recent trends in IC technology, Advantages of ICs over discrete components

**Unit 2 (Operational Amplifier Fundamentals and Characteristics):** Basic information of op-amp, ideal op-amp, open loop operation of op-amp, feedback, inverting amplifier, non-inverting amplifier, voltage follower, differential amplifier, differential and common mode gains, CMRR, op-amp internal circuit, transfer characteristics, low frequency small signal analysis of differential amplifier, current mirror, input resistance, active load, level shifters, output stage, 741 op-amp; DC Characteristics: input bias current, input offset current, input offset voltage, output offset voltage and thermal drift; AC characteristics: frequency response, stability, slew rate; analysis of data sheets of an op-amp

**Unit 3 (Operational Amplifier Applications):** Scale changer/inverter, summing amplifier – inverting and non-inverting, subtractor, instrumentation amplifier, inverter AC amplifier, non-inverting AC amplifier, AC voltage follower, transconductance amplifier, transresistance amplifier, op-amp circuits using diodes: half wave rectifier, full wave rectifier, precision rectifiers, peak detector, clipper, clamper; log and antilog amplifier, integrator, differentiator, comparator, zero crossing detector, window detector, Schmitt trigger, astable multivibrator,

monostable multivibrator, 555 timer: functional diagram, astable and monostable operation, Schmitt trigger; Sine wave generator, triangular wave generator, function generator IC 8038, audio power amplifier, series op-amp regulator, IC voltage regulators, 723 general purpose regulator. Simulation using standard circuit simulation tools

**Unit 4 (Active filters and Phase Locked Loops (PLLs)):** First, second and higher order low pass filter, high pass filter, band pass filter, band reject filter, all pass filter;, state variable filters, switched capacitor filters; PLL: basic principles, phase detector, voltage controlled oscillator, low pass filter

**Unit 5 (D/A and A/D Converters):** Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, Inverted R-2R ladder, flash ADC, counter type ADC, servo tracking ADC, successive approximation converter, dual-slope ADC, DAC/ADC specifications: resolution, linearity, accuracy, monotonocity, settling time, stability

**5. Course Map (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | | | | | | | | | | | | 3 | | |
| CO-2 | 3 | | | | | | | | | | | | 3 | | |
| CO-3 | 3 | 3 | 2 | 1 | | | | | | | | | 3 | 2 | |
| CO-4 | 3 | 3 | 2 | 1 | | | | | | | | | 3 | 2 | |
| CO-5 | 3 | 3 | 2 | 1 | | | | | | | | | 3 | 3 | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 40 |
| **Demonstrations** | | 05 |
| 1. Demonstration using Videos | 03 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 02 | |
| **Numeracy** | | 15 |
| 1. Solving Numerical Problems | 15 | |
| **Practical Work** | | 00 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 00 |
| 1. Case Study Presentation | 00 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **70** |

**7. Course Assessment and Reassessment**

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B.Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3), COs are assessed as illustrated in the following Table.

| For Theory Courses Only | | | |
|---|---|---|---|
| Focus of COs on each Component or Subcomponent of Evaluation | | | |
| | Component 1: CE (50% Weightage) | | Component 2: SEE (50% Weightage) |
| Subcomponent ▸ | | | |
| Subcomponent Type ▸ | Term Tests | Assignments | 100 Marks |
| Maximum Marks ▸ | 50 | 50 | |
| CO-1 | X | | X |
| CO-2 | X | | X |
| CO-3 | X | | X |
| CO-4 | | X | X |
| CO-5 | | X | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

**8. Achieving COs**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom Lectures |
| 2. | Understanding | Classroom Lectures, Self-study |
| 3. | Critical Skills | Assignment |
| 4. | Analytical Skills | Assignment |
| 5. | Problem Solving Skills | Assignment and Exam |
| 6. | Practical Skills | Assignment |
| 7. | Group Work | Assignment |
| 8. | Self-Learning | Self learning |
| 9. | Written Communication Skills | Assignment |
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | Assignment |
| 12. | Behavioral Skills | -- |
| 13. | Information Management | Assignment |
| 14. | Personal Management | -- |
| 15. | Leadership Skills | -- |

**9. Course Resources**

**a. Essential Reading**

1. Course Notes
2. Choudhary D.R, and Jain S. (2010) Linear Integrated Circuits. New Age International

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3. Gayakwad, R.A., (1993) Op Amps and Linear Integrated Circuits. 4th Edition. PHI Publication

b. **Recommended Reading**

1. Coughlin, Driscoll (2001) Operational Amplifiers and Linear Integrated Circuits. 4th Edition, PHI Publication
2. Salivahanan (2008) Linear Integrated Circuits. 1st Edition. McGraw Hill
3. Botkar, K.R. (1993) Integrated Circuits. 9th Edition. Khanna Publication
4. William D. Stanley, (2009) Operational Amplifiers with Linear Integrated Circuits. 4th edition, Pearson Education

c. **Magazines and Journals**

1. IEEE transaction on circuits and systems

d. **Websites**

1. http://www.tridenttechlabs.com
2. http://www.advancedchipdesigns.com

e. **Other Electronic Resources**

1. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-012-microelectronic-devices-and-circuits-spring-2009/
2. Multisim and P-spice

**Course Specifications: Electromagnetic Theory**

| | |
|---|---|
| **Course Title** | Electromagnetic Theory |
| **Course Code** | ECC209A |
| **Course Type** | Core Theory |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

**1. Course Summary**

This course deals with the principles of electrostatics, electromagnetics and their applications. The course emphasizes the essential principles and laws, used in analysis of electromagnetic waves and fields. Students are taught vectors, electrostatics, magnetostatics, propagation and reflection of electromagnetic waves. Students are trained to use standard tools to analyse the field distribution and propagation ofelectromagnetic waves.

**2. Course Size and Credits:**

| | |
|---|---|
| **Number of Credits** | 04 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:1:0 |
| **Total Hours of Interaction** | 60 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

**3. Course Outcomes (COs)**

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain the concept of vector, co-ordinate systems, electrostatics, magnetostatics and electromagnetic waves
- **CO-2.** Derive Gauss Divergence theorem, Stokes' theorem, continuity equation, Maxwell's equations, wave equations, solutions of Laplace equation and uniform plane waves
- **CO-3.** Solve simple problems of electrostatics and electromagnetic wave propagation
- **CO-4.** Solve complex problems of capacitance, potential field, electric field and electric force
- **CO-5.** Analyze the concepts of divergence and curl, Faraday's laws of magnetic induction
- **CO-6.** Use standard software tools to solve and analyse specific parameters of electrostatics, magnetostatics and time varying magnetic fields

**4. Course Contents**

**Unit 1 (Introduction to Field Theory):** Review of vector analysis, Scalar and Vector product, gradient, divergence, curl and their physical interpretation, line integral, surface integral, volume integral, stokes theorem, rectangular, cylindrical and spherical co-ordinate system and their transformations.

**Unit 2 (Electrostatics):** Coulomb's Law electrostatic force, Electric field intensity, Electric potential, Electric potential difference, Electric dipole and equipotential surfaces, Electric flux density, displacement flux. Electric field intensity and Electrostatic potential due to point charges, line charge, surface charge and volume charge distribution. Gauss's law and its applications; Divergence and Gauss divergence theorem, Ohm's law, continuity equations and relaxation time; Capacitance, Energy and energy density in

electrostatic fields; boundary conditions: dielectric- dielectric, dielectric-conductor. Poisson's and Laplace's equations: solution to Laplace's equations for problems of one dimension.

**Unit 3 (Magnetostatics):** Introduction to magnetic field intensity (H), Magnetic flux density (B), Ampere force law (Biot Savart Law), energy stored in magnetic field, magnetic flux and magnetic flux density, Magnetic scalar and vector potential and comparison with counterparts in electrostatics Lorentz force equation. Faradays laws of EM induction, Boundary conditions; Energy and energy density in a magnetic field

**Unit 4 (Electromagnetic Waves):** Electromagnetic Waves: Maxwell's equations in integral and point form for free space and material media, for sinusoidal time varying fields; Uniform plane wave propagation in various media; relation between electric and magnetic fields; characteristics of plane waves in various media; Electric and Magnetic wave equations and their solutions; Poynting vector and complex Poynting theorem, instantaneous and average energy in plane waves, incidence of plane waves from dielectric-dielectric and dielectric- conductor medium

**5. Course Map (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-1 | PO-12 | PSO-1 | PSO- | PSO-3 |
| CO-1 | 3 | 1 | | | | | | | | | | | 2 | 1 | |
| CO-2 | 3 | 3 | 2 | 2 | | | | | | | | | 3 | 2 | |
| CO-3 | 3 | 3 | 3 | 2 | 1 | | | | | | | | 3 | 3 | |
| CO-4 | 3 | 3 | 3 | 3 | 1 | | | | | | | | 3 | 3 | |
| CO-5 | 3 | 3 | 3 | 3 | 3 | | | | | | | | 3 | 3 | |
| CO-6 | 3 | 3 | 3 | 3 | 3 | | | | | | | | 3 | 3 | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 40 |
| **Demonstrations** | | 05 |
| 1. Demonstration using Videos | 02 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 03 | |
| **Numeracy** | | 15 |
| 1. Solving Numerical Problems | 15 | |
| **Practical Work** | | 00 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 00 |
| 1. Case Study Presentation | 00 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |

| | | |
|---|---|---|
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **70** |

**7. Course Assessment and Reassessment**

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B.Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3), COs are assessed as illustrated in the following Table.

| **For Theory Courses Only** | | | |
|---|---|---|---|
| **Focus of COs on each Component or Subcomponent of Evaluation** | | | |
| | **Component 1: CE (50% Weightage)** | | **Component 2: SEE (50% Weightage)** |
| **Subcomponent ▸** | | | |
| **Subcomponent Type ▸** | **Term Tests** | **Assignments** | **100 Marks** |
| **Maximum Marks ▸** | **50** | **50** | |
| **CO-1** | X | | X |
| **CO-2** | X | | X |
| **CO-3** | X | | X |
| **CO-4** | X | X | X |
| **CO-5** | | X | X |
| **CO-6** | | X | |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

**8. Achieving COs**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures |
| 2. | Understanding | Classroom lectures, Self-study |
| 3. | Critical Skills | Assignment |
| 4. | Analytical Skills | Assignment |
| 5. | Problem Solving Skills | Assignment, Examination |
| 6. | Practical Skills | Assignment |
| 7. | Group Work | -- |
| 8. | Self-Learning | Self-study |
| 9. | Written Communication Skills | Assignment, Examination |
| 10. | Verbal Communication Skills | -- |

ces

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| | | |
|---|---|---|
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | -- |
| 13. | Information Management | Assignment |
| 14. | Personal Management | -- |
| 15. | Leadership Skills | -- |

9. **Course Resources**

**a. Essential Reading**

1. Class Notes
2. Jr. Hayt and Bucker, 2006, Engineering Electromagnetics, 7th Edition, McGraw Hill

**b. Recommended Reading**

1. Jordan & Balman, 2006, Electromagnetic Waves and Radiating System, 4th Edition PHI
2. Johan D. Kraus, 2005, Electromagnetics, 4th Edition, McGraw Hill
3. David K. Cheng, 2009, Fields and Waves Electromagnetics, 2nd Edition, Addison Wesley
4. B.Guru & H. Hiziroglu, 2004, Electromagnetic Field Theory Fundamentals, 2nd Edition, Cambridge University Press
5. K. E. Longren, S. V. Savov and R. J. Jost, 2009, Fundamentals of Electromagnetics with MATLAB, PHI
6. Martin A. Plonus, 1978, Applied Electromagnetics, 2nd Edition McGraw Hill

**c. Magazines and Journals**

1. IEEE Transactions on Microwave Theory and Techniques

**d. Websites**

1. www. web.mit.edu/belcher/www/anim.html

**e. Other Electronic Resources**

1. PC Hardware
2. MATLAB software tool

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**Course Specifications: Microprocessors and Microcontrollers**

| | |
|---|---|
| **Course Title** | Microprocessors and Microcontrollers |
| **Course Code** | ECC210A |
| **Course Type** | Core Theory |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

**1. Course Summary**

This course deals with the architecture and applications of microprocessors and controllers. This course facilitates the students to understand the concepts of architecture and operation of embedded processors and controllers. Students are taught to program microprocessors and controllers to realize the given functionality. Students are trained to solve practical problems involving interfacing of microprocessors and controllers with the external peripherals.

**2. Course Size and Credits:**

| | |
|---|---|
| **Number of Credits** | 04 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:1:0 |
| **Total Hours of Interaction** | 60 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

**3. Course Outcomes (COs)**

After the successful completion of this course, the student will be able to:

**CO-1.** Explain architectures of microprocessors, microcontrollers and their applications in embedded systems
**CO-2.** Describe concepts of peripheral interfacing and programming of microprocessors and microcontrollers
**CO-3.** Program and verify functionality of given application using microprocessor or microcontroller
**CO-4.** Perform external peripheral interfacing using microprocessor or microcontroller for a given application
**CO-5.** Design applications using microprocessors, microcontrollers and embedded board with external peripherals

**4. Course Contents**

**Unit 1 (Introduction to Microprocessor):** Overview on evolution of Microprocessors (from 4004 to i7), Intel 8085 and 8086 Architecture, Bus Interface Unit and Execution Unit, The Instruction Pipeline, Data and Address Bus Configuration, Memory Segmentation, Memory Address generation, I/O Port addressing. Functions of all signals, Minimum and Maximum Mode signals, Bus Cycles, Bus driver 8288

**Unit 2 (Programming the Microprocessor):** Addressing Modes, Instruction Set in detail, Assembler directives, Assembly Language Programming, Macros, DOS function, interrupt processing, Types of interrupts, Internal interrupts

**Unit 3 (Peripherals interfacing and applications using 8086):** Memory Interfacing, Programmable Peripherals Interface-8255, Programmable I/O Interface 8254, Programmable Interval Timer 8251 Programmable USART, Programmable Interrupt Controller 8259

**Unit 4 (Introduction to Microcontroller):** Introduction to Microcontroller, Difference between Microprocessors and Microcontrollers, Difference between CISC and RISC Microcontrollers,

Advantages and applications of Microcontrollers, Evolution of 8051 family, Architectural features of 8051, Programming model, pin details, I/O Ports, Addressing modes

**Unit 5 (Programming the Microcontroller):** Instructions set of 8051, Counters and Timers programming, RS 232 standard, Serial I/O in 8051, Interrupts in 8051, Interrupt based Timer/Counter and Serial programming

**Unit 6 (Peripherals interfacing and applications using 8051):** External memory interface, LCD, ADC, DAC, Sensor, seven-segment display, DC motor, Stepper Motor, Keyboard, Interfacing using 8255

**5. Course Map (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | | | | | | | | | | | | 3 | | |
| CO-2 | 3 | | | | | | | | | | | | 3 | | |
| CO-3 | 3 | 2 | 2 | 2 | 3 | | | | | | | | 2 | 3 | |
| CO-4 | 3 | 2 | 2 | 2 | 3 | | | | | | | | 2 | 3 | |
| CO-5 | 3 | 2 | 2 | 2 | 3 | | | | | | | | 2 | 3 | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 40 |
| **Demonstrations** | | 00 |
| 1. Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 15 |
| 1. Solving Numerical Problems | 15 | |
| **Practical Work** | | 00 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 05 |
| 1. Case Study Presentation | 05 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **70** |

**7. Course Assessment and Reassessment**

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B. Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3), COs are assessed as illustrated in the following Table.

| For Theory Courses Only | | | |
|---|---|---|---|
| Focus of COs on each Component or Subcomponent of Evaluation | | | |
| | Component 1: CE (50% Weightage) | | Component 2: SEE (50% Weightage) |
| Subcomponent ▸ | | | |
| Subcomponent Type ▸ | Term Tests | Assignments | 100 Marks |
| Maximum Marks ▸ | 50 | 50 | |
| CO-1 | X | | X |
| CO-2 | X | | X |
| CO-3 | X | X | X |
| CO-4 | | X | X |
| CO-5 | | X | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

**8. Achieving COs**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures |
| 2. | Understanding | Classroom lectures, Self-study |
| 3. | Critical Skills | Assignment |
| 4. | Analytical Skills | Assignment |
| 5. | Problem Solving Skills | Assignment, Examination |
| 6. | Practical Skills | Assignment |
| 7. | Group Work | -- |
| 8. | Self-Learning | Self-study |
| 9. | Written Communication Skills | Assignment, Examination |
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | -- |
| 13. | Information Management | Assignment |
| 14. | Personal Management | -- |
| 15. | Leadership Skills | -- |

**9. Course Resources**

**a. Essential Reading**

1. Class Notes
2. Brey, Barry B. (2008), 'The Intel Microprocessors', Prentice Hall Press.
3. Mazidi, Muhammad Ali, Janice Gillispie Mazidi, and Rolin McKinlay D. (2006),' The 8051 microcontroller and embedded systems: using Assembly

and C', Vol. 626. Pearson/Prentice Hall.

**b. Recommended Reading**

1. Ray, Ajoy K., and Kishor,M., Bhurchandi(2006) Advanced microprocessors and peripherals: architecture, programming and interfacing, Tata McGraw Hill Education Private Limited.
2. Liu, Yu-Cheng, and Glenn Gibson, A. (1986) Microcomputer systems: the 8086/8088 family architecture, programming and design
3. Ayala, Kenneth,J. (2004) The 8051 microcontroller, Cengage Learning.Magazines and

**c. Journals**

1. The IUP Journal of Electrical and Electronics
2. Microcomputer Journal
3. Electronic Engineering Times
4. The Computer Journal

**d. Websites**

1. www.sci.electronics.com
2. http://www.embeddedrelated.com/usenet/embedded.php

**e. Other Electronic Resources**

1. https://www.electronicshub.org/difference-between-microprocessor-and-microcontroller/

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**Course Specifications: Measurements and Instrumentation**

| | |
|---|---|
| **Course Title** | Measurements and Instrumentation |
| **Course Code** | ECC211A |
| **Course Type** | Core Theory |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

**1. Course Summary**

The aim of this course is to introduce the principles of electrical and electronics measurements instrumentation. It deals with measurement system which includes sensors and transducers, signal conditioning circuits, recording, display devices, signal generators and function generators. This course also deals with static, dynamic characteristics of measurement system.

**2. Course Size and Credits:**

| | |
|---|---|
| **Number of Credits** | 04 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:1:0 |
| **Total Hours of Interaction** | 60 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

**3. Course Outcomes (COs)**

After the successful completion of this course, the student will be able to:

**CO-1.** Describe measurement standards, measurement units and measurement systems
**CO-2.** Explain the principles and applications of signal and function generators
**CO-3.** Describe different sensors and their usage in various applications.
**CO-4.** Analyse the models of measurement systems and analyze their static and dynamic characteristics
**CO-5.** Design appropriate signal conditioning circuits and choose recording / display devices
**CO-6.** Design of instrumentation for a system and measure resistance, capacitance, inductance, current, voltage and power

**4. Course Contents**

**Unit 1 (Introduction to Measurements and Instrumentation):** Introduction and Basics of Measurements, Instrument types and Performance characteristics, Errors in Measurements, Problems encountered during measurement of living system and solution for the same, Calibration and Standards

**Unit 2 (Sensors and Transducers):** Introduction to Sensors and Transducers, Data Acquisition and Sensors Classification, Types of Sensors and Transducer; Mechanical Sensors (Force Sensor, Pressure Sensor, Flow Sensor, Speed and Velocity Sensor, Accelerometer, Gyroscope, Other types of Mechanical Sensors); Temperature Sensors , Optical and Chemical Sensors

**Unit 3 (Bridge Measurement):** Bridge Circuit: Definition, Advantages, Types and differences between them. Introduction to Resistor, Capacitor and Inductor Basics. D.C Bridges (Wheatstone Bridge, Kelvin's Bridge and Kelvin's Double Bridge); A.C Bridges (Inductance -- Maxwell's Inductance Bridge, Maxwell's Wein Bridge, Hay Bridge and Anderson's Bridge Capacitance -- De- Sauty Bridge, Schering Bridge and Wien Bridge Shielding and Grounding of Bridges)

**Unit 4 (Display Devices):** Basics of different kinds of Display Devices, Cathode Ray Tube, Cathode Ray Oscilloscope, LED and LCD, Applications. Electronic and Digital Instruments: Signal conditioning circuits, function generator, Basics of Electronics and Digital Instruments, Electronic Multimeter, Tachometer, Velocimetry, Vibrometry, Flow meter, IR Camera, Weather measurement, Applications.

**5. Course Map (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | | | | | | | | | | | | 3 | | |
| CO-2 | 3 | | | | | | | | | | | | 3 | | |
| CO-3 | 3 | 1 | 2 | | | | | | | | | | 3 | | |
| CO-4 | 3 | 2 | 2 | | | | | | | | | | 3 | | |
| CO-5 | 3 | 2 | 2 | 1 | | | | | | | | | 3 | | |
| CO-6 | 3 | 2 | 2 | 3 | | | | | | | | | 3 | | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 40 |
| **Demonstrations** | | 05 |
| 1. Demonstration using Videos | 05 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 15 |
| 1. Solving Numerical Problems | 15 | |
| **Practical Work** | | 00 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 00 |
| 1. Case Study Presentation | 00 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **70** |

**7. Course Assessment and Reassessment**

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B.Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3), COs are assessed as illustrated in the following Table.

| For Theory Courses Only | | | |
|---|---|---|---|
| Focus of COs on each Component or Subcomponent of Evaluation | | | |
| | Component 1: CE (50% Weightage) | | Component 2: SEE (50% Weightage) |
| Subcomponent ▸ | | | |
| Subcomponent Type ▸ | Term Tests | Assignments | 100 Marks |
| Maximum Marks ▸ | 50 | 50 | |
| CO-1 | X | | X |
| CO-2 | X | | X |
| CO-3 | X | | X |
| CO-4 | | X | X |
| CO-5 | | X | X |
| CO-6 | | X | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

**8. Achieving COs**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures |
| 2. | Understanding | Classroom lectures, Self-study |
| 3. | Critical Skills | Assignment |
| 4. | Analytical Skills | Assignment |
| 5. | Problem Solving Skills | Assignment, Examination |
| 6. | Practical Skills | Assignment |
| 7. | Group Work | -- |
| 8. | Self-Learning | Self-study |
| 9. | Written Communication Skills | Assignment, Examination |
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | -- |
| 13. | Information Management | Assignment |
| 14. | Personal Management | -- |
| 15. | Leadership Skills | -- |

**9. Course Resources**

**a. Essential Reading**

1. Class Notes
2. K. Sawhney, (2008) Electrical and Electronic Measurements and Instrumentation, Dhanpatrai and Sons, New Delhi.
3. Cooper D. and A.D. Heifrick (2009) Modern Electronic Instrumentation and Measuring Techniques, PHI

**b. Recommended Reading**

1. Carr. (2003) Elements of Electronic Instrumentation and Measurements, 3rd Edition, Pearson Education
2. Walt. (2003) Instrumentation Reference Book, 3rd Edition, Elsevier Science
3. Bell. (2002) Electronic Instrumentation and Measurements, Prentice Hall of India
4. Bentley. (2000) Principles of Measurement Systems, 3rd Edition, Pearson Education

**c. Magazines and Journals**

1. IEEE Transactions on Instrumentation and Measurement
2. Journal of Instrumentation (JINST)
3. Journal of Instrumentation Science and Technology
4. Journal of Instrumentation Technology and Innovations
5. Instrument Society of India Journal

**d. Websites**

1. http://www.ieee-ims.org
2. http://www.ni.com/academic/measurements.htm

**e. Other Electronic Resources**

1. Trainer Kits

**Course Specifications: Linear Integrated Circuit Laboratory**

| | |
|---|---|
| **Course Title** | Linear Integrated Circuit Laboratory |
| **Course Code** | ECL212A |
| **Course Type** | Laboratory |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

**1. Course Summary**

This lab course deals with simulation and experimental aspects of linear Integrated Circuits. This lab course facilitates students to design, model, simulate and build electronic systems using Linear Integrated Circuits. Students are trained to use standard software tools for simulation and build electronic circuits.

**2. Course Size and Credits:**

| | |
|---|---|
| **Number of Credits** | 01 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 0:0:1 |
| **Total Hours of Interaction** | 30 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 50 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

**3. Course Outcomes (COs)**

After the successful completion of this course, the student will be able to:

**CO-1.** Design electronic circuits using linear ICs for various applications
**CO-2.** Construct /Build electronic circuits using Linear ICs
**CO-3.** Test, evaluate and compare the performance of electronic circuits with theoretical designs
**CO-4.** Write laboratory report as per the prescribed format

**4. Course Contents**

| | |
|---|---|
| 1 | Op-Amp Characteristics using IC741 |
| 2 | Op-amp Application: Inverting and Non Inverting Amplifiers |
| 3 | Op- amp Application: Integrator and Differentiator |
| 4 | Op-amp Application: Comparator and Schmitt Trigger |
| 5 | Design, Construction and Testing of Precision Rectifier (Half Wave and Full Wave) |
| 6 | Design, Construction and Testing of IC 555 as Astable and Monostable Multivibrator |
| 7 | Design, Construction and Testing of Active Filters |
| 8 | Study of Function Generator IC 8038 and Audio Power Amplifier |
| 9 | Op-Amp Voltage Regulator IC 723 |
| 10 | System Design/DAC and ADC |
| 11 | System Design/PLL |

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5. **Course Map (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | 3 | 3 | 2 | 1 | | | | 3 | | | | 3 | 3 | |
| CO-2 | 3 | 3 | 3 | 2 | 1 | | | | 3 | | | | 3 | 3 | |
| CO-3 | 3 | 3 | 3 | 2 | 1 | | | | 3 | | | | 3 | 2 | |
| CO-4 | 3 | | | | | | | | | 3 | | | 3 | 1 | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

6. **Course Teaching and Learning Methods**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 00 |
| **Demonstrations** | | 00 |
| 1. Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 03 | |
| **Numeracy** | | 00 |
| 1. Solving Numerical Problems | 00 | |
| **Practical Work** | | 30 |
| 1. Course Laboratory | 30 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 00 |
| 1. Case Study Presentation | 00 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **40** |

7. **Course Assessment and Reassessment**

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B.Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3 ), COs are assessed as illustrated in the following Table.

| For Laboratory Courses Only | | | |
|---|---|---|---|
| Focus of COs on each Component or Subcomponent of Evaluation | | | |
| | Component 1: CE (50% Weightage) | | Component 2: SEE (50% Weightage) |
| Subcomponent ▸ | | | |
| Subcomponent Type ▸ | Conduct of Experiments | Laboratory Report + Viva | Laboratory SEE |
| Maximum Marks ▸ | 25 | 25 | 50 |
| CO-1 | X | | X |
| CO-2 | X | | X |
| CO-3 | X | | X |
| CO-4 | | X | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

**8. Achieving COs**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Laboratory Demonstration |
| 2. | Understanding | Laboratory Demonstration and Performing Experiment |
| 3. | Critical Skills | Performing Experiment |
| 4. | Analytical Skills | Performing Experiment |
| 5. | Problem Solving Skills | Performing Experiment |
| 6. | Practical Skills | Performing Experiment |
| 7. | Group Work | -- |
| 8. | Self-Learning | Self Study |
| 9. | Written Communication Skills | Lab Reports |
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | -- |
| 13. | Information Management | Lab reports |
| 14. | Personal Management | -- |
| 15. | Leadership Skills | -- |

**9. Course Resources**

**a. Essential Reading**

1. Lab Manual
2. Coughlin, Driscoll (2001) Operational Amplifiers and Linear Integrated Circuits. 4th edition, PHI Publication

**b. Recommended Reading**

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1. Gayakwad, R.A. (1993) Op - Amps and Linear Integrated Circuits. 4th Edition, PHI Publication
2. Moore, J. P. (1968) Integrated Circuit Laboratory Manual, 1st edition, Hickok Teaching Systems
3. Bell, D. A. (1997) Laboratory Manual for Operational Amplifiers and Linear ICs, 2nd edition

**c. Magazines and Journals**

2. IEEE transactions on circuits and systems

**d. Websites**

3. http://www.tridenttechlabs.com
4. http://www.advancedchipdesigns.com

**e. Other Electronic Resources**

3. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-012-microelectronic-devices-and-circuits-spring-2009/
4. Multisim and P-spice

**Course Specifications: Microprocessors and Microcontrollers Laboratory**

| | |
|---|---|
| **Course Title** | Microprocessors and Microcontrollers Laboratory |
| **Course Code** | ECL213A |
| **Course Type** | Laboratory |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

**1. Course Summary**

This laboratory deals with developing applications using microprocessor and microcontroller. The students are taught programming microprocessor, microcontroller and embedded board such as Arduino. Students are trained to solve practical problems involving interfacing of microprocessors and controllers with the external peripherals. In addition, students are trained to design applications for given practical scenarios.

**2. Course Size and Credits:**

| | |
|---|---|
| **Number of Credits** | 01 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 0:0:1 |
| **Total Hours of Interaction** | 30 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 50 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

**3. Course Outcomes (COs)**

After the successful completion of this course, the student will be able to:

**CO-1.** Develop the assembly level program on a Microprocessor / Microcontroller for a given application
**CO-2.** Design circuits for performing given tasks using Arduino board
**CO-3.** Interface external peripherals with Arduino board for given applications
**CO-4.** Demonstrate the developed designs for different applications
**CO-5.** Write the report as per the prescribed format

**4. Course Contents**

| | |
|---|---|
| 1 | 8086 microprocessor to perform arithmetic operations on 8 bit and 16 bit numbers using EMU 8086 software |
| 2 | 8086 microprocessor to perform arithmetic operations on 8 bit and 16 bit numbers using kit |
| 3 | Code conversion: Binary to Gray & Gray to Binary using 8086 microprocessor |
| 4 | Sorting a list of numbers in ascending & descending order using 8086 microprocessor |
| 5 | 8051 microcontroller to perform arithmetic operations on 8 bit and 16 bit numbers using software |
| 6 | 8051 microcontroller to perform arithmetic operations on 8 bit and 16 bit numbers using kit |
| 7 | Code conversions: Decimal to hexadecimal and vice versa using 8051 |
| 8 | Create a 10KHz square wave using Timer0 |
| 9 | Implement LED blinking and fading using Arduino board |
| 10 | Interface LCD with Arduino board to display message |
| 11 | Interface IR and ultrasonic sensor with Arduino board |
| 12 | Design a stepper motor controller and traffic light controller |

5. **Course Map (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | 3 | 2 | 3 | 3 | | | | 3 | | | | 3 | 3 | |
| CO-2 | 3 | 3 | 2 | 3 | 3 | | | | 3 | | | | 3 | 3 | |
| CO-3 | 3 | 3 | 1 | 3 | 3 | | | | 3 | | | | 3 | 3 | |
| CO-4 | 3 | 3 | 2 | 3 | 3 | | | | 3 | | | | 3 | 3 | |
| CO-5 | 3 | | | | | | | | | 3 | | | 3 | | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

6. **Course Teaching and Learning Methods**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 00 |
| **Demonstrations** | | 00 |
| 1. Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 00 |
| 1. Solving Numerical Problems | 00 | |
| **Practical Work** | | 30 |
| 1. Course Laboratory | 30 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 00 |
| 1. Case Study Presentation | 00 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **40** |

7. **Course Assessment and Reassessment**

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B.Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3 ), COs are assessed as illustrated in the following Table.

| For Laboratory Courses Only | | | |
|---|---|---|---|
| Focus of COs on each Component or Subcomponent of Evaluation | | | |
| | Component 1: CE (50% Weightage) | | Component 2: SEE (50% Weightage) |
| Subcomponent ▸ | | | |
| Subcomponent Type ▸ | Conduct of Experiments | Laboratory Report + Viva | Laboratory SEE |
| Maximum Marks ▸ | 25 | 25 | 50 |
| CO-1 | X | | X |
| CO-2 | X | | X |
| CO-3 | X | | X |
| CO-4 | X | | X |
| CO-5 | | X | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

**8. Achieving COs**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Laboratory instruction |
| 2. | Understanding | Laboratory instructions and experiments |
| 3. | Critical Skills | Laboratory work |
| 4. | Analytical Skills | Laboratory work |
| 5. | Problem Solving Skills | Laboratory work |
| 6. | Practical Skills | Laboratory work |
| 7. | Group Work | Laboratory work |
| 8. | Self-Learning | Laboratory work |
| 9. | Written Communication Skills | Laboratory work, Examination |
| 10. | Verbal Communication Skills | Laboratory Examination |
| 11. | Presentation Skills | |
| 12. | Behavioral Skills | Course work |
| 13. | Information Management | Laboratory work |
| 14. | Personal Management | Course work |
| 15. | Leadership Skills | Laboratory instruction |

**9. Course Resources**

**a. Essential Reading**

1. Lab Manual

2. Brey, Barry B(2008), 'The Intel Microprocessors', Prentice Hall Press

3. Mazidi, Muhammad Ali, Janice Gillispie Mazidi, and Rolin McKinlay, D., (2006), The 8051 microcontroller and embedded systems: using Assembly and C, Vol. 626. Pearson/Prentice Hall

**b. Recommended Reading**

1. Ray, Ajoy, K. and Kishor Bhurchandi,M. (2006) Advanced microprocessors and peripherals: architecture, programming and interfacing,Tata McGraw Hill Education Private Limited.
2. Liu,Yu-Cheng, and Glenn Gibson,A.,(1986) Microcomputer Systems: The 8086/8088 family architecture,programming and design.
3. Ayala, Kenneth, J. (2004), The 8051 Microcontroller, Cengage Learning.

**c. Magazines and Journals**

1. The IUP Journal of Electrical and Electronics
2. Microcomputer Journal
3. Electronic Engineering Times
4. The Computer Journal

**d. Websites**

1. www.sci.electronics.com
2. http://www.embeddedrelated.com/usenet/embedded.php

**e. Other Electronic Resources**

1. https://www.arduino.cc/en/Tutorial/HomePage

Course Specifications: Innovation and Entrepreneurship

| | |
|---|---|
| **Course Title** | Innovation and Entrepreneurship |
| **Course Code** | BAU201A |
| **Course Type** | Core Theory Course |
| **Department** | Management Studies |
| **Faculty** | Management and Commerce |

**1. Course Summary**

This course on Innovation and Entrepreneurship is introduced across all the undergraduate programs with an aim to impart comprehensive knowledge of an entrepreneurial ecosystem. Further, the course enables to develop entrepreneurial skills by building entrepreneurial intentions among students. The students also gain knowledge on competencies to provide with necessary inputs for creation of new ventures and scaling up existing startups. The students are also introduced to design thinking process to nurture entrepreneurial way of thinking.

**2. Course Size and Credits:**

| | |
|---|---|
| **Number of Credits** | 03 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:0:0 |
| **Total Hours of Interaction** | 45 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Respective Department of the Faculty |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

**3. Course Outcomes (COs)**

**After the successful completion of this course, the student will be able to:**

**CO-1.** Explain the concepts and process of Innovation as well as entrepreneurship
**CO-2.** Construct and apply the idea generation techniques
**CO-3.** Discuss the opportunities for launching of new venture and various entry strategies
**CO-4.** Examine innovative ideas for the creation and management of entrepreneurship **CO-5.** Formulate and present a viable business plan to the investors appraisal

**4. Course Contents**

**Unit 1: Introduction to Entrepreneurship**
Introduction to entrepreneurship, Evolution of the concept, Entrepreneurial process, Types of Entrepreneurship - Social entrepreneurship, rural entrepreneurship. Characteristics of an Entrepreneur, Incorporation of a Company, Managing a Family Business, Corporate Intrapreneurship

**Unit 2:**

**Innovation and Creativity:** Types of Innovations. Identify Various Sources of Ideas for New Ventures, Methods Available for Generating New Venture Ideas - Creativity, Design Thinking and the Techniques for Creative Problem Solving. Aspects of the Product Planning and Development Process.

**Unit 3**
**New Venture:**
Creating Opportunities, Resources, Role of New Ventures and Small Businesses in the Economy, Types of Entry Strategies, Launch a New Venture and the Generic Strategies

**Unit 4**
**Strategies to Sustain and Grow:**
Strategies for Expansion, Joint Ventures, Acquisitions, Merges, Franchising, Growth Strategy, Exit Strategy.

**Unit 5 Business Plan**
Business plan, scope and value of the business plan, step-by-step explanation of the business plan, marketing plan, Organizational plan, financial plan (source of capital), entrepreneurship models

**5. Course Map (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PSO-1 | PSO-2 | PSO-3 | PSO-4 |
| CO-1 | 2 | 2 | 2 | | | | | | | | | 2 | | | 3 |
| CO-2 | 3 | 2 | 2 | 2 | 3 | | | | | | | | 3 | 2 | |
| CO-3 | 3 | 3 | 2 | 2 | | | | | | | | 2 | | 2 | |
| CO-4 | 3 | 2 | 2 | 2 | 2 | 3 | | | 3 | 3 | | | 2 | | 3 |
| CO-5 | 2 | 3 | | 2 | | | | | | | 3 | | 2 | 3 | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 20 |
| **Demonstrations** | | 02 |
| 1. Demonstration using Videos | 02 | |
| 2. Demonstration using Physical Models / Posters | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 00 |
| 1. Solving Numerical Problems | 00 | |
| **Practical Work** | | 03 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 03 | |
| 4. Clinical Laboratory | 00 | |

| | | |
|---|---|---|
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 15 |
| 1. Case Study Presentation | 05 | |
| 2. Guest Lecture | 01 | |
| 3. Industry / Field Visit | 02 | |
| 4. Brain Storming Sessions | 02 | |
| 5. Group Discussions | 04 | |
| 6. Discussing Possible Innovations | 01 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 05 |
| **Total Duration in Hours** | | **45** |

## 7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Program Specifications document pertaining to the UG Program. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2), COs are assessed as illustrated in the following Table.

| **For Theory Courses Only** | | | |
|---|---|---|---|
| **Focus of COs on each Component or Subcomponent of Evaluation** | | | |
| | **Component 1: CE (50% Weightage)** | | **Component 2: SEE (50% Weightage)** |
| **Subcomponent ▸** | | | |
| **Subcomponent Type ▸** | **Terms Tests** | **Assignments** | **100 Marks** |
| **Maximum Marks ▸** | **50** | **50** | |
| **CO-1** | X | | X |
| **CO-2** | X | | X |
| **CO-3** | | X | X |
| **CO-4** | | X | X |
| **CO-5** | | X | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, shall provide the focus of COs in each component of assessment in the beginning of the semester to capture the Group Task evaluation parameters such as: field visit, presentation of business plan, case study presentation on success and failure companies. Ideating and running the business for a day inside the campus.

Course reassessment policies are presented in the Academic Regulations document.

## 8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Class room lectures |
| 2. | Understanding | Class room lectures |

| | | |
|---|---|---|
| 3. | Critical Skills | Assignment |
| 4. | Analytical Skills | Class room, assignment, examination |
| 5. | Problem Solving Skills | Assignment, Field visit and presentation |
| 6. | Practical Skills | Assignment |
| 7. | Group Work | Case study Presentation |
| 8. | Self-Learning | Assignment |
| 9. | Written Communication Skills | Assignment, examination |
| 10. | Verbal Communication Skills | Case study and group discussions |
| 11. | Presentation Skills | Case study and group discussions |
| 12. | Behavioral Skills | Group discussions |
| 13. | Information Management | Assignment |
| 14. | Personal Management | Assignment and Group Discussion |
| 15. | Leadership Skills | Group discussions and Case study |

**9. Course Resources**

**a. Essential Reading**

1. Course notes
2. Hisrich, R., Peters, M. and Shepherd, D., 2020. *Entrepreneurship*. 11th ed. Noida: McGraw Hill.

**b. Recommended Reading**

1. Charantimath, P., 2018. *Entrepreneurship development and small business enterprises*. 3rd ed. Belgaum, India: Pearson Education.
2. Roy, R., 2020. *Entrepreneurship*. 3rd ed. Noida: Oxford University Press.

**c. Magazines and Journals**

1. Business World: ABP Group
2. Journal of Small Business Management, Blackwell Publishing
3. Business Strategy: PwC Strategy & Inc.

**d. Websites**

1. India, S., 2022. *Homepage*. [online] Start-up India. Available at: <https://www.startupindia.gov.in/> [Accessed 10 July 2022].
2. Allsharktank, Products., 2022. *Homepage*. [online] All Shark Tank Products. Available at: <https://www.allsharktankproducts.com/> [Accessed 10 July 2022].
3. India, M., 2022. *Make In India*. [online] Makeinindia.com. Available at: <https://www.makeinindia.com/> [Accessed 10 July 2022].

**e. Other Electronic Resources**

NA

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## Course Specifications: Additional Mathematics - 2

| | |
|---|---|
| **Course Title** | Additional Mathematics - 2 |
| **Course Code** | MTB104A |
| **Course Type** | Core Theory |
| **Department** | Mathematics and Statistics |
| **Faculty** | Engineering and Technology |

### 1. Course Summary

This course deals with analytical solutions of ordinary differential equations, numerical analysis and data modelling techniques. Students are taught the concepts of fundamentals of ordinary differential equations. The solution procedures for certain standard forms of ordinary differential equations are illustrated. The role, relevance of ordinary differential equations in modelling some ofthe real world problems are emphasized. The significance of data modelling in applied engineering problems are discussed with the help of MATLAB. Numerical methods for the solution of nonlinear equations and linear systems are elucidated using MATLAB.

### 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 03 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 2:1:0 |
| **Total Hours of Interaction** | 45 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Mathematics and Statistics |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

### 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Describe the fundamentals of ordinary differential equations State theorems and solvesimple problems in two variable calculus
**CO-2.** Solve standard forms of ordinary differential equations Illustrate fundamentals of Linear algebra
**CO-3.** Model real world problems using ordinary differential equations and solve complex problems associated with ordinary differential equations
**CO-4.** Apply numerical methods to solve nonlinear equations in one variable, system of linear equations, interpolation and numerical quadrature, and implement the same using MATLAB
**CO-5.** Solve complex problems associated with nonlinear equations and linear systems, interpolation and numerical integration using MATLAB

### 4. Course Contents

**Unit 1 (First Order Differential Equations):** Introduction, basic concepts and geometrical meaning. Separable, linear and exact differential equations. Integrating factors and transformations. Applications of first order ordinary differential equations, orthogonal trajectories, growth/decay problems and mixture problems.
**Unit 2 (Higher Order Differential Equations):** Introduction, initial and boundary value problems. Linear homogenous/nonhomogeneous differential equations with constant coefficients, method of

undetermined coefficients and variation of parameters. Application of second order linear

differential equations with constant coefficients, mass-spring-dashpot system, electric circuits.
**Unit 3 (System of Linear Differential Equations)**: Homogeneous system of linear differential equations of first order, solutions by matrix method.
**Unit 4 (Single Variable Equations and System of Equations):** Numerical solution of algebraic and transcendental equations, Newton-Raphson method and error analysis. Numerical solution of linear system of equations, Gauss-Seidel methods.
**Unit 5 (Interpolation and Numerical Integration):** Interpolation - Lagrange interpolation, Newton's divided difference interpolation. Numerical Integration - Newton-Cotes' quadrature, trapezoidal, Simpson's 1/3 and Simpson's 3/8 rules.

## 5. Course Map (CO-PO-PSO Map)

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | 3 | 2 | | | | | | | | | | 3 | | |
| CO-2 | 2 | 3 | 2 | | | | | | | | | | 3 | | |
| CO-3 | 3 | 3 | 1 | | | | | | | | | | 3 | | |
| CO-4 | 3 | 3 | 2 | 2 | 2 | | | | | 1 | | | 3 | 2 | 1 |
| CO-5 | 3 | 3 | 2 | 2 | 2 | | | | | 1 | | | 3 | 2 | 1 |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

## 6. Course Teaching and Learning Methods

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 30 |
| **Demonstrations** | | 00 |
| 1. Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 00 |
| 1. Solving Numerical Problems | 00 | |
| **Practical Work** | | 15 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 15 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 00 |
| 1. Case Study Presentation | 00 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **55** |

## 7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B.Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3 ), COs are assessed as illustrated in the following Table.

| For Theory Courses Only | | | |
|---|---|---|---|
| Focus of COs on each Component or Subcomponent of Evaluation | | | |
| | Component 1: CE (50% Weightage) | | Component 2: SEE (50% Weightage) |
| Subcomponent ▸ | | | |
| Subcomponent Type ▸ | Term Tests | Assignments | 100 Marks |
| Maximum Marks ▸ | 50 | 50 | |
| CO-1 | X | | X |
| CO-2 | X | | X |
| CO-3 | X | | X |
| CO-4 | | X | X |
| CO-5 | | X | |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

## 8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures |
| 2. | Understanding | Classroom lectures, Self-study |
| 3. | Critical Skills | Assignment |
| 4. | Analytical Skills | Assignment |
| 5. | Problem Solving Skills | Assignment, Examination |
| 6. | Practical Skills | Assignment |
| 7. | Group Work | -- |
| 8. | Self-Learning | Self-study |
| 9. | Written Communication Skills | Assignment, Examination |
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | -- |
| 13. | Information Management | Assignment |
| 14. | Personal Management | -- |
| 15. | Leadership Skills | -- |

## 9. Course Resources

### a. Essential Reading

## Course Specifications: Analog Communication

| | |
|---|---|
| **Course Title** | Analog Communication |
| **Course Code** | ECC301A |
| **Course Type** | Core Theory |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

### 1. Course Summary

This course introduces the fundamental concepts of random process, Fourier analysis ofSignals and analog communication systems. Students are taught the concepts of analog communication system employing amplitude modulation, angle modulation and system performance analysis. The students get an insight on the performance of communication systems in the presence of noise. The design principles in analog communication system and problem solving will be emphasized

### 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 04 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:1:0 |
| **Total Hours of Interaction** | 60 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

### 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Explain the principles in random process and its relevance to channel distortion and noise signals in communication systems
**CO-2.** Describe the Fourier representation and analysis of signal as applied to analog communication systems
**CO-3.** Solve simple problems related to analog communication system design
**CO-4.** Derive and analyse various analog modulation schemes and their performance for bandwidth, modulation index, efficiency and transmission power
**CO-5.** Design and analyse analog communications systems
**CO-6.** Solve complex problems related to analog communication and compare the results with that of the solutions obtained using software tools

### 4. Course Contents

**Unit 1 (Random Process):** Random variables: Several random variables. Statistical averages: Function of Random variables, moments, Mean, Correlation and Covariance function: Principles of autocorrelation function, cross – correlation functions. Central limit theorem, Properties of Gaussian process. Ensemble averages, System with random signal excitation,

1. Shepley Ross, 2007, Introduction to Ordinary Differential Equations, 4th edition, New York, John Wiley & sons
2. Dennis Zill, 2012, A First Course in Differential Equations, 10th edition, Massachusetts, Brooks/Cole
3. Richard Burden and Douglas Faires, 2017, Numerical Analysis, 9th edition, Massachusetts, Brooks/Cole

**b. Recommended Reading**

1. George Simmons, 2017, Differential Equations with Applications and Historical Notes, 2nd edition, New Jersey, McGraw Hill
2. Steven Chapra and Raymond Canale, 2016, Numerical Methods for Engineers, 7th edition, New Jersey, McGraw Hill

**c. Magazines and Journals**

**d. Websites**

1. https://www.coursera.org/
2. http://nptel.ac.in/
3. https://ocw.mit.edu/index.htm
4. tutorial.math.lamar.edu/

**e. Other Electronic Resources**

Spectral densities, The Gaussian process, Electrical noise, Narrow band noise

**Unit 2 (Fourier Representation and Analysis of Signals):** Fourier Transform of useful signals, Inverse Relationship between Time and Frequency, Fourier Transforms of Periodic Signals, Transmission of signal through linear systems, Ideal and Practical filters, Correlation andSpectral Density, Signal Energy and Energy Spectral Density, Signal Power and Power Spectral Density

**Unit 3 (Amplitude Modulation (AM) and Demodulation):** Review of Fourier and Hilbert Transforms, Introduction to AM, Virtues, Limitations and Modifications of AM, Linear Modulation Schemes - DSBSC Modulation – coherent detection, Costas Receiver, Quadrature-Carrier Multiplexing, SSB – Frequency Discrimination, Phase Discrimination Method, Coherent Detection, Frequency Translation. VSB – Sideband shaping, Coherent Detection, FDM

**Unit 4 (Angle Modulation and Demodulation):** Basic definitions, Properties of Angle modulation, FM and PM, Narrow band and wide band FM, FM - Transmission bandwidth, Generation of FM Signal- Indirect FM and Direct FM. Demodulation of FM waves, FM Stereo multiplexing, Nonlinear effects in FM systems, Super heterodyne receiver, Phase-locked loop, Nonlinear model of the phase – locked loop, Linear model of the phase – locked loop

**Unit 5 (Noise in Continuous Wave Systems):** Introduction, shot noise, thermal noise, white noise, Noise equivalent bandwidth, Narrow bandwidth, Noise Figure, Equivalent noise temperature, Noise in Receiver model, Noise in AM, DSB-SC, SSB, VSB receivers, Noise in FM receivers, FM threshold effect, Pre- emphasis and De-emphasis in FM, Capture Effect, Threshold effect

## 5. Course Map (CO-PO-PSO Map)

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-1 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | | | | | | | | | | | | 3 | 1 | |
| CO-2 | 3 | | | | | | | | | | | | 3 | 1 | |
| CO-3 | 3 | 2 | 2 | 1 | | | | | | | | | 3 | 3 | |
| CO-4 | 3 | 1 | | | | | | | | | | | 3 | 3 | |
| CO-5 | 3 | 3 | 2 | 1 | | | | | | | | | 3 | 3 | |
| CO-6 | 3 | 3 | 3 | 1 | | | | | | | | | 3 | 3 | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

## 6. Course Teaching and Learning Methods

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 40 |
| **Demonstrations** | | 05 |
| 1. Demonstration using Videos | 05 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 15 |
| 1. Solving Numerical Problems | 15 | |
| **Practical Work** | | 00 |

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| | | |
|---|---|---|
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | |
| 1. Case Study Presentation | 00 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | 00 |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **70** |

**7. Course Assessment and Reassessment**

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B.Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3 ), COs are assessed as illustrated in the following Table.

| **For Theory Courses Only** | | | |
|---|---|---|---|
| **Focus of COs on each Component or Subcomponent of Evaluation** | | | |
| | **Component 1: CE (50% Weightage)** | | **Component 2: SEE (50% Weightage)** |
| **Subcomponent ▸** | | | |
| **Subcomponent Type ▸** | **Term Tests** | **Assignments** | **100 Marks** |
| **Maximum Marks ▸** | **50** | **50** | |
| **CO-1** | X | | X |
| **CO-2** | X | | X |
| **CO-3** | X | | X |
| **CO-4** | X | X | X |
| **CO-5** | | X | X |
| **CO-6** | | X | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

**8. Achieving COs**

The following skills are directly or indirectly imparted to the students in the following

teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom Lectures, Assignments |
| 2. | Understanding | Classroom Lectures, Assignments |
| 3. | Critical Skills | Classroom Lectures, Assignments |
| 4. | Analytical Skills | Classroom Lectures, Assignments |
| 5. | Problem Solving Skills | Classroom Lectures, Assignments |
| 6. | Practical Skills | Assignments |
| 7. | Group Work | -- |
| 8. | Self-Learning | Assignments |
| 9. | Written Communication Skills | Assignment, Examination |
| 10. | Verbal Communication Skills | Assignment, Examination |
| 11. | Presentation Skills | Assignments |
| 12. | Behavioral Skills | Coursework |
| 13. | Information Management | Assignment, Examination |
| 14. | Personal Management | Coursework |
| 15. | Leadership Skills | -- |

**9. Course Resources**

**a. Essential Reading**

1. Class Notes
2. Haykin, S. (1996) Communication Systems, 3rd Edition. John Willey Publications
3. Haykin, S. (2003) An Introduction to Analog and Digital Communication. John Willey

**b. Recommended Reading**

1. Lathi, B. P. (2005) Modern Digital and Analog Communication Systems. 3rd Edition. Oxford University Press
2. Harold, P. E., Samy, S., and Mahmond, A. (2004) Communication Systems. Pearson Education
3. H.Taub & D.L.Schilling (2011), Principles of Communication Systems, TMH

**c. Magazines and Journals**

1. IEEE Spectrum

**d. Websites**

1. www.rfcafe.com

**e. Other Electronic Resources**

1. https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-36-communication-systems-engineering-spring-2009/

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## Course Specifications: Digital Signal Processing

| | |
|---|---|
| **Course Title** | Digital Signal Processing |
| **Course Code** | ECC302A |
| **Course Type** | Core Theory |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

### 1. Course Summary

This course deals with the basic concepts of digital signal processing. It deals with the discrete time signals and principles of discrete Fourier transform techniques. Students are taught Fourier transforms as applied to discrete signals, digital filter design techniques, IIR, FIR structures and the concepts of multirate signal processing. Students are taught to design simple digital systems based on analysis of system response.

### 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 04 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:1:0 |
| **Total Hours of Interaction** | 60 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

### 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Describe types of signals, transforms, filters, algorithms and its properties.
**CO-2.** Explain the filter design techniques, types of transformations, and multirate principles in signal processing.
**CO-3.** Determine Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT),
**CO-4.** Determine convolution using DFT and filter structures for discrete time sequences
**CO-5.** Design digital filters using IIR and FIR using structures
**CO-6.** Use software tools to apply principles of Fourier transforms for spectral analysis of digital signals and systems.

### 4. Course Contents

**Unit 1 (Discrete Fourier Transform):** Review of discrete-time signals & systems, DFS representation of periodic sequences, Discrete Fourier Transforms (DFT): Properties of DFT, linear convolution of sequences using DFT, Computation of DFT. Relation between Z- transform and DFS., Fast Fourier transforms (FFT) - Radix-2 decimation in time and decimationin frequency FFT Algorithms, Inverse FFT and FFT for composite.

**Unit 2 (Infinite Impulse Response Filter):** Analog filters – Butterworth filters, Chebyshev Type 1 filters (up to 3rd order), Analog Transformation of prototype LPF to BPF /BSF/ HPF.

Transformation of analog filters into equivalent digital filters using Impulse invariant method and Bilinear Z transform method- Realization structures for IIR filters – direct, cascade, parallel forms.

**Unit 3 (Finite Impulse Response Filter):** Design of linear phase FIR filters windowing and Frequency sampling methods – Realization structures for FIR filters – Transversal and Linear phase structures- Comparison of FIR & IIR.

**Unit 4 (Multirate Signal Processing):** Introduction to Multirate signal processing, Decimation, Interpolation, Polyphase Decomposition of FIR filter, Multistage implementation of sampling rate conversion, Design of narrow band filters and applications of Multirate signal processing.

## 5. Course Map (CO-PO-PSO Map)

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-1 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | | | | | | | | | | | | 3 | 1 | |
| CO-2 | 3 | | | | | | | | | | | | 3 | 1 | |
| CO-3 | 3 | 2 | | 1 | | 3 | | | | | | | 3 | 2 | |
| CO-4 | 3 | 2 | | 1 | | 3 | | | | | | | 3 | 2 | |
| CO-5 | 3 | 3 | 2 | 1 | | 3 | | | | | | | 3 | 3 | |
| CO-6 | 3 | 2 | 2 | 1 | | 3 | | | | | | | 3 | 3 | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

## 6. Course Teaching and Learning Methods

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 40 |
| **Demonstrations** | | 05 |
| 1. Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 05 | |
| **Numeracy** | | 15 |
| 1. Solving Numerical Problems | 15 | |
| **Practical Work** | | 00 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 00 |
| 1. Case Study Presentation | 00 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |

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| | | |
|---|---|---|
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **70** |

## 7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B.Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3 ), COs are assessed as illustrated in the following Table.

| **For Theory Courses Only** | | | |
|---|---|---|---|
| **Focus of COs on each Component or Subcomponent of Evaluation** | | | |
| | **Component 1: CE (50% Weightage)** | | **Component 2: SEE (50% Weightage)** |
| **Subcomponent ▸** | | | |
| **Subcomponent Type ▸** | **Term Tests** | **Assignments** | **100 Marks** |
| **Maximum Marks ▸** | **50** | **50** | |
| **CO-1** | X | | X |
| **CO-2** | X | | X |
| **CO-3** | X | | X |
| **CO-4** | X | X | X |
| **CO-5** | | X | X |
| **CO-6** | | X | |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

## 8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom Lectures, Assignments |
| 2. | Understanding | Classroom Lectures, Assignments |
| 3. | Critical Skills | Classroom Lectures, Assignments |
| 4. | Analytical Skills | Classroom Lectures, Assignments |
| 5. | Problem Solving Skills | Classroom Lectures, Assignments |
| 6. | Practical Skills | -- |
| 7. | Group Work | Assignment |
| 8. | Self-Learning | Assignment |
| 9. | Written Communication Skills | Assignment, Examination |

| | | |
|---|---|---|
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | Course work |
| 13. | Information Management | Assignment, Examination |
| 14. | Personal Management | Coursework |
| 15. | Leadership Skills | -- |

**9. Course Resources**

**a. Essential Reading**

1. Class Notes

2. Mitra, S.K. (1998) Digital Signal Processing- A Computer Based approach, Tata McGraw- Hill
3. Oppenheim, A.V., and Schaffer R.W. (2004) Discrete Time Signal Processing, PHI.

**b. Recommended Reading**

4. John G. Proakis, Dimitris Manolakis, G. (2007) Digital Signal Processing- Principles, Algorithms, and Applications, Pearson Education.
5. Vaidyanathan,P.P. (1993) Multirate Systems and Filter Bank, Prentice Hall, Englewood cliffs: NJ

**c. Magazines and Journals**

2. IEEE Transactions on Signal Processing

**d. Websites**

2. https://www.tutorialspoint.com/digital_signal_processing/index.htm

**e. Other Electronic Resources**

2. https://ocw.mit.edu/resources/res-6-008-digital-signal-processing-spring-2011

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## Course Specifications: Microwave Engineering

| | |
|---|---|
| **Course Title** | Microwave Engineering |
| **Course Code** | ECC303A |
| **Course Type** | Core Theory |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

### 1. Course Summary

This course deals with microwave transmission lines and devices. Students are taught the principles of microwave network theory, impedance matching, Faraday's rotation and related devices. Students are trained to set up a microwave bench and study the characteristics of active and passive devices such as Gunn Diode, Klystron tube, Isolator, Circulator, Magic Tee etc.,

### 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 04 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:1:0 |
| **Total Hours of Interaction** | 60 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

### 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Explain microwave transmission lines, waveguides, microwave devices, amplifiers and oscillators
**CO-2.** Derive the transmission lines equations, waveguide mode equations, microwave amplifier equations and network parameters for microwave circuits
**CO-3.** Compute transmission line parameters, waveguides modes, amplifiers performance metrics, network parameters for microwave devices / networks
**CO-4.** Analyse the transmission line parameters, waveguides, microwave devices, amplifiers, oscillators and network parameters for various networks
**CO-5.** Design and analyse various microwave subsystems and networks
**CO-6.** Solve complex problems on transmission line parameters, waveguides modes, amplifiers performance metrics, network parameters for microwave devices / networks and CEM

### 4. Course Contents

**Unit 1 (Introduction to Microwave frequency bands and transmission lines):** Evolution of microwave engineering, Transmission line general solution, distortion less line, reflection on a line not terminated to characteristic impedance, Open Circuited and Short Circuited line,

Reflection loss, Insertion loss, T and PI sections, Microwave transmission lines. Parameters of open wire at high frequency, standing waves, standing wave ratio, impedance matching, Smith chart, Stub matching, Application of smith chart

**Unit 2 (Microwave tubes and Amplifiers):** Linear-beam tubes: Multi-cavity klystron, Reflex klystron, Travelling Wave Tube (TWT), Crossed- field tubes: Magnetron oscillator

**Unit 3 (Two Port Networks):** Microwave network theory and passive devices, Y, Z, ABCD matrices, Symmetrical Z and Y matrices, reciprocal network, S matrix representation, Resonant circuits, S – Parameter Simulations for Transmission Lines and its analysis

**Unit 4 (Waveguide Theory):** Maxwell's Equations, Application of Maxwell's equation, Types of wave propagation, Maxwell's equation to rectangular waveguides, Modes of propagation in waveguides, Transverse Electric (TE) and Transverse Magnetic mode (TM), Excitation of waveguides by probes and apertures.

**Unit 5 (Passive Microwave Devices):** Terminations, Attenuators, Phase shifters, Power dividers, directional couplers, Hybrid junctions, Isolators, Circulators

**Unit 6 (Active Microwave Devices):** Introduction to Transferred electron devices: Gunn, Avalanche transit-time devices: Description and working of IMPATT, TRAPATT, BARITT diodes

**Unit 7 (Computational Electromagnetics):** Introduction to Physical Optics for EM analysis and Case Studies

**5. Course Map (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | | | | | | | | | | | | 3 | | |
| CO-2 | 3 | 1 | 1 | | | | | | | | | | 2 | | |
| CO-3 | 3 | 3 | 2 | 2 | 2 | | | | | | | | 3 | 2 | |
| CO-4 | 3 | 3 | 2 | 2 | 2 | | | | | | | | 3 | 2 | |
| CO-5 | 3 | 3 | 3 | 3 | 3 | | | | | | | | 3 | 3 | |
| CO-6 | 3 | 3 | 3 | 3 | 3 | | | | | | | | 3 | 3 | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 40 |
| **Demonstrations** | | 05 |
| 1. Demonstration using Videos | 02 | |
| 2. Demonstration using Physical Models / Systems | 01 | |
| 3. Demonstration on a Computer | 02 | |
| **Numeracy** | | 15 |
| 1. Solving Numerical Problems | 15 | |

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| | | |
|---|---|---|
| **Practical Work** | | 00 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 00 |
| 1. Case Study Presentation | 00 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **70** |

**7. Course Assessment and Reassessment**

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B.Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3 ), COs are assessed as illustrated in the following Table.

| **For Theory Courses Only** | | | |
|---|---|---|---|
| **Focus of COs on each Component or Subcomponent of Evaluation** | | | |
| | **Component 1: CE (50% Weightage)** | | **Component 2: SEE (50% Weightage)** |
| **Subcomponent ▸** | | | |
| **Subcomponent Type ▸** | **Term Tests** | **Assignments** | **100 Marks** |
| **Maximum Marks ▸** | **50** | **50** | |
| **CO-1** | X | | X |
| **CO-2** | X | | X |
| **CO-3** | X | | X |
| **CO-4** | X | X | X |
| **CO-5** | | X | X |
| **CO-6** | | X | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

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## 8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures |
| 2. | Understanding | Classroom lectures, Self-study |
| 3. | Critical Skills | Assignment |
| 4. | Analytical Skills | Assignment |
| 5. | Problem Solving Skills | Assignment, Examination |
| 6. | Practical Skills | Assignment |
| 7. | Group Work | -- |
| 8. | Self-Learning | Self-study |
| 9. | Written Communication Skills | Assignment, Examination |
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | -- |
| 13. | Information Management | Assignment |
| 14. | Personal Management | -- |
| 15. | Leadership Skills | -- |

## 9. Course Resources

a. **Essential Reading**
   1. Class Notes
   2. Pozar D.M. (2009) Microwave Engineering John Wiley & Sons

b. **Recommended Reading**
   1. Liao S. Y. (1997) Microwave devices and Circuits PHI, New Delhi
   2. Collin R. E. (2007) Foundations of Microwave Engineering John Wiley & Sons

c. **Magazines and Journals**
   1. IEEE Transactions on Microwave Theory and Techniques
   2. IEEE Microwave and Wireless components Letters
   3. IEEE Microwave magazine

d. **Websites**
   1. http://www.mtt.org/publications.html.org
   2. https://www.microwaves101.com

e. **Other Electronic Resources**
   1. Microwave bench
   2. EM Simulators

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## Course Specifications: Control Systems

| | |
|---|---|
| **Course Title** | Control Systems |
| **Course Code** | ECC304A |
| **Course Type** | Core Theory |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

### 1. Course Summary

This course imparts the skills for analytical design and analysis of continuous time control systems. The students will be trained on necessary mathematical tools for control system analysis and design in time and frequency domain. Students will be taught aboutmathematical modelling of linear systems, design and analysis of systems for given specifications and tune the controller for stable system operation. Students will be trained on the modeling and simulation of linear systems and design and analysis of controllers using MATLAB.

### 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 04 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:1:0 |
| **Total Hours of Interaction** | 60 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

### 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Explain the mathematical models of physical systems such as electrical, mechanical, electro mechanical, thermal and determine their transfer functions
**CO-2.** Analyse time and frequency domain response of a system
**CO-3.** Evaluate the system stability with time and frequency domain techniques and design suitable compensators
**CO-4.** Design a controller to meet the specifications of an application
**CO-5.** Analyse the performance of a controller and the feedback system
**CO-6.** Use standard software tools to analyse the systems in time and frequency domain

### 4. Course Contents

**Unit 1 (Introduction to Control Systems):** Concepts of Control Systems- Open Loop and closed loop control systems and their differences- A few illustrations of control systems- Effects of feedback, Classification of control systems, Requirements of control systems

**Unit 2 (Mathematical Modelling of Physical Systems):** Review of mathematical fundamentals - Linear differential equations, Order and degree of a system, Laplace transforms, Complex

numbers, Mathematical models and transfer functions of mechanical, electrical, electro mechanical, thermal systems, analogous systems. Block diagram and signal flow graph analysis

**Unit 3 (Transient and Steady-State Response Analyses):** Standard input signals like step, ramp, parabolic and impulse, time response specifications, time response analysis of first order and second order systems, Routh–Hurwitz stability criteria, Effects of proportional, integral and derivative control actions on system performance, Error analysis - open loop and closed loop poles and zeros, type number, steady state error and dynamic error and error coefficients

**Unit 4 (Control Systems Analysis and Design by the Root-Locus Method):** Introduction to Root Locus plots, Root Locus plots of positive feedback systems, Root Locus approach to control system design, Compensators – Lead, Lag, Lead-Lag, parallel compensators

**Unit 5 (Control Systems Analysis and Design by the Frequency-Response Method):** Introduction to Bode diagrams, Polar plot, Log magnitude versus Phase angle plot, M circles, N circles, Nichol's chart, Nyquist stability criterion, Stability and Relative stability analysis, Closed-loop frequency response of unity-feedback systems, Compensation Techniques - Lag, Lead, Lead-Lag compensators, Magnitude and Phase compensators design using Bode plot, Performance analysis of control systems with and without a compensator

**Unit 6 (Control System Analysis in State Space):** State space representation of transfer function systems, Conversion of state variable models to transfer functions and vice versa, Solutions of state equations, Controllability and Observability

## 5. Course Map (CO-PO-PSO Map)

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-1 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | | | | | | | | | | | 2 | 3 | | 2 |
| CO-2 | 2 | 3 | 2 | | | | | | | | | 2 | 3 | | 2 |
| CO-3 | 2 | 3 | 2 | | | | | | | | | 2 | 3 | | 2 |
| CO-4 | 1 | 1 | 2 | 2 | | | | | | | | 2 | 2 | 2 | 2 |
| CO-5 | 1 | 2 | 2 | 1 | | | | | | | | 2 | 2 | 1 | 2 |
| CO-6 | | 1 | 2 | 1 | | | | | | | | 2 | 2 | 1 | 2 |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

## 6. Course Teaching and Learning Methods

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 30 |
| **Demonstrations** | | 05 |
| 1. Demonstration using Videos | 05 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 25 |
| 1. Solving Numerical Problems | 25 | |

| | | |
|---|---|---|
| **Practical Work** | | 00 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 00 |
| 1. Case Study Presentation | 00 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **70** |

**7. Course Assessment and Reassessment**

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B.Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3 ), COs are assessed as illustrated in the following Table.

| **For Theory Courses Only** | | | |
|---|---|---|---|
| **Focus of COs on each Component or Subcomponent of Evaluation** | | | |
| | **Component 1: CE (50% Weightage)** | | **Component 2: SEE (50% Weightage)** |
| **Subcomponent ▸** | | | |
| **Subcomponent Type ▸** | **Term Tests** | **Assignments** | **100 Marks** |
| **Maximum Marks ▸** | **50** | **50** | |
| **CO-1** | X | | X |
| **CO-2** | X | | X |
| **CO-3** | X | | X |
| **CO-4** | | X | X |
| **CO-5** | | X | X |
| **CO-6** | | X | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

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**8. Achieving COs**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures |
| 2. | Understanding | Classroom lectures, Self-study |
| 3. | Critical Skills | Assignment |
| 4. | Analytical Skills | Assignment |
| 5. | Problem Solving Skills | Assignment, Examination |
| 6. | Practical Skills | Assignment |
| 7. | Group Work | -- |
| 8. | Self-Learning | Self-study |
| 9. | Written Communication Skills | Assignment, Examination |
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | -- |
| 13. | Information Management | Assignment |
| 14. | Personal Management | -- |
| 15. | Leadership Skills | -- |

**9. Course Resources**

a. **Essential Reading**
   3. Course Notes
   4. Katsuhiko Ogata, 2010, Modern Control Engineering, Prentice Hall

b. **Recommended Reading**
   3. Dorf, Richard, C. and Bishop, R.H., 2008, Modern Control Systems, Pearson Education
   4. Gopal M., 2002, Control Systems: Principles and Design. Tata McGraw-Hill Education

c. **Magazines and Journals**
   1. IEEE Control Systems Magazine

d. **Websites**
   3. http://ctms.engin.umich.edu/CTMS/index.php?aux=Home

e. **Other Electronic Resources**
   1. https://ocw.mit.edu/courses/mechanical-engineering/2-04a-systems-and-controls-spring-2013/

## Course Specifications: HDL Programming

| | |
|---|---|
| **Course Title** | HDL Programming |
| **Course Code** | ECC305A |
| **Course Type** | Core Theory |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

### 1. Course Summary

This course intends to prepare students to develop HDL program for a given digital design. Students are trained in VHDL and Verilog languages; and their application to solve practical problems. Students are taught the concepts of different design methodologies, and design modelling. Students will be trained to employ the appropriate modelling techniques to provide a solution for the given problem. Students are also taught simulation and synthesis of the programs developed using EDA tools. Significance and application of finite state machine are also emphasized.

### 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 04 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:1:0 |
| **Total Hours of Interaction** | 60 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

### 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Describe and compare different Hardware Description Languages (HDLs), design methodologies and modeling techniques
**CO-2.** Explain the lexical conventions, data types, constructs, delay concepts and synthesis approaches of HDL
**CO-3.** Design, develop and analyze HDL for digital circuits and Finite State Machines
**CO-4.** Design and develop the HDL for a given digital system's specification
**CO-5.** Simulate, synthesize and analyze the HDL for a given digital system using standard EDA tools
**CO-6.** Apply the concepts of HDL to solve problems related to real time scenario

### 4. Course Contents

**Unit 1 (Introduction to HDL):** Introduction of digital system design, A brief history of HDL, typical digital design flow, levels of design descriptions, design methodologies, simulation and synthesis tools, test bench

**Unit 2 (Verilog and VHDL Basics):** Verilog: Elements of Verilog HDLs, Lexical conventions:

Keywords, Identifiers, White Space Characters, Comments, Numbers, Strings, Logic Values; Data Types: Scalars and Vectors, Parameters, Memory, Operators; System Tasks and functions; VHDL: Port Declarations, Concurrency, Event Scheduling, Data Types; Brief comparison of Verilog and VHDL

**Unit 3 (Structural and Data Flow Modelling):** Styles (types) of modelling techniques, Importance of RTL Design, Parts of RTL design, Verilog: Types of gates, types of gate delays, types of delay values, continuous assignment, assignment delay, expressions, operators, operands, operator types, design examples; VHDL: Component declaration and instantiation, port map clause, Binding between library and component in VHDL, signal declaration and assignment statements, operators, design examples

**Unit 4 (Behavioral Modelling):** Verilog: Procedural assignment, Timing Controls, Conditional statements, Branching statement, Loops, Sequential and Parallel blocks, design examples; VHDL: Signals, variables and constants, Process block, Sequential statements, Sensitivity, Conditional statements, Branching statement, Looping statements; Next, exit, wait and assert statements, design examples

**Unit 5 (Finite State Machines):** Need of FSM, Elements of FSM, Components in FSM, FSM in HDL, Issues in FSM design, Case studies: Sequence detector, Odd parity Checker, Vending Machine

**Unit 6 (Synthesis and simulation Basics):** Highlights of Synthesis, Synthesis information from Entity and Module, Mapping Process and Always in the Hardware Domain. Simulation using standard EDA tool.

## 5. Course Map (CO-PO-PSO Map)

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | 3 | | | | | | | | | | | 3 | | |
| CO-2 | 3 | 3 | | | | | | | | | | | 3 | 1 | |
| CO-3 | 3 | 3 | 2 | 1 | 2 | | | | | | | | 3 | 2 | |
| CO-4 | 3 | 3 | 2 | 1 | 2 | | | | | | | | 3 | 2 | |
| CO-5 | 3 | 3 | 3 | 3 | 3 | | | | | | | | 3 | 2 | |
| CO-6 | 3 | 3 | 2 | 2 | 2 | | | | | | | | 3 | 2 | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

## 6. Course Teaching and Learning Methods

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 40 |
| **Demonstrations** | | 03 |
| 1. Demonstration using Videos | 01 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 02 | |
| **Numeracy** | | 15 |
| 1. Solving Numerical Problems | 15 | |
| **Practical Work** | | 00 |

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| | | |
|---|---|---|
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | |
| 1. Case Study Presentation | 02 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | 02 |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **70** |

## 7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B.Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the Cos. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3 ), Cos are assessed as illustrated in the following Table.

| **For Theory Courses Only** | | | |
|---|---|---|---|
| **Focus of COs on each Component or Subcomponent of Evaluation** | | | |
| | **Component 1: CE (50% Weightage)** | | **Component 2: SEE (50% Weightage)** |
| **Subcomponent ▸** | | | |
| **Subcomponent Type ▸** | **Term Tests** | **Assignments** | **100 Marks** |
| **Maximum Marks ▸** | **50** | **50** | |
| **CO-1** | X | | X |
| **CO-2** | X | | X |
| **CO-3** | X | | X |
| **CO-4** | | X | X |
| **CO-5** | | X | |
| **CO-6** | | X | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

## 8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following

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teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom Lectures, Assignment |
| 2. | Understanding | Classroom Lectures, Assignment |
| 3. | Critical Skills | Classroom Lectures, Assignment |
| 4. | Analytical Skills | Classroom Lectures, Assignment |
| 5. | Problem Solving Skills | Classroom Lectures, Assignment |
| 6. | Practical Skills | -- |
| 7. | Group Work | Assignment |
| 8. | Self-Learning | Assignment |
| 9. | Written Communication Skills | Assignment, Examination |
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | Course Work |
| 13. | Information Management | Assignment, Examination |
| 14. | Personal Management | Course Work |
| 15. | Leadership Skills | -- |

**9. Course Resources**

**a. Essential Reading**

1. Class Notes
2. Ciletti, Michael D. (2007) Advanced Digital Design with the Verilog HDL, Third Edition, Prentice Hall
3. Douglas L. Perry, (2002), Programming by example, 4th Edition, The McGraw-Hill Companies, Inc

**b. Recommended Reading**

1. Peter J. Ashenden (2002), The designer's Guide to VHDL, Second Edition, Morgan Kaufmann Publishers
2. Chu, P.P. (2011), FPGA prototyping by Verilog examples: Xilinx Spartan-3 version, John Wiley & Sons
3. Palnitkar, Samir (2003) Verilog HDL: A Guide to Digital Design and Synthesis, Second Edition, Prentice Hall Professional

**c. Magazines and Journals**

1. IEEE Transactions on Very Large Scale Integration (VLSI) Systems
2. IEEE Design & Test of Computers
3. IEEE Circuits and Devices Magazine

**d. Websites**

1. https://www.edaplayground.com
2. http://www.asic-world.com

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## Course Specifications: Engineering Economics

| | |
|---|---|
| **Course Title** | Engineering Economics |
| **Course Code** | ECH301A |
| **Course Type** | Ability Enhancement Compulsory |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

### 1. Course Summary

This course deals with the essentials of economics for engineers. Students are introduced to supply and demand and the basic forces that determine equilibrium in a market economy. An introduction to important macroeconomic topics is given. Students are also trained to analyse the budget and estimate costing related to electronic products.

### 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 03 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:0:0 |
| **Total Hours of Interaction** | 30 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 50 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

### 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Explain the concepts related to engineering decision making, time value of money, cash-flow analysis, financial accounting, budget, and project management
**CO-2.** Describe the factors related to microeconomics and macroeconomics
**CO-3.** Solve simple problems related to engineering decision making, time value of money, cash-flow analysis, financial accounting, budget, microeconomics, macroeconomics and project management
**CO-4.** Analyse a financial budget and interpret from economics point of view
**CO-5.** Develop a project management report related to an electronic product/system considering the financial and economic aspects

### 4. Course Contents

**Unit 1 (Engineering Decision Making):** Engineering Economics in Action, Engineering Decision Making, Making Decisions, Engineering Economics in Action, Uncertainty and Sensitivity Analysis

**Unit 2 (Time Value of Money and Cash Flow Analysis):** Interest and Interest Rates, Compound and Simple Interest, Effective and Nominal Interest Rates, Continuous Compounding, Cash Flow Diagrams, Equivalence: Mathematical Equivalence, Decisional Equivalence, Market Equivalence, Cash Flow Analysis: Timing of Cash Flows and Modelling, Compound Interest

Factors for Discrete Compounding, Compound Interest Factors for Single Disbursements or Receipts

**Unit 3 (Depreciation and Financial Accounting):** Depreciation and Depreciation Accounting, Reasons for Depreciation, Value of an Asset, Straight-Line Depreciation, Declining-Balance Depreciation, Elements of Financial Accounting: Measuring the Performance of a Firm, The Balance Sheet, The Income Statement, Estimated Values in Financial Statements, Financial Ratio Analysis

**Unit 4 (Microeconomics):** Applications of Supply and Demand, Demand and Consumer Behavior, Geometrical Analysis of Consumer Equilibrium, Production and Business Organization, Analysis of Costs, Production, Cost Theory, and Decisions of the Firm

**Unit 5 (Macroeconomics):** Overview of Macroeconomics, Measuring Economic Activity, Consumption and Investment, Business Fluctuations and the Theory of Aggregate Demand

**Unit 6 (Project Management):** Project Management Lifecycle: Initiation, Planning, Execution, Monitoring and Controlling, Closure; Project Management Tools: Work Breakdown Structure, Gantt Charts, The Critical Path Method Scheduling and the Critical Path Method; Dealing with Uncertainty and Risk; Case study on project management related to Electronic product and system

**5. Course Map (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-1 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 2 | | | | | | | | | | | | 1 | | |
| CO-2 | 2 | | | | | 2 | | 2 | | | | | 1 | 2 | |
| CO-3 | 2 | 2 | 1 | | | 2 | | 2 | | | | | 2 | 2 | |
| CO-4 | 2 | 2 | 1 | 2 | | 3 | | 2 | | | | | 2 | 2 | |
| CO-5 | 2 | 2 | 1 | 2 | | 3 | | 2 | | | | | 2 | 2 | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 20 |
| **Demonstrations** | | 05 |
| 1. Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 00 |
| 1. Solving Numerical Problems | 00 | |
| **Practical Work** | | 00 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |

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| | | |
|---|---|---|
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | |
| 1. Case Study Presentation | 04 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | 05 |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 01 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **40** |

**7. Course Assessment and Reassessment**

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B.Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3 ), COs are assessed as illustrated in the following Table.

| **For Theory Courses Only** | | | |
|---|---|---|---|
| **Focus of COs on each Component or Subcomponent of Evaluation** | | | |
| | **Component 1: CE (50% Weightage)** | | **Component 2: SEE (50% Weightage)** |
| **Subcomponent ▸** | | | |
| **Subcomponent Type ▸** | **Term Tests** | **Assignments** | **50 Marks** |
| **Maximum Marks ▸** | **25** | **25** | |
| **CO-1** | X | | X |
| **CO-2** | X | | X |
| **CO-3** | X | | X |
| **CO-4** | | X | X |
| **CO-5** | | X | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

**8. Achieving COs**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures, Assignments |
| 2. | Understanding | Classroom lectures, Assignments |

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| | | |
|---|---|---|
| 3. | Critical Skills | Classroom lectures, Assignments |
| 4. | Analytical Skills | Classroom lectures, Assignments |
| 5. | Problem Solving Skills | Classroom lectures, Assignments |
| 6. | Practical Skills | -- |
| 7. | Group Work | Assignment |
| 8. | Self-Learning | Assignment |
| 9. | Written Communication Skills | Assignment, examination |
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | Course work |
| 13. | Information Management | Assignment, examination |
| 14. | Personal Management | Course work |
| 15. | Leadership Skills | -- |

**9. Course Resources**

**a. Essential Reading**

5. Class Notes
6. Niall M. Fraser Elezabeth M. Jewkes (2013) Engineering Economics-Financial Decision Making for Engineers, Pearson, Fifth edition
7. Paul A. Samuelson and William D. Nordhaus (2001), Economics, McGraw-Hill, 17th edition

**b. Recommended Reading**

5. Mankiw, Gergory, N (2012) Principles of Microeconomics, South Western
6. Mankiw Gregory (2008) Macroeconomics 6th edition, Palgrave

**c. Magazines and Journals**

4. The Economist

**d. Websites**

1. www.economist.com
2. www.ft.com

**e. Other Electronic Resources**

1. https://www.investopedia.com/university/all/economics/

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## Course Specifications: Analog Communication Laboratory

| | |
|---|---|
| **Course Title** | Analog Communication Laboratory |
| **Course Code** | ECL306A |
| **Course Type** | Laboratory |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

### 1. Course Summary

The focus of this course is to design analog communication systems, model, simulate and verify the simulated results with that of the physical model built based on the design. Students are required to use appropriate software for simulation and trained to build and test analog communication systems.

### 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 01 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 0:0:1 |
| **Total Hours of Interaction** | 30 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 50 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

### 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Design, model and simulate analog communication circuits and sub-systems
**CO-2.** Build designed analog communication systems
**CO-3.** Analyse and evaluate standard analog communication systems through their waveforms
**CO-4.** Write the analysis report as per the prescribed format

### 4. Course Contents

| | |
|---|---|
| 1 | Design and development of an Amplitude Modulation (AM) system |
| 2 | Design and development of a Double Sideband Suppressed Carrier (DSB-SC) Modulation |
| 3 | Design and development of a Single Sideband Suppressed Carrier (SSB-SC) Modulation |
| 4 | Design and Implementation of Frequency Modulation (FM) system |
| 5 | Development of Amplitude Modulation using 8038 IC |
| 6 | Development of Frequency Modulation using 8038 IC |
| 7 | Development and Implementation of Pre-emphasis and De-emphasis Circuits |
| 8 | Development and software simulation of PAM, PWM and PPM waveforms |
| 9 | Demonstration of USRP and LabView based AM and FM communication links |
| 10 | Software Simulation of AM, FM waveforms using MATLAB/ LabView |

## 5. Course Map (CO-PO-PSO Map)

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | 2 | 2 | 3 | 2 | | | | | | | | 3 | 3 | |
| CO-2 | 3 | 2 | 2 | 3 | 2 | | | | | | | | 3 | 3 | |
| CO-3 | 3 | 2 | 2 | 3 | 2 | | | | | | | | 3 | 3 | |
| CO-4 | 3 | | | | | | | | 3 | 3 | | | 1 | 1 | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

## 6. Course Teaching and Learning Methods

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 00 |
| **Demonstrations** | | 00 |
| 1. Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 00 |
| 1. Solving Numerical Problems | 00 | |
| **Practical Work** | | 30 |
| 1. Course Laboratory | 30 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 00 |
| 1. Case Study Presentation | 00 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **36** |

## 7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B.Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

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The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3 ), COs are assessed as illustrated in the following Table.

| For Laboratory Courses Only | | | |
|---|---|---|---|
| Focus of COs on each Component or Subcomponent of Evaluation | | | |
| | Component 1: CE (50% Weightage) | | Component 2: SEE (50% Weightage) |
| Subcomponent ▸ | | | |
| Subcomponent Type ▸ | Conduct of Experiments | Laboratory Report + Viva | Laboratory SEE |
| Maximum Marks ▸ | 25 | 25 | 50 |
| CO-1 | X | | X |
| CO-2 | X | | X |
| CO-3 | X | | X |
| CO-4 | | X | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

**8. Achieving COs**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Laboratory Instruction |
| 2. | Understanding | Laboratory Instructions and Experiments |
| 3. | Critical Skills | Laboratory Work |
| 4. | Analytical Skills | Laboratory Work |
| 5. | Problem Solving Skills | Laboratory Work |
| 6. | Practical Skills | Laboratory Work |
| 7. | Group Work | Laboratory Work |
| 8. | Self-Learning | Laboratory Work |
| 9. | Written Communication Skills | Laboratory Work, Examination |
| 10. | Verbal Communication Skills | Laboratory Examination |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | Course work |
| 13. | Information Management | Laboratory Work |
| 14. | Personal Management | Course Work |
| 15. | Leadership Skills | -- |

**9. Course Resources**

**a. Essential Reading**

1. Lab Manual

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2. Haykin, S. (1996) Communication Systems, 3rd Edition, John Willey Publications
3. Haykin, S. (2003) An Introduction to Analog and Digital Communication, John Willey Publications

**b. Recommended Reading**

1. Lathi, B.P. (2007) Modern Digital and Analog Communication Systems, 3rd Edition, Oxford University Press
2. Harold, P. E., Samy, S., and Mahmond, A. (2004) *Communication Systems,* Pearson Education

**c. Magazines and Journals**

5. IEEE Spectrum
6. IET Communication Magazine

**d. Websites**

3. www.rfeda.com

**e. Other Electronic Resources**

i. SystemVUE

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## Course Specifications: Digital Signal Processing Laboratory

| | |
|---|---|
| **Course Title** | Digital Signal Processing Laboratory |
| **Course Code** | ECL307A |
| **Course Type** | Laboratory |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

### 1. Course Summary

This laboratory deals with verification of concepts of digital signal processing through modelling and simulation. Sampling theorem, Analog and digital filters, spectral analysis, multirate processing are simulated using standard software. Students are trained to model and simulate signal processing algorithms as applied to communications and image processing.

### 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 01 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 0:0:1 |
| **Total Hours of Interaction** | 30 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 50 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

### 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Simulate key concepts of signal processing using software tools
**CO-2.** Design, model, simulate and analyse analogue and digital filters
**CO-3.** Develop routines for DSP algorithms using standard software and compare the results obtained by analytical method
**CO-4.** Design, model, simulate and analyse given communication and image processing applications
**CO-5.** Write laboratory report as per the prescribed format

### 4. Course Contents

| | |
|---|---|
| 1 | Verification of sampling theorem. |
| 2 | Computation of impulse response of a given system. |
| 3 | Derivation of impulse response of a given system represented by a difference equation. |
| 4 | Computation of linear and circular convolution of two given sequences in time and frequency domain and verification using DSP Processor |
| 5 | Computation of autocorrelation of given sequence and verification of its properties. |
| 6 | Computation of cross correlation of a given sequences and verification of its properties. |

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| | |
|---|---|
| 7 | Computation of N-point DFT of a given sequence and plotting of frequency response and verification using DSP Processor. |
| 8 | Design and implementation of FIR filters (LPF, HPF, BPF, BSF) to meet given specifications and verification using DSP Processor. |
| 9 | Design and implementation of IIR filters (LPF, HPF, BPF, BSF) to meet given specifications and verification using DSP Processor. |
| 10 | Implementation of interpolation and decimation on signals and images. |

**5. Course Map (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | 3 | 3 | 2 | 3 | | | | | | 1 | | 3 | 2 | |
| CO-2 | 3 | 3 | 2 | 2 | 3 | | | | | | | | 3 | 2 | |
| CO-3 | 3 | 3 | 1 | 2 | 3 | | | | | | | | 3 | 2 | |
| CO-4 | 3 | 3 | 3 | 2 | 3 | | | | | | | | 3 | 2 | |
| CO-5 | | | | | | | | | 3 | 3 | | | 1 | 1 | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 00 |
| **Demonstrations** | | 00 |
| 1. Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 00 |
| 1. Solving Numerical Problems | 00 | |
| **Practical Work** | | 30 |
| 1. Course Laboratory | 30 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 00 |
| 1. Case Study Presentation | 00 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **40** |

**7. Course Assessment and Reassessment**

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The details of the components and subcomponents of course assessment is presented in the Programme Specifications document pertaining to the B.Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3 ), COs are assessed as illustrated in the following Table.

| For Laboratory Courses Only | | | |
|---|---|---|---|
| Focus of COs on each Component or Subcomponent of Evaluation | | | |
| | Component 1: CE (50% Weightage) | | Component 2: SEE (50% Weightage) |
| Subcomponent ▸ | | | |
| Subcomponent Type ▸ | Conduct of Experiments | Laboratory Report + Viva | Laboratory SEE |
| Maximum Marks ▸ | 25 | 25 | 50 |
| CO-1 | X | | X |
| CO-2 | X | | X |
| CO-3 | X | | X |
| CO-4 | X | | X |
| CO-5 | | X | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

### 8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Laboratory Demonstration |
| 2. | Understanding | Laboratory Demonstration, Performing |
| 3. | Critical Skills | Experiments |
| 4. | Analytical Skills | Performing Experiments |
| 5. | Problem Solving Skills | Performing Experiments |
| 6. | Practical Skills | Performing Experiments |
| 7. | Group Work | Performing Experiments |
| 8. | Self-Learning | -- |
| 9. | Written Communication Skills | Self-Study |
| 10. | Verbal Communication Skills | Lab Report |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | -- |
| 13. | Information Management | -- |

| | | |
|---|---|---|
| 14. | Personal Management | Lab Report |
| 15. | Leadership Skills | -- |

**9. Course Resources**

**a. Essential Reading**

1. Lab Manual
2. Mitra S. K. (1999) Digital Signal Processing Laboratory Using Matlab, McGraw-Hill

**b. Recommended Reading**

1. Ingle V. K. (2011) Digital Signal Processing Using MATLAB, 3rd edition, Cengage Learning

**c. Magazines and Journals**

2. IEEE Transactions on Signal Processing

**d. Websites**

1. https://www.tutorialspoint.com/digital_signal_processing/index.htm

**e. Other Electronic Resources**

1. https://ocw.mit.edu/resources/res-6-008-digital-signal-processing-spring-2011/

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**Course Specifications: Information Theory**

| | |
|---|---|
| **Course Title** | Information Theory |
| **Course Code** | ECC308A |
| **Course Type** | Core Theory |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

**1. Course Summary**

The course deals with the concepts of information theory and coding. Students are taught various encoding techniques for digital data transmission and performance limits and Shannon's channel capacity theorem. The course also emphasizes entropy, information measures and various error detection and correction techniques as applied to data reception

**2. Course Size and Credits:**

| | |
|---|---|
| **Number of Credits** | 04 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:1:0 |
| **Total Hours of Interaction** | 60 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

**3. Course Outcomes (COs)**

After the successful completion of this course, the student will be able to:

**CO-1.** Describe the types of information sources, encoding techniques, channels and channel capacity.
**CO-2.** Explain the basic concepts of information theory, Shannon's theorems, and various encoding techniques.
**CO-3.** Solve simple problems to compute entropy, information measures and evaluate various codes.
**CO-4.** Design encoders and decoders for error control coding techniques
**CO-5.** Solve complex problems to compute entropy, information measures and evaluate various codes.
**CO-6.** Use software tools for implementation and performance analysis of error detection and correction codes.

**4. Course Contents**

**Unit 1 (Information Theory):** Introduction, Measure of information, Average information content of symbols in long independent sequences, Average information content of symbols in long dependent sequences. Mark off statistical model for information source, Entropy and information rate of mark-off source.

**Unit 2 (Source Coding):** Encoding of the source output, Shannon's encoding algorithm.

Communication Channels, Discrete communication channels, Continuous channels. Source encoding: Encoding of the source output, Shannon's encoding theorem and algorithm. Shannon-Fano codes, Huffman coding, Arithmetic coding, The Lempel –Ziv coding, Run length encoding

**Unit 3 (Fundamental Limits on Performance):** Source coding theorem, Huffman coding, Discrete memory less Channels, Mutual information, Channel Capacity. Channel coding theorem, Differential entropy and mutual information for continuous ensembles, Channel capacity theorem. Discrete communication channel: Models, Mutual information, Channel coding theorem, Channel capacity theorem. Continuous channel: Differential entropy, Mutual information, Channel capacity

**Unit 4 (Error Control Coding):** Introduction, Types of errors, examples, Types of codes Linear Block Codes: Matrix description, Error detection and correction, Standard arrays and table look up for decoding. Finite fields, Binary Cycle Codes, Algebraic structures of cyclic codes, Encoding using an (n-k) bit shift register, Syndrome calculation. BCH codes. RS codes, Golay codes, Shortened cyclic codes, Burst error correcting codes. Burst and Random Error correcting codes. Convolution Codes: Time domain approach, Transform domain approach. Viterbi decoding, feedback decoding, sequential decoding, Turbo Codes.

**5. Course Map (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-1 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | | | | | | | | | | | | 3 | | |
| CO-2 | 3 | | | | | | | | | | | | 3 | | |
| CO-3 | 3 | 3 | 3 | 2 | 3 | | | | | | | | 3 | 3 | |
| CO-4 | 3 | 3 | 3 | 2 | 3 | | | | | | | | 3 | 3 | |
| CO-5 | 3 | 3 | 3 | 2 | 3 | | | | | | | | 3 | 3 | |
| CO-6 | 3 | 3 | 3 | 2 | 3 | | | | | | | | 3 | 3 | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 30 |
| **Demonstrations** | | 05 |
| 1. Demonstration using Videos | 05 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 25 |
| 1. Solving Numerical Problems | 25 | |
| **Practical Work** | | 00 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |

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| | | |
|---|---|---|
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | |
| 1. Case Study Presentation | 00 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | 00 |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **70** |

**7. Course Assessment and Reassessment**

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B.Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the Cos. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3 ), Cos are assessed as illustrated in the following Table.

| **For Theory Courses Only** | | | |
|---|---|---|---|
| **Focus of COs on each Component or Subcomponent of Evaluation** | | | |
| | **Component 1: CE (50% Weightage)** | | **Component 2: SEE (50% Weightage)** |
| **Subcomponent ▸** | | | |
| **Subcomponent Type ▸** | **Term Tests** | **Assignments** | **100 Marks** |
| **Maximum Marks ▸** | **50** | **50** | |
| **CO-1** | X | | X |
| **CO-2** | X | | X |
| **CO-3** | X | | X |
| **CO-4** | X | X | X |
| **CO-5** | | X | X |
| **CO-6** | | X | |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

**8. Achieving COs**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom Lectures, Assignments |

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| | | |
|---|---|---|
| 2. | Understanding | Classroom Lectures, Assignments |
| 3. | Critical Skills | Classroom Lectures, Assignments |
| 4. | Analytical Skills | Classroom Lectures, Assignments |
| 5. | Problem Solving Skills | Classroom Lectures, Assignments |
| 6. | Practical Skills | -- |
| 7. | Group Work | Assignment |
| 8. | Self-Learning | Assignment |
| 9. | Written Communication Skills | Assignment, Examination |
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | Course work |
| 13. | Information Management | Assignment, Examination |
| 14. | Personal Management | Coursework |
| 15. | Leadership Skills | -- |

## 9. Course Resources

### a. Essential Reading

1. Class Notes
2. K. Sam Shanmugam (1996) Digital and Analog Communication Systems, John Wiley India pvt. Ltd
3. Simon Haykin (2008) Digital Communication, John Wiley India Pvt. Ltd

### b. Recommended Reading

1. Ranjan Bose (2007) ITC and Cryptography, Second Edition, Tata McGraw- Hill
2. Glover and Grant (2008) Digital Communications, Second Edition, Pearson Education.

### c. Magazines and Journals

1. IEEE Journals

### d. Other Electronic Resources

1. NPTEL Videos

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## Course Specifications: Digital Communication

| | |
|---|---|
| **Course Title** | Digital Communication |
| **Course Code** | ECC309A |
| **Course Type** | Core Theory |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

### 1. Course Summary

This course deals with the principles of digital communication systems. Students are taught the principles and functional analysis of sub blocks such as digital modulation schemes, coherent and non-coherent demodulation schemes, digital receiver structures, equalization, synchronization and multicarrier modulation techniques.

### 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 04 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:1:0 |
| **Total Hours of Interaction** | 60 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

### 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe the baseband pulse modulation schemes, line coding schemes, and Nyquist criterion for digital transmissions.
- **CO-2.** Discuss geometric representation of signals, M-ary modulation schemes, equalization techniques of digital communication systems
- **CO-3.** Explain coherent and non-coherent receiver structures, synchronization, spread spectrum techniques and multicarrier modulations
- **CO-4.** Analyse digital base band communication systems by applying digital coding, Nyquist criterion, PSD, eye pattern and equalization
- **CO-5.** Evaluate M-ary modulation schemes, digital receiver structures, synchronization and spread spectrum schemes and multicarrier modulations for digital communication systems
- **CO-6.** Use software tools for programming and performance analysis of blocksets of digital communication system

### 4. Course Contents

**Unit 1 (Baseband Communication):** Pulse Modulation-PAM,PPM and PDM, Line codes - RZ,NRZ, Manchester, Binary N-zero, substitution codes – PSDs – ISI – Nyquist criterion for distortion less transmission, Quantization & Coding, Quantization error, Companding in PCM

systems. Differential PCM systems (DPCM) – Pulse shaping, Delta modulation, its draw backs, adaptive delta modulation, comparison of PCM and DM systems, noise in PCM and DMsystems. Correlative coding - M-ary PAM schemes – Eye pattern, Equalization – Zero forcing

**Unit 2 (Bandpass Signaling):** Geometric representation of signals – ML detection - Correlator and matched filter detection, Passband transmission - generation and detection of ASK, FSK, PSK, DPSK, QPSK, M-ary PSK, ASK, FSK BER and Power spectral Density, Comparison - Structure of non-coherent receivers - generation and detection of BFSK, DPSK – Principles of QAM. Band Pass Sampling, BER Analysis.

**Unit 3 (Spread Spectrum Techniques):** Spread Spectrum - PN Sequences, Direct Sequence Spread Spectrum (DSSS) and Frequency Hopping Spread Spectrum Systems (FHSS), Processing gain and Jamming Margin, Application in Cellular Systems

**Unit 4 (Synchronization Techniques):** Synchronization – Carrier, symbol, Carrier phase estimation, Symbol timing estimation.

**Unit 5 (Multicarrier Modulation):** Discrete Multi-tone modulation, Multicarrier Modulation, Basics of OFDM System – Orthogonal carriers, FFT Based OFDM System

**5. Course Map (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | 1 | | | | | | | | | | | 3 | | |
| CO-2 | 3 | 2 | 1 | | | | | | | | | | 3 | 2 | |
| CO-3 | 3 | 2 | 1 | 2 | | | | | | | | | 3 | 2 | |
| CO-4 | 3 | 3 | 3 | 3 | 3 | | | | | | | | 3 | 3 | |
| CO-5 | 3 | 3 | 3 | 3 | 3 | | | | | | | | 3 | 3 | |
| CO-6 | 3 | 3 | 3 | 3 | 3 | | | | | | | | 3 | 3 | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 40 |
| **Demonstrations** | | 05 |
| 1. Demonstration using Videos | 03 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 02 | |
| **Numeracy** | | 15 |
| 1. Solving Numerical Problems | 30 | |
| **Practical Work** | | 00 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |

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| | | |
|---|---|---|
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | |
| 1. Case Study Presentation | 00 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | 00 |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **70** |

**7. Course Assessment and Reassessment**

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B.Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3 ), COs are assessed as illustrated in the following Table.

| **For Theory Courses Only** | | | |
|---|---|---|---|
| **Focus of COs on each Component or Subcomponent of Evaluation** | | | |
| | **Component 1: CE (50% Weightage)** | | **Component 2: SEE (50% Weightage)** |
| **Subcomponent ▸** | | | |
| **Subcomponent Type ▸** | **Term Tests** | **Assignments** | **100 Marks** |
| **Maximum Marks ▸** | **50** | **50** | |
| **CO-1** | X | | X |
| **CO-2** | X | | X |
| **CO-3** | X | | X |
| **CO-4** | X | X | X |
| **CO-5** | | X | X |
| **CO-6** | | X | |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

**8. Achieving COs**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures and Assignments |

| | | |
|---|---|---|
| 2. | Understanding | Classroom lectures and Assignments |
| 3. | Critical Skills | Classroom lectures and Assignments |
| 4. | Analytical Skills | Classroom lectures and Assignments |
| 5. | Problem Solving Skills | Classroom lectures and Assignments |
| 6. | Practical Skills | Assignment |
| 7. | Group Work | Assignment |
| 8. | Self-Learning | Assignment |
| 9. | Written Communication Skills | Assignment and Examination |
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | Course work |
| 13. | Information Management | Assignment and Examination |
| 14. | Personal Management | Course work |
| 15. | Leadership Skills | -- |

**9. Course Resources**

**a. Essential Reading**

1. Course Notes
2. Haykin, S. (2005) Digital Communications. John Wiley

**b. Recommended Reading**

1. Proakis, J.G. (2001) Digital Communication, 4th edition, Mc-Graw Hill
2. Lathi, B.P. (2007) Modern Digital and Analog Communication Systems, 3rd Edition, Oxford University Press
3. Sklar B, 2007, Digital Communication Fundamentals and Applications, 2nd Edition, Pearson Education

**c. Magazines and Journals**

1. IEEE Spectrum

**d. Websites**

1. www.mwrf.com

**e. Other Electronic Resources**

1. MATLAB
2. SystemVUE

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## Course Specifications: Antenna and Propagation

| | |
|---|---|
| **Course Title** | Antenna and Propagation |
| **Course Code** | ECC310A |
| **Course Type** | Core Theory |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

### 1. Course Summary

The course deals with antenna and propagation of electromagnetic waves. Students are taught antenna theory, common antenna configurations such as linear dipoles, loops, arrays, horn, microstrip and reflector. In addition, the basic concepts of integrated antennas, antennas for mobile communications, RFID systems and Ultra-Wide-Band (UWB) applications are also taught. Simple models of the major phenomena of interaction between radio wave propagation and environment are presented.

### 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 04 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:1:0 |
| **Total Hours of Interaction** | 60 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

### 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Describe antenna theory, wave propagation, antenna arrays and their performance metrics
**CO-2.** Explain the various antenna performance parameters, measurement techniques and design guidelines with respect to various antenna configurations
**CO-3.** Discuss radio wave propagation and computational electromagnetics techniques
**CO-4.** Discuss the principles and theorems in aperture and reflector antenna
**CO-5.** Analyse antenna arrays, performance metrics of various antenna
**CO-6.** Use software tools for analysis of various antenna characteristics and performance metrics

### 4. Course Contents

**Unit 1 (Fundamentals of Electromagnetic Theory and Antenna Basics):** Vector potential, Solution of wave equation, Hertizian dipole. Basic Antenna parameters, patterns, beam area, radiation intensity, beam efficiency, diversity and gain, antenna apertures, effective height, bandwidth, radiation, efficiency, antenna temperature and antenna field zones

**Unit 2 (Antenna Theory):** Point Sources and Arrays: Point sources, power patterns, power

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theorem, radiation intensity, filed patterns, phase patterns. Array of two isotropic point sources, principles of pattern multiplication, non-isotropic point sources, broad side versus end fire array, direction of maxima fire arrays of n isotropic point sources of equal amplitude and spacing.
Linear Array and Pattern Multiplication, Two-element Array, Uniform Array, Polynomial representation, Array with non-uniform Excitation-Binomial Array

**Unit 3 (Types of Antennas and their characteristics:** Wire antennas: Short electric dipole, fields of a short dipole, radiation resistance of short dipole Directivity, radiation resistances Antenna (Half wave Dipole), Monopole Loop Antennas: Small loop, loop antenna general case,far field patterns of circular loop, radiation resistance, and directivity. Aperture Antennas: Magnetic Current and its fields, Uniqueness theorem, Field equivalence principle, Duality principle, Method of Images, Pattern properties, Babinet's principle, slot antenna, Reflector Antenna- Flat reflector, Corner Reflector, Common curved reflector shapes, Lens Antenna Antenna Types: Helical Antenna, Yagi-Uda array, parabolic reflectors, omni directional antennas, RFID and UWB antennas

**Unit 4 (Antenna Measurements):** Radiation Pattern measurement, Gain and Directivity Measurements, Anechoic Chamber measurement

**Unit 5 (Radio Wave Propagation):** Ground Wave Propagation, Great Circle Distance Free-space Propagation, Ground Reflection, Surface waves, Tropospheric Propagation, Structure of ionosphere, Sky waves, skip distance, Virtual height, Critical frequency, MUF

**Unit 6 (Computational Electromagnetics):** Introduction to FEM and FDTD, Case Studies

**5. Course Map (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | | | | | | | | | | | | 3 | | |
| CO-2 | 3 | 1 | 2 | | | | | | | | | | 3 | 2 | |
| CO-3 | 3 | 2 | 2 | 2 | 2 | | | | | | | | 3 | 2 | |
| CO-4 | 3 | 2 | 2 | 2 | 3 | | | | | | | | 3 | 3 | |
| CO-5 | 3 | 3 | 3 | 3 | 3 | | | | | | | | 3 | 3 | |
| CO-6 | 3 | 3 | 3 | 3 | 3 | | | | | | | | 3 | 3 | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 40 |
| **Demonstrations** | | 05 |
| 1. Demonstration using Videos | 02 | |
| 2. Demonstration using Physical Models / Systems | 01 | |
| 3. Demonstration on a Computer | 02 | |
| **Numeracy** | | 15 |
| 1. Solving Numerical Problems | 30 | |

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| | | |
|---|---|---|
| **Practical Work** | | 00 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 00 |
| 1. Case Study Presentation | 00 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **70** |

## 7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B.Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3 ), COs are assessed as illustrated in the following Table.

| **For Theory Courses Only** | | | |
|---|---|---|---|
| **Focus of COs on each Component or Subcomponent of Evaluation** | | | |
| | **Component 1: CE (50% Weightage)** | | **Component 2: SEE (50% Weightage)** |
| **Subcomponent ▸** | | | |
| **Subcomponent Type ▸** | **Term Tests** | **Assignments** | **100 Marks** |
| **Maximum Marks ▸** | **50** | **50** | |
| **CO-1** | X | | X |
| **CO-2** | X | | X |
| **CO-3** | X | | X |
| **CO-4** | X | | X |
| **CO-5** | | X | X |
| **CO-6** | | X | |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

## 8. Achieving COs

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The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures, Assignments |
| 2. | Understanding | Classroom lectures, Assignments |
| 3. | Critical Skills | Classroom lectures, Assignments |
| 4. | Analytical Skills | Classroom lectures, Assignments |
| 5. | Problem Solving Skills | Classroom lectures, Assignments |
| 6. | Practical Skills | -- |
| 7. | Group Work | Assignment |
| 8. | Self-Learning | Assignment |
| 9. | Written Communication Skills | Assignment, examination |
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | Course work |
| 13. | Information Management | Assignment, examination |
| 14. | Personal Management | Course work |
| 15. | Leadership Skills | -- |

**9. Course Resources**

**a. Essential Reading**

1. Class Notes
2. Balanis (2003) Antenna Theory, John Wiley & Sons, Second Edition

**b. Recommended Reading**

1. Kraus, J. D. and Marhefka R. (2002) Antennas, Tata McGraw-Hill Book Company
2. Collins, R. E. (1987) Antennas and Radio Propagation, McGraw-Hill

**c. Magazines and Journals**

1. IEEE Transactions on Microwave Theory and Techniques
2. IEEE Microwave and Wireless components Letters
3. IEEE Microwave magazine

**d. Websites**

1. www.mwrf.com
2. www.microwavejournal.com

**e. Other Electronic Resources**

1. EMpro EM tools
2. Network Analyser
3. Spectrum Analyser

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**Course Specifications: Computer Networks**

| | |
|---|---|
| **Course Title** | Computer Networks |
| **Course Code** | ECC311A |
| **Course Type** | Core Theory |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

## 1. Course Summary

This course deals with the concept and technologies used in modern computer networking and data communication. This course facilitates the students to understand the function of different layers and IEEE standards employed in computer networking. The students are taught the methods to enhance network performance such as routing and congestion control. Control mechanisms underlying local area and wide area networks will be dealt in detail. Further, wireless networks and the fundamentals of information transmission will be emphasized.

## 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 04 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 4:0:0 |
| **Total Hours of Interaction** | 60 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

## 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Explain the fundamentals of data communications, functionalities of OSI layers, algorithms and protocols, frame formats, network security issues related to data communications
**CO-2.** Describe error detection and correction for communication, structure of wired and wireless networks, point to point protocols for communication and QoS performance measurements
**CO-3.** Solve numerical problems related to data communications
**CO-4.** Design the protocols and algorithms for data communication
**CO-5.** Analyse the networks and interpret their performance
**CO-6.** Develop the protocols and algorithms for end to end communication and simulations using standard tools

## 4. Course Contents

**Unit 1 (Introduction):** Data communication, Categories of Networks, Interconnection of Networks: Internetwork, Internet Protocols and Standards: Protocols, Standards, Standards Organizations, Internet Standards, The OSI Model, TCP/IP Protocol suite and Addressing

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**Unit 2 (Physical Layer):** Analog and Digital: Analog signals, Digital signals, Analog and Digital Signal conversion techniques, Transmission impairment, Data rate limits and Performance Digital Transmission: Line coding, Block coding, sampling, Digital to Digital Conversion, Analog to Digital conversion, Transmission modes
Analog Transmission: Digital to Analog Conversion, Analog to Analog Conversion, Telephone modems
Bandwidth Utilization: Multiplexing and De-multiplexing processes, WDM, TBM-time slots and frames, interleaving, synchronization, bit padding
Circuit switching

**Unit 3 (Data Link Layer):** Error detection and correction: Types of Errors, Detection-redundancy, parity check, cyclic redundancy check, checksum, Error correction- Error correction by retransmission, forward error correction, Burst error correction, Framing, flow and error control, Media access control, Ethernet (802.3) , Wireless LANs – 802.11, Switching and bridging, Basic Internetworking (IP, CIDR, ARP, DHCP,ICMP)

**Unit 4 (Network Layer):** Need of network layer, switched network, Addressing, network address translation, Logical Addressing: IPv4 Addresses and structures, IPV6 address and structures, conversion techniques of IPV4 to IPV6, Routing techniques, IP protocols: ARP, RARP, ICMP, IGMP

**Unit 5 (Transport Layer):** User Datagram Protocol, TCP, SCTP, TCP Congestion control and avoidance, Quality of Service

**Unit 6 (Application Layer):** Domain Name System: Name Space, DNS, Distribution of NS, DNS in the internet, Resolution, DNS messages, Remote logging, Electronic Mail, File Transfer, WWW and HTTP, SNM

**5. Course Map (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | | | | | | | | | | | | 3 | | |
| CO-2 | 3 | | | | | | | | | | | | 3 | 1 | |
| CO-3 | 3 | 2 | 2 | 1 | 2 | | | | | | | | 3 | 1 | |
| CO-4 | 3 | 2 | 2 | 1 | 2 | | | | | | | | 3 | 2 | |
| CO-5 | 3 | 2 | 3 | 2 | 3 | | | | | | | | 3 | 2 | |
| CO-6 | 1 | 2 | 3 | 2 | 3 | | | | | | | | 3 | 3 | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 40 |
| **Demonstrations** | | 05 |
| 1. Demonstration using Videos | 03 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 02 | |

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| | | |
|---|---|---|
| **Numeracy** | | 15 |
| 1. Solving Numerical Problems | 15 | |
| **Practical Work** | | 00 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 00 |
| 1. Case Study Presentation | 00 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **70** |

**7. Course Assessment and Reassessment**

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B.Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the Cos. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3 ), Cos are assessed as illustrated in the following Table.

| **For Theory Courses Only** | | | |
|---|---|---|---|
| **Focus of COs on each Component or Subcomponent of Evaluation** | | | |
| | **Component 1: CE (50% Weightage)** | | **Component 2: SEE (50% Weightage)** |
| **Subcomponent ▸** | | | |
| **Subcomponent Type ▸** | **Term Tests** | **Assignments** | **100 Marks** |
| **Maximum Marks ▸** | **50** | **50** | |
| **CO-1** | X | | X |
| **CO-2** | X | | X |
| **CO-3** | X | | X |
| **CO-4** | | X | X |
| **CO-5** | | X | X |
| **CO-6** | | X | |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

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**8. Achieving COs**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom Lectures |
| 2. | Understanding | Classroom Lectures, Self-study |
| 3. | Critical Skills | Assignment |
| 4. | Analytical Skills | Assignment |
| 5. | Problem Solving Skills | Assignment and Exam |
| 6. | Practical Skills | Assignment |
| 7. | Group Work | Assignment |
| 8. | Self-Learning | Self-learning |
| 9. | Written Communication Skills | Assignment |
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | Assignment |
| 12. | Behavioral Skills | -- |
| 13. | Information Management | Assignment |
| 14. | Personal Management | -- |
| 15. | Leadership Skills | -- |

**9. Course Resources**

**a. Essential Reading**

1. Course Notes
2. Forouzan, B. (2013) Data Communication and Networking, 5th edn. McGraw-Hill
3. Cordeiro, C. M., and Agrawal, D. P. (2011) Ad Hoc and Sensor Networks: Theory and Applications, 2nd edn. World Scientific
4. Cole, E. (2009) Network Security Bible, 2nd edn. Wiley Publishing

**b. Recommended Reading**

1. Tanenbaum, A. S., and Wetherall, D. J. (2010) Computer Networks, 5th edn. Prentice Hall
2. Olifer, N., and Olifer, V. (2006) Computer Networks: Principles, Technologies and Protocols for Network Design. Wiley
3. Stevens, R. W. (1998) Network Programming-Networking APIs: Sockets and XTI. Prentice Hall

**c. Magazines and Journals**

1. ACM Transactions on Networking
2. IEEE Transactions on Communications
3. Wireless Networks
4. IEEE Communication Letters

**d. Websites**

1. http://www.comsoc.org

**e. Other Electronic Resources**

1. https://www.iso.org/ics/35.100/x/
2. Simulators (NS2 and MATLAB

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## Course Specifications: Digital Communication Laboratory

| | |
|---|---|
| **Course Title** | Digital Communication Laboratory |
| **Course Code** | ECL312A |
| **Course Type** | Laboratory |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

### 1. Course Summary

This laboratory deals with practice of experiments and exercises on digital communication block sets. The Nyquist sampling theorem for sampling of analog waveforms, various form of pulse modulation schemes, line coding schemes and digital modulations demodulation techniques will be carried out. The students will be taught to analyse spread spectrum modulation techniques.

### 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 01 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 0:0:1 |
| **Total Hours of Interaction** | 30 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 50 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

### 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

- **CO-1.** Design, model and simulate digital communication circuits and sub-systems
- **CO-2.** Build sub-systems of digital communication systems using kits
- **CO-3.** Analyse and evaluate standard digital communication systems through their waveforms
- **CO-4.** Write the analysis report as per the prescribed format

### 4. Course Contents

| | |
|---|---|
| 1 | Analysis of Nyquist Criterion on Signal Sampling and Reconstruction |
| 2 | Pulse Amplitude Modulation (PAM) and demodulation. |
| 3 | Pulse Width Modulation (PWM) and demodulation. |
| 4 | Pulse Position Modulation (PPM) and demodulation. |
| 5 | Time Division Multiplexing (TDM) |
| 6 | Pulse Code Modulation (PCM) and Demodulation |
| 7 | Differential Pulse Code Modulation (DPCM) |
| 8 | Delta Modulation and Demodulation |
| 9 | Line coding schemes |
| 10 | ASK, FSK, PSK and DPSK schemes |
| 11 | Analysis of Nyquist Criterion on Signal Sampling and Reconstruction (MATLAB Simulation) |

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| | |
|---|---|
| 12 | Pulse Modulations (MATLAB Simulation) |
| 13 | Line coding schemes (MATLAB Simulation) |
| 14 | ASK, FSK, PSK and DPSK schemes (MATLAB Simulation) |
| 15 | Spread Spectrum Modulation (MATLAB Simulation) |

**5. Course Map (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | 3 | 3 | 2 | 3 | | | | | | | | 3 | 3 | |
| CO-2 | 3 | 3 | 3 | 2 | 3 | | | | | | | | 3 | 3 | |
| CO-3 | 3 | 3 | 3 | 2 | 3 | | | | | | | | 3 | 3 | |
| CO-4 | | | | | | | | | 3 | 3 | | | | | 3 |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 00 |
| **Demonstrations** | | 00 |
| 1. Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 00 |
| 1. Solving Numerical Problems | 00 | |
| **Practical Work** | | 30 |
| 1. Course Laboratory | 30 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 00 |
| 1. Case Study Presentation | 00 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **40** |

**7. Course Assessment and Reassessment**

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B.Tech. (Electronics and Communication

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Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3 ), COs are assessed as illustrated in the following Table.

| For Laboratory Courses Only | | | |
|---|---|---|---|
| Focus of COs on each Component or Subcomponent of Evaluation | | | |
| | Component 1: CE (50% Weightage) | | Component 2: SEE (50% Weightage) |
| Subcomponent ▸ | | | |
| Subcomponent Type ▸ | Conduct of Experiments | Laboratory Report + Viva | Laboratory SEE |
| Maximum Marks ▸ | 25 | 25 | 50 |
| CO-1 | X | | X |
| CO-2 | X | | X |
| CO-3 | X | | X |
| CO-4 | | X | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

**8. Achieving COs**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Laboratory Instruction |
| 2. | Understanding | Laboratory Instructions and Experiments |
| 3. | Critical Skills | Laboratory Work |
| 4. | Analytical Skills | Laboratory Work |
| 5. | Problem Solving Skills | Laboratory Work |
| 6. | Practical Skills | Laboratory Work |
| 7. | Group Work | Laboratory Work |
| 8. | Self-Learning | Laboratory Work |
| 9. | Written Communication Skills | Laboratory Work, Examination |
| 10. | Verbal Communication Skills | Laboratory Examination |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | Course work |
| 13. | Information Management | Laboratory Work |
| 14. | Personal Management | Course Work |
| 15. | Leadership Skills | -- |

**9. Course Resources**

**a. Essential Reading**

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4. Lab Manual
5. Sklar B. (2007) Digital Communication Fundamentals and Applications. 2nd Edition, Pearson Education
6. Haykin S. (2005) Digital Communications, John Wiley

**b. Recommended Reading**

3. Lathi, B.P. (2007) Modern Digital and Analog Communication Systems, 3rd Edition, Oxford University Press
4. Proakis, J.G. (2001) Digital Communication, 4th edition, Mc-Graw Hill

**c. Magazines and Journals**

5. IEEE Spectrum

**d. Websites**

3. www.mwrf.com

**e. Other Electronic Resources**

1. MATLAB
2. SystemVUE

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## Course Specifications: Antenna and Microwave Laboratory

| | |
|---|---|
| **Course Title** | Antenna and Microwave Laboratory |
| **Course Code** | ECL313A |
| **Course Type** | Laboratory |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

### 1. Course Summary

This course focuses on the study of characteristics of passive microwave devices experimentally and measurement of antenna parameters such as gain, bandwidth and half power beam width.

### 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 01 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 0:0:1 |
| **Total Hours of Interaction** | 30 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 50 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

### 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Plan the experimental setup to achieve the stated aim
**CO-2.** Conduct experiments as per the standard procedures and tabulate the measured values
**CO-3.** Calculate the required parameters and plot the results
**CO-4.** Interpret, compare with standard results and draw conclusions
**CO-5.** Write laboratory report as per the prescribed format
**CO-6.** Conduct experiments as per the standard procedures and tabulate the measured values

### 4. Course Contents

| | |
|---|---|
| 1 | Measurement of microwave power |
| 2 | Calibration of variable attenuator |
| 3 | Study on E-plane, H-plane Tee Junction |
| 4 | Magic Tee and extraction of S-parameters |
| 5 | Measurement of Dielectric Strength |
| 6 | Study on circulator |
| 7 | Study on Directional Coupler and extraction of S-parameter |
| 8 | Measurement of phase shift of ferrite phase shifter |
| 9 | Field intensity measurement of a horn antenna |
| 10 | Field intensity measurement of a parabolic dish antenna |
| 11 | Field intensity measurement of a dielectric antenna |
| 12 | MATLAB implementation of CEM |

## 5. Course Map (CO-PO-PSO Map)

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-1 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | 3 | 3 | 2 | 3 | | | | | | | | 3 | 3 | |
| CO-2 | 3 | 3 | 3 | 2 | 3 | | | | | | | | 3 | 3 | |
| CO-3 | 3 | 3 | 3 | 2 | 3 | | | | | | | | 3 | 3 | |
| CO-4 | 3 | 3 | 3 | 2 | 3 | | | | | | | | 3 | 3 | |
| CO-5 | | | | | | | | | 3 | 3 | | | | | |
| CO-6 | | | | | | | | | 3 | 3 | | | | | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

## 6. Course Teaching and Learning Methods

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 00 |
| **Demonstrations** | | 00 |
| 1. Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 00 |
| 1. Solving Numerical Problems | 00 | |
| **Practical Work** | | 30 |
| 1. Course Laboratory | 30 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 00 |
| 1. Case Study Presentation | 00 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **40** |

## 7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B.Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

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The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3 ), COs are assessed as illustrated in the following Table.

| For Laboratory Courses Only | | | |
|---|---|---|---|
| Focus of COs on each Component or Subcomponent of Evaluation | | | |
| | Component 1: CE (50% Weightage) | | Component 2: SEE (50% Weightage) |
| Subcomponent ▸ | | | |
| Subcomponent Type ▸ | Conduct of Experiments | Laboratory Report + Viva | Laboratory SEE |
| Maximum Marks ▸ | 25 | 25 | 50 |
| CO-1 | X | | X |
| CO-2 | X | | X |
| CO-3 | X | | X |
| CO-4 | X | | X |
| CO-5 | | X | X |
| CO-6 | X | | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

## 8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Laboratory Instruction |
| 2. | Understanding | Laboratory Instructions and Experiments |
| 3. | Critical Skills | Laboratory Work |
| 4. | Analytical Skills | Laboratory Work |
| 5. | Problem Solving Skills | Laboratory Work |
| 6. | Practical Skills | Laboratory Work |
| 7. | Group Work | Laboratory Work |
| 8. | Self-Learning | Laboratory Work |
| 9. | Written Communication Skills | Laboratory Work, Examination |
| 10. | Verbal Communication Skills | Laboratory Examination |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | Course work |
| 13. | Information Management | Laboratory Work |
| 14. | Personal Management | Course Work |
| 15. | Leadership Skills | -- |

## 9. Course Resources

### a. Essential Reading

1. Lab Manual

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2. Jordan E. C. and Balmain (2003) Electro Magnetic Waves and Radiating Systems, PHI.
3. David M. Pozar (2009) Microwave Engineering, John Wiley & Sons

**b. Recommended Reading**

1. Maas, 1998, Practical Microwave Circuits, Artech House

**c. Magazines and Journals**

1. IEEE Transactions on Microwave Theory and Techniques
2. IEEE Microwave and Wireless components Letters
3. IEEE Microwave magazine

**d. Websites**

1. www.mwrf.com
2. www.microwavejournal.com

**e. Other Electronic Resources**

1. EMpro EM tools

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**Course Specifications: Seminar**

| | |
|---|---|
| **Course Title** | Seminar |
| **Course Code** | ECC314A |
| **Course Type** | Seminar |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

## 1. Course Summary

The aim of the course is to train the students on data collection, analysis and presentation about a chosen topic. In this course students are required to deliver seminars on various relevant topics from the broad areas mentioned in the course content. Students will be trainedto prepare a brief report on the chosen seminar topic.

## 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 01 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 0:0:1 |
| **Total Hours of Interaction** | 30 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 50 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

## 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Prepare and deliver seminar on a given topic.

**CO-2.** Write a report on the seminar topic.

## 4. Course Contents

**Indicative topics**:

| | | | |
|---|---|---|---|
| Array Signal Processing | Hyperspectral Image Processing | Cellular Communications | Image and Video Processing |
| Biomedical Signal Processing | High speed board design | EMI/EMC, PI and SI Analysis | Low Power Processors |
| Spectral Analysis | Nano electronics | FinFET technology | Power Analysis |
| Radar Signal Processing | System on chip and Network on chip | VLSI Testing | Verification and Reliability |
| Adaptive Signal Processing | Optoelectronics and Integrated Optics | Pipeline/parallel architectures | Multicore architectures |
| Audio and Speech Processing | Antenna Measurement Techniques | RF & Microwave Devices and Circuits | Photonics |
| Pattern Recognition | Software Defined Networks | Aerospace and Satellite Antennas | Phased Array and Multi-beam Antennas |
| Graph Signal Processing | Cognitive Radio Networks | Digital Beamformers | Next-Generation Network Architectures |
| Statistical Learning and Estimation Schemes | Multicarrier Techniques | MIMO Systems | SDR and Cognitive Radio Systems |

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## 5. Course Map (CO-PO-PSO Map)

| CO | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 3 |
| CO-2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 3 |

## 6. Course Teaching and Learning Methods

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 0 |
| **Demonstrations** | | 0 |
| 1. Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 0 |
| 1. Solving Numerical Problems | 0 | |
| **Practical Work** | | 00 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 30 |
| 1. Case Study Presentation | 22 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 08 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | 40 |

## 7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B.Tech. (Automotive Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2), COs are assessed as illustrated in the following Table.

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| Focus of COs on each Component or Subcomponent of Evaluation | | |
|---|---|---|
| | **Component 1: Presentation (50% Weightage)** | **Component 2: Report (50% Weightage)** |
| **Maximum Marks ▸** | **25** | **25** |
| **CO-1** | X | |
| **CO-2** | | X |
| The details of SC1, SC2, SC3 are presented in the Programme Specifications Document. | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

**8. Achieving COs**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures |
| 2. | Understanding | Classroom lectures, Self-study |
| 3. | Critical Skills | Assignment |
| 4. | Analytical Skills | Assignment |
| 5. | Problem Solving Skills | Assignment, Examination |
| 6. | Practical Skills | Assignment |
| 7. | Group Work | -- |
| 8. | Self-Learning | Self-study |
| 9. | Written Communication Skills | Assignment, Examination |
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | -- |
| 13. | Information Management | Assignment |
| 14. | Personal Management | -- |
| 15. | Leadership Skills | -- |

**9. Course Resources**

**a. Essential Reading**

1. Jerry Weissman, Presenting to Win
2. Cliff Atkinson, Beyond Bullet Points
3. Bruce R. Gibrielle, Speaking Powerpoint
4. Garr Reynolds, Presentation Zen Design

**b. Recommended Reading**

1. Based on the topic choosen

**c. Magazines and Journals**

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1. Based on the topic chosen, details will be shared in the class

**d. Websites**

1. Based on the topic chosen, details will be shared in the class

**e. Other Electronic Resources**

1. Relevant resources available in RUAS Library

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**Course Specifications: Biomedical Signal Processing**

| | |
|---|---|
| **Course Title** | Biomedical Signal Processing |
| **Course Code** | ECE311A |
| **Course Type** | Professional Core Elective |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

## 1. Course Summary

The aim of this course is to present the fundamentals of signal processing with emphasis on problems in biomedical signal processing. Principles and algorithms for processing of biomedical signals are discussed. Signal processing including methodology of data acquisition, filtering and feature extraction.

## 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 04 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:1:0 |
| **Total Hours of Interaction** | 60 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

## 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Explain the origin, dynamics, time and frequency domain analysis of various biomedical signals
**CO-2.** Describe filter and transform techniques to process the biomedical signals
**CO-3.** Compute the features of biomedical signals from the events by solving problems in time and frequency domain
**CO-4.** Analyze biomedical signals in time domain, frequency domain using various statistical and transform features
**CO-5.** Design and implement digital filters in spatial and frequency domain for removing artefacts present in the medical images
**CO-6.** Implement various time and frequency domain algorithms for event detection in ECG and EEG signals using software tools

## 4. Course Contents

**Unit 1 (Biomedical signal origin and dynamics):** Bioelectric signals-Action potential, Electro-neurogram, Electro-oculogram, Electro-encephalogram, Evoked potential, Electro-cardiogram, Electrogastrogram, bio-impedance signals, mechanical signals - bioacoustics signals, biochemical signals- objectives of biomedical signal analysis, difficulties in biomedical signal analysis.

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**Unit 2 (Time domain characterization of bio signals):** Root-mean-square, average rectified value coherent average, cross-correlation, covariance, autocorrelation, phase-shift averaging.

**Unit 3 (Frequency domain characterization of bio signals):** Fourier transform, Discrete Fourier transform, Spectral analysis, Cepstral analysis, Feature extraction. Estimation of power spectral density, spectral power ratio and Power Cepstrum in Biomedical applications. The periodogram, averaging, Spectral resolution and leakage.

**Unit 4 (Adaptive filters):** Random noise, structured noise and physiological interference. Adaptive filters-general structure, LMS adaptive filter, Noise cancellation. Adaptive noise canceller-cancellation of 60Hz interference in ECG, cancelling donor heart interference in Heart transplant ECG, cancellation of ECG signals from electrical activity of chest muscles.

**Unit 5 (Event Detection in ECG):** Detection of P, QRS and T waves in ECG, dicrotic notch detection, morphological analysis of ECG, envelope extraction and zero crossing rates analysis of ECG signal.

**Unit 6 (Event Detection in EEG):** EEG rhythms, Correlation and coherence analysis of EEG channels, Detection of EEG spike and wave complexes.

**5. Course Map (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | 3 | 2 | |
| CO-2 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | | | | | | 3 | 3 | |
| CO-3 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | | | | | | 3 | 3 | |
| CO-4 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | | | | | | 3 | 3 | |
| CO-5 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | | | | | | 3 | 3 | |
| CO-6 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | | | | | | 3 | 3 | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 55 |
| **Demonstrations** | | 00 |
| 1. Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 00 |
| 1. Solving Numerical Problems | 00 | |
| **Practical Work** | | 00 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |

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| | | |
|---|---|---|
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | |
| 1. Case Study Presentation | 05 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | 05 |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **70** |

**7. Course Assessment and Reassessment**

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B.Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3 ), COs are assessed as illustrated in the following Table.

| **For Theory Courses Only** | | | |
|---|---|---|---|
| **Focus of COs on each Component or Subcomponent of Evaluation** | | | |
| | **Component 1: CE (50% Weightage)** | | **Component 2: SEE (50% Weightage)** |
| **Subcomponent ▸** | | | |
| **Subcomponent Type ▸** | **Term Tests** | **Assignments** | **100 Marks** |
| **Maximum Marks ▸** | **50** | **50** | |
| **CO-1** | X | | X |
| **CO-2** | X | | X |
| **CO-3** | X | X | X |
| **CO-4** | | X | X |
| **CO-5** | | X | |
| **CO-6** | | X | |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

**8. Achieving COs**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|

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| | | |
|---|---|---|
| 1. | Knowledge | Classroom Lectures, Assignment |
| 2. | Understanding | Classroom Lectures, Assignment |
| 3. | Critical Skills | Classroom Lectures, Assignment |
| 4. | Analytical Skills | Classroom Lectures, Assignment |
| 5. | Problem Solving Skills | Classroom Lectures, Assignment |
| 6. | Practical Skills | -- |
| 7. | Group Work | Assignment |
| 8. | Self-Learning | Assignment |
| 9. | Written Communication Skills | Assignment, Examination |
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | Course Work |
| 13. | Information Management | Assignment, Examination |
| 14. | Personal Management | Course Work |
| 15. | Leadership Skills | -- |

**9. Course Resources**

**a. Essential Reading**

1. Class Notes
2. D. C. Reddy, 2005, Biomedical signal processing – Principles and Technique, Tata McGraw-Hill
3. Wills J. Tompkins, 1993, Biomedical digital signal processing, , Prentice Hall of India Pvt. Ltd

**b. Recommended Reading**

1. Oppenheim & Ronald W Schafer, 1975, Digital Signal Processing, , Prentice Hall India
2. Andreas Antoniou, 2001, Digital Filters: Analysis, Design and Applications, McGraw-Hill
3. Reddy D.C, 2nd edition, 2005, Biomedical Signal Processing: Priniciples and Techniques, New Delh, Tata McGraw-Hill
4. J. G. Prokis and D. G. Manolakis, 2007, 4th Edition, "Digital Signal Processing: Principles, Algorithm and Applications, , PHI/Pearson Education
5. Rangaraj M Rangayyan, 2002, Biomedical signal processing, IEEE press, first edition
6. Arnon Cohen, 1986, Biomedical Signal Processing Time and Frequency Domains Analysis (Volume I), CRC press

**c. Magazines and Journals**

1. IEEE Signal Processing Magazine.
2. IET signal processing
3. IEEE Transaction on signal processing
4. IEEE signal processing letters

**d. Websites**

1. https://freevideolectures.com/course/digital-signal-processing-iit-delhi/
2. http://www.nptelvideos.in/2012/12/digital-signal-processing.html

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**e. Other Electronic Resources**

1. www.pdfdrive.net

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**Course Specifications: Embedded and IoT Systems**

| | |
|---|---|
| **Course Title** | Embedded Systems and IoT |
| **Course Code** | ECE312A |
| **Course Type** | Professional Core Elective |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

## 1. Course Summary

This course intends to prepare the student in the field of real time embedded system development. The students are exposed to a range of hardware and software design considerations for embedded and Internet of Things (IOT) systems. The principles of interfacing analog components, timers, Input / Output and memory, along with other interrupt handling techniques, are taught. Real Time Operating Systems (RTOS) are also introduced. Development of an embedded system using the underlying techniques are emphasized.

## 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 04 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:1:0 |
| **Total Hours of Interaction** | 60 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

## 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Describe the concepts and techniques of designing embedded system, RTOS and IoT
**CO-2.** Explain the hardware and software considerations for embedded systems
**CO-3.** Discuss the architecture, principles and layer protocols for IoT
**CO-4.** Apply the memory interfacing, exceptions and interrupts in an embedded system
**CO-5.** Design and develop a real time application of embedded and IoT system design development using appropriate development tool kits

## 4. Course Contents

**Unit 1 (Introduction to embedded concepts):** Introduction to embedded systems, Application Areas, Categories of embedded systems, Overview of embedded system architecture, Specialties of embedded systems, recent trends in embedded systems, Architecture of embedded systems, Hardware architecture, Software architecture, Application Software, Communication Software.

**Unit 2 (Overview of ARM and Cortex-M3):** Background of ARM Architecture, Architecture Versions, Processor Naming, Instruction Set Development, Thumb-2 and Instruction Set

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Architecture. Cortex-M3 Basics: Registers, General Purpose Registers, Stack Pointer, Link Register, Program Counter, Special Registers, Operation Mode, Exceptions and Interrupts, Vector Tables, Stack Memory Operations, Reset Sequence. Cortex-M3 Instruction Sets, Implementation Overview, I-Code Bus, DCode Bus, System Bus, External PPB and DAP Bus

**Unit 3 (Open source RTOS):** Basics of RTOS: Real-time concepts, Hard Real time and Soft Real-time, Differences between General Purpose OS & RTOS, Basic architecture of an RTOS, Scheduling Systems, Inter-process communication, Performance Matric in scheduling models, Interrupt management in RTOS environment, Memory management, File systems, I/O Systems, Advantage and disadvantage of RTOS. POSIX standards, RTOS Issues – Selecting a Real-Time Operating System, RTOS comparative study.

**Unit 4 (Overview on IOT system):** IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M and IoT Analytics, Knowledge Management

**Unit 5 (IoT layer protocols):** PHY/MAC Layer (3GPP MTC, IEEE 802.11, IEEE 802.15), Bluetooth Low Energy, Zigbee Smart Energy, Network Layer-IPv4, IPv6, DHCP, Transport Layer, Session Layer, Service Layer – MAC 802.15.4, Application Layer-case study

**5. Course Map (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | | | | | | | | | | | | 3 | | |
| CO-2 | 3 | | | | | | | | | | | | 3 | 2 | |
| CO-3 | 3 | 2 | | | | | | | | | | | 3 | 2 | |
| CO-4 | 3 | 3 | 2 | 2 | 2 | | | | | | | | 3 | 2 | |
| CO-5 | 2 | 3 | 3 | 3 | 2 | | | | | | | | 3 | 3 | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 55 |
| **Demonstrations** | | 00 |
| 1. Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 00 |
| 1. Solving Numerical Problems | 00 | |
| **Practical Work** | | 00 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |

| | | |
|---|---|---|
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | |
| 1. Case Study Presentation | 05 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | 05 |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **70** |

**7. Course Assessment and Reassessment**

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B.Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3 ), COs are assessed as illustrated in the following Table.

| **For Theory Courses Only** | | | |
|---|---|---|---|
| **Focus of COs on each Component or Subcomponent of Evaluation** | | | |
| | **Component 1: CE (50% Weightage)** | | **Component 2: SEE (50% Weightage)** |
| **Subcomponent ▸** | | | |
| **Subcomponent Type ▸** | **Term Tests** | **Assignments** | **100 Marks** |
| **Maximum Marks ▸** | **50** | **50** | |
| **CO-1** | X | | X |
| **CO-2** | X | | X |
| **CO-3** | X | | X |
| **CO-4** | | X | X |
| **CO-5** | | X | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

**8. Achieving COs**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures |



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| | | |
|---|---|---|
| 2. | Understanding | Classroom lectures, Self-study |
| 3. | Critical Skills | Assignment |
| 4. | Analytical Skills | Assignment |
| 5. | Problem Solving Skills | Assignment, Examination |
| 6. | Practical Skills | Assignment |
| 7. | Group Work | -- |
| 8. | Self-Learning | Self-study |
| 9. | Written Communication Skills | Assignment, Examination |
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | -- |
| 13. | Information Management | Assignment |
| 14. | Personal Management | -- |
| 15. | Leadership Skills | -- |

**9. Course Resources**

**a. Essential Reading**


4. Frank Vahid and Tony Givargi (2006) Embedded System Design: A Unified Hardware/Software Introduction, John Wiley & Sons
5. Laplante, P. A. (2008) Real Time Systems Design and Analysis, 3rd edn. John Wiley and Sons
6. Vijay Madisetti and ArshdeepBahga, (2014) "Internet of Things (A Hands-onApproach)", 1st Edition, VPT.


**b. Recommended Reading**


7. Tammy Noergaard (2005) Embedded Systems Architecture–A Comprehensive Guide for Engineers and Programmers, Elsevier Publication
8. Raj Kamal (2008) Embedded Systems: Architecture and Programming, 2nd Edition, Tata Mc-Graw Hill
9. KVK Prasad, (2003) "Embedded/Real Time Systems Concepts, Design and Programming Black Book",, Wiley India
10. Seppo J. Ovaska Phillip A. Laplante, (2013) "Real-Time Systems Design and Analysis:Tools for the Practitioner"
11. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, (2014) "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press
12. Kopetz, H. (2011) Real Time Systems-Design Principles for Distributed Embedded Applications, 2nd edn. Springer
13. James K. Peckol (2008) Embedded Systems – A contemporary Design Tool, John Wiley India Pvt. Ltd
14. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118- 47347-4, Willy Publications
15. Li, Q., and Yao, C. (2003) Real-Time Concepts for Embedded Systems, Elsevier.


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16. Valvano, J. W. (2011) Embedded Microcomputer Systems-Real Time Interfacing, Cengage Learning

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## Course Specifications: Statistical Signal Processing

| | |
|---|---|
| **Course Title** | Statistical Signal Processing |
| **Course Code** | ECE313A |
| **Course Type** | Professional Core Elective |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

### 1. Course Summary

This course deals with the introduction to the principles of statistical signal processing. Students are briefed on applications requiring statistical estimation and detection. Signal modeling, filtering approaches, estimation techniques and detectors will be taught in detail. They will be taught to evaluate different estimation methods and detectors for error analysis and performance criteria.

### 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 04 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 4:1:0 |
| **Total Hours of Interaction** | 60 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

### 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Discuss the concepts of statistical estimation, hypothesis testing and decision theory
**CO-2.** Analyze the performance of signal modeling approaches and various filtering techniques
**CO-3.** Develop Maximum likelihood and Bayesian estimators for various sensor transmission scenarios
**CO-4.** Analyze and evaluate multiple hypothesis testing techniques to detect events in sensor transmissions
**CO-5.** Analyze the performance of various signal modeling approaches
**CO-6.** Evaluate the performance of recursive models and adaptive filters on finite length data records

### 4. Course Contents

**Unit 1 (Random Variables and Processes):** Random variables and expectations: Gaussian, Uniform, Rayleigh, Exponential, Binomial, Poisson distributions, Joint moments: Independent, uncorrelated and orthogonal random variables
Random Processes: wide sense stationary, strict sense stationary, ergodic processes, power spectral density of filtered random process, random vector representations, Auto-covariance and Autocorrelation matrix, white noise process

**Unit 2 (Signal Modeling):** Pade's model, Prony's method for pole-zero modeling, Finite data records: All pole modeling using Autocorrelation method, Basics of stochastic models and significance of Yule Walker equations

**Unit 3 (Principles of statistical estimation and linear models):** Mathematical formalism of estimation, Minimum variance unbiased estimation, Cramer- Rao lower bound, Maximum Likelihood estimation, Principle of Best linear unbiased estimator, Bayesian estimation

**Unit 4 (Statistical decision theory):** Mathematical formalism of detection, Deflection coefficient and its significance, Neyman-Pearson approach for hypothesis testing, Probability of false alarm, Probability of missed detection, Probability of correct detection and ROC

**Unit 5 (Optimal Filtering):** Weiner filter and Weiner Hopf equations, Steepest descent and Adaptive filter with least mean squares approach, Significance of kalman filtering for non- stationary processes

## 5. Course Map (CO-PO-PSO Map)

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-1 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | | | | | | | | | | | | 3 | | |
| CO-2 | 3 | 3 | 3 | 3 | | | | | | | | | 3 | 2 | |
| CO-3 | 3 | 2 | 3 | 3 | 3 | | | | | | | | 2 | 2 | |
| CO-4 | 3 | 3 | 3 | 3 | 3 | | | | | | | | 3 | 3 | |
| CO-5 | 3 | 3 | 3 | 3 | 3 | | | | | | | | 3 | 3 | |
| CO-6 | 3 | 3 | 3 | 3 | 3 | | | | | | | | 3 | 3 | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

## 6. Course Teaching and Learning Methods

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 55 |
| **Demonstrations** | | 00 |
| 1. Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 00 |
| 1. Solving Numerical Problems | 00 | |
| **Practical Work** | | 00 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |

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| | | |
|---|---|---|
| **Others** | | 05 |
| 1. Case Study Presentation | 05 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **70** |

## 7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B.Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3 ), COs are assessed as illustrated in the following Table.

| **For Theory Courses Only** | | | |
|---|---|---|---|
| **Focus of COs on each Component or Subcomponent of Evaluation** | | | |
| | **Component 1: CE (50% Weightage)** | | **Component 2: SEE (50% Weightage)** |
| **Subcomponent ▸** | | | |
| **Subcomponent Type ▸** | **Term Tests** | **Assignments** | **100 Marks** |
| **Maximum Marks ▸** | **50** | **50** | |
| **CO-1** | X | | X |
| **CO-2** | X | X | X |
| **CO-3** | X | X | X |
| **CO-4** | | X | X |
| **CO-5** | | X | X |
| **CO-6** | | X | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

## 8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures, Assignments |
| 2. | Understanding | Classroom lectures, Assignments |

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| | | |
|---|---|---|
| 3. | Critical Skills | Classroom lectures, Assignments |
| 4. | Analytical Skills | Classroom lectures, Assignments |
| 5. | Problem Solving Skills | Classroom lectures, Assignments |
| 6. | Practical Skills | --- |
| 7. | Group Work | Assignment |
| 8. | Self-Learning | Assignment |
| 9. | Written Communication Skills | Assignment, examination |
| 10. | Verbal Communication Skills | --- |
| 11. | Presentation Skills | --- |
| 12. | Behavioral Skills | Course work |
| 13. | Information Management | Assignment, examination |
| 14. | Personal Management | Course work |
| 15. | Leadership Skills | --- |

**9. Course Resources**

**a. Essential Reading**

1. Class Notes

2. Monson H. Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley & Sons (Asia) Pte. Ltd., 2002.
3. Kay S. M. (1993). Fundamentals of Statistical Signal Processing, Volume-I: Estimation Theory. Prentice Hall.
4. Kay S. M. (1998). Fundamentals of Statistical Signal Processing, Volume-II: Detection Theory. Prentice Hall.

**b. Recommended Reading**

1. Van Trees, H.L., (2004). Detection, estimation, and modulation theory. John Wiley & Sons.
2. Kay S. M. (2013). Fundamentals of Statistical Signal Processing, Volume-III: Practical Algorithm Development. Prentice Hall.
3. Mourad Barkat (2005). Signal Detection and Estimation. Artech House Publishers. **b.**
4. Poor, H.V. (2013). An introduction to signal detection and estimation. Springer Science & Business Media.

**c. Magazines and Journals**

1. IEEE Transactions on Communications
2. IEEE Transactions on Wireless Communications

**d. Websites**

1. https://nptel.ac.in/syllabus/117103019/

**e. Other Electronic Resources**

1. PC Hardware
2. MATLAB software tool

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**Course Specifications: Image Processing**

| | |
|---|---|
| **Course Title** | Image Processing |
| **Course Code** | ECE314A |
| **Course Type** | Professional Core Elective |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

## 1. Course Summary

This course deals with the techniques involved in image processing and image analysis. Students are taught various algorithms for image segmentation, image registration, image restoration, compression, image manipulation and characteristics of images. Students are taught the basics of sampling and quantization for images. Students are trained to model, simulate and analyse image processing algorithms for developing image processing applications using software tools

## 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 04 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:1:0 |
| **Total Hours of Interaction** | 60 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

## 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Describe the fundamental techniques for image processing, filtering, restoration and morphological processing, segmentation
**CO-2.** Explain the principles of various image processing algorithms
**CO-3.** Analyse and evaluate image processing algorithms for a specific application
**CO-4.** Apply image processing algorithms for various applications
**CO-5.** Apply image filtering and segmentation techniques for various applications
**CO-6.** Use software tools to model, simulate and analyse image processing algorithms for developing image processing applications

## 4. Course Contents

**Unit 1 (Introduction):** Introduction to Digital Image Processing: Gamma Ray imaging, X-ray, Ultraviolet, Visible and Infrared band, Microwave band, Radio band, Fundamental steps in Digital Image Processing, Components of Image Processing System, Elements of visual perception, Light and Electromagnetic Spectrum, Image Sampling and Quantization.

**Unit 2 (Filtering in Spatial and Frequency Domain):** Basic gray level transformations, Histogram processing, Enhancement using arithmetic / logic operations, Smoothing Filters, Sharpening Filters, Homomorphic Filtering

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**Unit 3 (Image Restoration):** Basic Framework, Model of the Image restoration process, Noise models, Restoration in the presence of noise, Periodic noise reduction by Frequency domain filtering, Linear, Position-Invariant Degradations, Estimating the degradation function, Inverse Filtering, Weiner Filtering, Constrained Least Square Filtering.

**Unit 4 (Morphological Image Processing)**: Preliminaries, Dilation and Erosion, Opening and Closing, Hit-or-Miss transformation, Basic morphological algorithms, Extensions to gray-scale images.

**Unit 5 (Image Segmentation)**: Detection and Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region based segmentation, Segmentation by morphological watersheds

**5. Course Map (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-1 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | | | | | | | | | | | | 3 | | |
| CO-2 | 3 | | | | | | | | | | | | 3 | | |
| CO-3 | 3 | 3 | 2 | 2 | 3 | | | | | | | | 3 | 2 | |
| CO-4 | 3 | 3 | 3 | 3 | 3 | | | | | | | | 3 | 3 | |
| CO-5 | 3 | 3 | 3 | 3 | 3 | | | | | | | | 3 | 3 | |
| CO-6 | 3 | 3 | 3 | 3 | 3 | | | | | | | | 3 | 3 | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 55 |
| **Demonstrations** | | 00 |
| 1. Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 00 |
| 1. Solving Numerical Problems | 00 | |
| **Practical Work** | | 00 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 05 |
| 1. Case Study Presentation | 05 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |

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| | | |
|---|---|---|
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **70** |

## 7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B.Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3 ), COs are assessed as illustrated in the following Table.

| **For Theory Courses Only** | | | |
|---|---|---|---|
| **Focus of COs on each Component or Subcomponent of Evaluation** | | | |
| | **Component 1: CE (50% Weightage)** | | **Component 2: SEE (50% Weightage)** |
| **Subcomponent ▸** | | | |
| **Subcomponent Type ▸** | **Term Tests** | **Assignments** | **100 Marks** |
| **Maximum Marks ▸** | **50** | **50** | |
| **CO-1** | X | | X |
| **CO-2** | X | | X |
| **CO-3** | X | X | X |
| **CO-4** | | X | X |
| **CO-5** | | X | X |
| **CO-6** | | X | |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

## 8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom Lectures, Assignment |
| 2. | Understanding | Classroom Lectures, Assignment |
| 3. | Critical Skills | Classroom Lectures, Assignment |
| 4. | Analytical Skills | Classroom Lectures, Assignment |
| 5. | Problem Solving Skills | Classroom Lectures, Assignment |
| 6. | Practical Skills | -- |
| 7. | Group Work | Assignment |

| | | |
|---|---|---|
| 8. | Self-Learning | Assignment |
| 9. | Written Communication Skills | Assignment, Examination |
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | Course Work |
| 13. | Information Management | Assignment, Examination |
| 14. | Personal Management | Course Work |
| 15. | Leadership Skills | Classroom Lectures, Assignment |

**9. Course Resources**

**a. Essential Reading**

1. Class Notes

2. Rafael C. Gonzalez, Richard E. Woods (2004) Digital Image Processing, Second Edition, Prentice Hall

**b. Recommended Reading**

1. Anil k. Jain (2004) Fundamentals of Digital Image Processing. Third Edition, Prentice Hall
2. Oge Marques (2011) Practical Image and Video Processing Using MATLAB, Wiley-IEEE Press
3. Alan Bovik. (2009) The essential guide to image processing, Academic Press
4. Bernd Jahne. (2005) Digital Image Processing, Sixth Edition, Springer

**c. Magazines and Journals**

1. IEEE Transactions of Image Processing
2. IET Image Processing, Digital Library
3. International Journal of Image Processing (IJIP), CSC Journals, Malaysia

**d. Websites**

2. www.cambridgeincolour.com/tutorials.htm
3. http://www.ece.arizona.edu/~dial
4. http://www.imageprocessingplace.com
5. http://www.imageprocessingbasics.com

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## Course Specifications: Biomedical Image Processing

| | |
|---|---|
| **Course Title** | Biomedical Image Processing |
| **Course Code** | ECE411A |
| **Course Type** | Professional Core Elective |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

### 1. Course Summary

The aim of this course is to present the fundamentals of biomedical image processing and image processing techniques in different medical imaging modalities. The course covers the main sources of medical imaging data (CT, MRI, PET, and ultrasound) and current methods used to enhance and extract useful information from medical images. Also various algorithms for image analysis in medical imaging are discussed

### 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 04 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:1:0 |
| **Total Hours of Interaction** | 60 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

### 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Explain the imaging modalities, image properties, time and frequency domain analysis of various biomedical images
**CO-2.** Compute the spatial and frequency domain features to anlyse the biomedical images
**CO-3.** Describe the principles of image enhancement, image restoration, image segmentation, and morphological operations
**CO-4.** Analyze the biomedical images in time domain, frequency domain using various statistical and transform features
**CO-5.** Design and implement digital filters in spatial and frequency domain for removing artefacts present in the medical images
**CO-6.** Implement appropriate image enhancement, morphological, segmentation and filtering algorithms for a specific application using software tools

### 4. Course Contents

**Unit 1 (Introduction to Biomedical Imaging):** Ultrasound, X- ray, CT, MRI, PET, ultrasound and SPECT. Properties of the resulting images, and discuss the advantages and disadvantages of each imaging modality

**Unit 2 (Spatial Domain characterization of Images):** Elements of digital image processing,

Image model, Relationships between pixel, Intensity transformations, contrast stretching, histogram equalization, Correlation and convolution, Smoothing filters, sharpening filters, gradient and Laplacian

**Unit 3 (Frequency domain characterization of Images):** Fourier Transforms and properties, Convolution, Correlation, 2-D sampling, Discrete Cosine Transform, Frequency domain filtering

**Unit 4 (Image Restoration):** Basic Framework, Interactive Restoration, Image deformation and geometric transformations, image morphing, Restoration techniques, Noise characterization, Noise restoration filters, Adaptive filters, Linear, Position invariant degradations, Estimation of Degradation functions, Restoration from projections

**Unit 5 (Morphological Image Processing):** Basics, Structuring Elements, Erosion, Dilation, Opening, Closing, Hit-or-Miss Transform, Boundary Detection, Hole filling, Connected components, convex hull, thinning, thickening, skeletons, pruning, Geodesic Dilation, Erosion, Reconstruction by dilation and erosion.

**Unit 6 (Image Segmentation)**: Boundary detection based techniques, Point, line detection, Edge detection, Edge linking, local processing, regional processing, Hough transform, Thresholding, Iterative thresholding, Otsu's method, Moving averages, Multivariable thresholding, Region-based segmentation, Watershed algorithm, Use of motion in segmentation

**Unit 7**: Filter design, image enhancement, image restoration, image segmentation, and morphological operations on X- ray, CT, MRI, PET, ultrasound and SPECT using MATLAB programming

**5. Course Map (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | | | | | 3 | 1 | |
| CO-2 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | | | | | 3 | 1 | |
| CO-3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | | | 3 | 2 | |
| CO-4 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | | | | | 3 | 2 | |
| CO-5 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | | | | | 3 | 3 | |
| CO-6 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | | | | | 3 | 3 | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 55 |
| **Demonstrations** | | 00 |
| 1. Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 00 |

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| | | |
|---|---|---|
| 1. Solving Numerical Problems | 00 | |
| **Practical Work** | | 00 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 05 |
| 1. Case Study Presentation | 05 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **70** |

**7. Course Assessment and Reassessment**

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B.Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3 ), COs are assessed as illustrated in the following Table.

| **For Theory Courses Only** | | | |
|---|---|---|---|
| **Focus of COs on each Component or Subcomponent of Evaluation** | | | |
| | **Component 1: CE (50% Weightage)** | | **Component 2: SEE (50% Weightage)** |
| **Subcomponent ▸** | | | |
| **Subcomponent Type ▸** | **Term Tests** | **Assignments** | **100 Marks** |
| **Maximum Marks ▸** | **50** | **50** | |
| **CO-1** | X | | X |
| **CO-2** | X | | X |
| **CO-3** | X | | X |
| **CO-4** | X | X | X |
| **CO-5** | | X | X |
| **CO-6** | | X | |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

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**8. Achieving COs**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Class Room Lectures, Assignment |
| 2. | Understanding | Class Room Lectures, Assignment |
| 3. | Critical Skills | Class Room Lectures, Assignment |
| 4. | Analytical Skills | Class Room Lectures, Assignment |
| 5. | Problem Solving Skills | Class Room Lectures, Assignment |
| 6. | Practical Skills | -- |
| 7. | Group Work | Assignment |
| 8. | Self-Learning | Assignment |
| 9. | Written Communication Skills | Assignment, Examination |
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | Course Work |
| 13. | Information Management | Assignment, Examination |
| 14. | Personal Management | Course Work |
| 15. | Leadership Skills | -- |

**9. Course Resources**

**a. Essential Reading**

1. Class Notes


2. Rafael C. Gonzales, Richard E. Woods 2010, Digital Image Processing, Pearson Education
3. K.K. Shung, M.B. Smith, B. Tsui, 1993, Principles of Medical Imaging, , Academic Press


**b. Recommended Reading**


1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, ,2011, Digital Image Processing Using MATLAB, Tata Mc Graw Hill Pvt. Ltd
2. Wolfgang and Birkfellner, 2010, Medical Image Processing: A Basic Course, Taylor & Francis
3. Alan Bovik, 2009, The essential guide to image processing, 2009, Academic Press
4. Bernd Jahne, 2005, Digital Image Processing, Springer,6thEdition
5. Anil Jain K, 2011, Fundamentals of Digital Image Processing, , PHI Learning Pvt. Ltd.,


**c. Magazines and Journals**

1. IET Image processing
2. Medical Image Analysis Journal-Elsevier
3. IEEE Transactions of Image Processing
4. Journal of Biomedical Engineering and Medical Imaging

5. Computer Vision and Image Understanding
6. Journal of Real Time Image Processing

**d. Website**

1. www.nitrc.org
2. www.human connectome project.com
3. https://perso.telecom-paristech.fr/tupin/ATHENS/SEMINARS/Medical_imaging.pdf

**e. Other Electronic Resources**

1. http://eeweb.poly.edu/~onur/lectures/lectures.html.
2. https://www.cs.nmt.edu/~ip/lectures.html
3. www.pdfdrive.net

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## Course Specifications: Programmable Logic Design using FPGA

| | |
|---|---|
| **Course Title** | Programmable Logic Design using FPGA |
| **Course Code** | ECE412A |
| **Course Type** | Professional Core Elective |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

### 1. Course Summary

This course deals with introduction and practical design skills of FPGA. Students are taught architecture of FPGA and interfacing peripherals to the hardware. Students are trained to use state of the art software tools for FPGA development and solve digital design problems using FPGAs. Students will be taught to perform co-simulation using system generator using FPGA.

### 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 04 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:1:0 |
| **Total Hours of Interaction** | 60 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

### 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Explain digital logic blocks, different FPGA architectures and their components
**CO-2.** Describe FPGA design flow, combinational and sequential logic blocks, and synthesis reports
**CO-3.** Design digital filters for DSP and image processing applications
**CO-4.** Develop digital logics for various applications
**CO-5.** Program and verify functionality of design using FPGA design tool
**CO-6.** Develop applications using FPGA design tool and system generator

### 4. Course Contents

**Unit 1 (Introduction to FPGA):** Overview of digital logic blocks (Multipliers, Adders and FSM's), Review of PLA, PAL, PLDs and CPLDs, FPGAs Vs DSP Processors, Need of FPGAs in DSP Applications

**Unit 2 (FPGA Architecture):** Introduction to FPGA Architecture, Components of FPGA Architectures – Programming Technologies, Logic elements and Look-up Tables, Dedicated multipliers, Distributed RAM, Shift registers, Digital Clock Managers, comparison between Spartan 3, Virtex-5 and Virtex-7 FPGA from Xilinx

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**Unit 3 (FPGA Implementation Flow):** Overview of Verilog programming concepts, FPGA design flow, Introduction to the FPGA software tool, designing basic combinational and sequential logic blocks, Synthesis reports

**Unit 4 (Applications using FPGA):** Implementation of 8-bit ALU, Interface with keypad, LEDs, Switches, seven segment display, VGA, Case study on Traffic Light Controller and Vending Machine

**Unit 5 (FPGA Implementation using System Generator):** Overview of System generator, Designing basic DSP System, Implementation of FIR and IIR filters, Different transform blocks (FFT,WT etc.) image processing blocks (edge detectors), Case Study on: Single channel DDC for MRI

**5. Course Map (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-1 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 2 | | 1 | | | | | | | | | | 3 | 2 | |
| CO-2 | 3 | 2 | 1 | | | | | | | | | | 3 | 2 | |
| CO-3 | 3 | 3 | 3 | 3 | 3 | | | | | | | | 3 | 2 | |
| CO-4 | 3 | 2 | 2 | 2 | 3 | | | | | | | | 3 | 2 | |
| CO-5 | 3 | 2 | 2 | 2 | 3 | | | | | | | | 3 | 2 | |
| CO-6 | 3 | 2 | 2 | 2 | 3 | | | | | | | | 3 | 2 | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 55 |
| **Demonstrations** | | 00 |
| 1. Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 00 |
| 1. Solving Numerical Problems | 00 | |
| **Practical Work** | | 00 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 05 |
| 1. Case Study Presentation | 05 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |

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| | | |
|---|---|---|
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **70** |

## 7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B.Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3 ), COs are assessed as illustrated in the following Table.

| **For Theory Courses Only** | | | |
|---|---|---|---|
| **Focus of COs on each Component or Subcomponent of Evaluation** | | | |
| | **Component 1: CE (50% Weightage)** | | **Component 2: SEE (50% Weightage)** |
| **Subcomponent ▸** | | | |
| **Subcomponent Type ▸** | **Term Tests** | **Assignments** | **100 Marks** |
| **Maximum Marks ▸** | **50** | **50** | |
| **CO-1** | X | | X |
| **CO-2** | X | | X |
| **CO-3** | X | X | X |
| **CO-4** | | X | X |
| **CO-5** | | X | X |
| **CO-6** | | X | |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

## 8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures |
| 2. | Understanding | Classroom lectures, Self-study |
| 3. | Critical Skills | Assignment |
| 4. | Analytical Skills | Assignment |
| 5. | Problem Solving Skills | Assignment, Examination |
| 6. | Practical Skills | Assignment |
| 7. | Group Work | -- |
| 8. | Self-Learning | Self-study |
| 9. | Written Communication Skills | Assignment, Examination |

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| | | |
|---|---|---|
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | -- |
| 13. | Information Management | Assignment |
| 14. | Personal Management | -- |
| 15. | Leadership Skills | -- |

**9. Course Resources**

**a. Essential Reading**

1. Class Notes
2. Steven Kilts (2007) Advanced FPGA Design, John Wiley and Sons
3. Michael D. Ciletti (2010) Advanced Digital Design with the Verilog HDL, 4th edition, Pearson Education

**b. Recommended Reading**

1. Clive Max Filed (2004) The design. Warriors Guide to FPGA, Elsevier
2. Stuart Sutherland (2002) Verilog 2001, Kluwer Academic Publishers
3. Ken Coffman (2000) Real World FPGA Design with Verilog, Prentice Hal
4. Samir Palnitkar (2012) Verilog HDL, 5th edition, Prentice Hall

**c. Websites**

1. https://embeddedmicro.com/blogs/tutorials/what-is-an-fpga

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**Course Specifications: Optical Communication**

| | |
|---|---|
| **Course Title** | Optical Communication |
| **Course Code** | ECE413A |
| **Course Type** | Professional Core Elective |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

## 1. Course Summary

The aim of this course is to present the fundamentals principles of optics, optical fiber transmission system, optical networks and optical network protocols. Design, modelling, simulation and analysis of optical amplifiers and network components are emphasized. The topologies of optical networks and their protocols, optical instruments are also discussed. Students are trained to use standard simulation tools for design, modelling, analysis and validation of the functionalities of optical fiber components.

## 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 04 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:1:0 |
| **Total Hours of Interaction** | 60 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

## 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Describe characteristics of fiber optic devices for optical communication system
**CO-2.** Explain the principles of fiber optic passive and active devices, optical network components and the optical measuring instruments
**CO-3.** Solve simple numerical problems on optical devices and optical networks
**CO-4.** Solve complex numerical problems on optical devices and optical networks using standard software tools
**CO-5.** Develop a simulation model for active and passive optical devices
**CO-6.** Analyze performance of various optical networks topologies

## 4. Course Contents

**Unit 1 (Introduction to optical fiber communication):** Evolution of fiber optics systems and transmission link, Basic optical laws, optical fiber modes and configuration. Step Index Fiber, Graded Index Fiber and specialty fibers, Attenuation, Bending Losses, Scattering, Absorption and Signal distortion in optical fiber

**Unit 2 (Optical sources and Detectors):** Semiconductor physics, Fiber materials and fabrication, working principle of Light emitting diodes (LED) and LASER, Distributed Feedback

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Lasers and Fabry Perot Lasers. Photodiodes: PIN photodiodes and Avalanche photodiode.

**Unit 3 (Optical Amplification and modulation):** Concept of optical amplification. Erbium Doped Fiber Amplifier (EDFA) and SOA. Advanced modulation and demodulation formats for optical fiber communications

**Unit 4 (Optical measurements)**: Field measurements: Optical Time Domain Reflectometry (OTDR), Splicer, connectors, Optical power meters, Optical attenuators, Tunable laser sources, Optical spectrum analyzer and Bit Error Rate Testing (BERT).

**Unit 5 (Optical networks)**: Network evolution, SONET, SDH, WDM concept and components, Wavelength routing networks and virtual topology design.

**Unit 6 (Digital and Analog Optical transmission systems)**: Overview of Analog and digital link, Optical transmitter and receiver circuits, Digital system planning, Point-to-Point link, Rise-time budget and Link power budget.

**5. Course Map (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-1 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | | | | | | | | | | | | 3 | | |
| CO-2 | 3 | | | | | | | | | | | | 3 | | |
| CO-3 | 1 | 3 | | 3 | | | | | | | | | 3 | 3 | |
| CO-4 | 1 | 3 | 3 | 3 | 3 | | | | | | | | 3 | 3 | |
| CO-5 | 1 | 1 | 3 | 3 | 1 | 2 | | | | | | | 3 | 3 | |
| CO-6 | 1 | 2 | 1 | 3 | 1 | 2 | | | | | | | 2 | 3 | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 55 |
| **Demonstrations** | | 00 |
| 1. Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 00 |
| 1. Solving Numerical Problems | 00 | |
| **Practical Work** | | 00 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 05 |

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| | | |
|---|---|---|
| 1. Case Study Presentation | 05 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **70** |

### 7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B.Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3 ), COs are assessed as illustrated in the following Table.

| **For Theory Courses Only** | | | |
|---|---|---|---|
| **Focus of COs on each Component or Subcomponent of Evaluation** | | | |
| | **Component 1: CE (50% Weightage)** | | **Component 2: SEE (50% Weightage)** |
| **Subcomponent ▸** | | | |
| **Subcomponent Type ▸** | **Term Tests** | **Assignments** | **100 Marks** |
| **Maximum Marks ▸** | **50** | **50** | |
| **CO-1** | X | | X |
| **CO-2** | X | | X |
| **CO-3** | X | | X |
| **CO-4** | | X | |
| **CO-5** | | X | |
| **CO-6** | | X | |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

### 8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures |
| 2. | Understanding | Classroom lectures, Self-study |
| 3. | Critical Skills | Assignment |
| 4. | Analytical Skills | Assignment |

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| | | |
|---|---|---|
| 5. | Problem Solving Skills | Assignment, Examination |
| 6. | Practical Skills | Assignment |
| 7. | Group Work | -- |
| 8. | Self-Learning | Self-study |
| 9. | Written Communication Skills | Assignment, Examination |
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | -- |
| 13. | Information Management | Assignment |
| 14. | Personal Management | -- |
| 15. | Leadership Skills | -- |

**9. Course Resources**

**a. Essential Reading**

1. Course notes
2. G.Keiser, 2013, Optical Fiber Communication, McGraw Hill
3. Rajiv Ramaswami, Kumar N. Sivarajan and Galen Saski, 2010, Optical networks: A practical perspective, Morgan Kaufmann

**b. Recommended Reading**

1. A. Ghatak and K. Thyagarajan, 2016, Introduction to Fiber Optics, Cambridge India
2. Govind P. Agrawal, 2002, Optical Fiber Communication System, Third Edition, Wiley Series
3. G.L.Li and P.K.L.Yu, 2003, Optical Intensity Modulators for Digital and Analog Applications

**c. Magazines and Journals**

1. Institute of Electrical and Electronics Engineering (IEEE) Journal of Lightwave Technology
2. Institute of Electrical and Electronics Engineering (IEEE) Photonics Technology Letters
3. The International Society for Optics and Photonics (SPIE) Optical Engineering Journal
4. Optics and Photonics News: Optical Society of America

**d. Websites**

1. www.photonicssociety.org
2. www.spie.org
3. www.osa.org

**e. Other Electronic Resources**

1. Electronic resources on the course area are available on RUAS library
2. NPTEL lectures on Advanced Optical Communications by Prof. R.K.Shevgaonkar

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**Course Specifications: DSP Architecture**

| | |
|---|---|
| **Course Title** | DSP Architecture |
| **Course Code** | ECE414A |
| **Course Type** | Professional Core Elective |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

## 1. Course Summary

This course deals with real-time DSP applications, algorithms and their hardware implementation. Students are taught number representation and architecture of DSP processor. Memory handling and interfacing of peripherals to the hardware are emphasized. Students are trained in programming processors using high level language, and implement DSP algorithms using standard development environments.

## 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 04 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:1:0 |
| **Total Hours of Interaction** | 60 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

## 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Explain the architectures and programming instructions of Digital Signal Processors
**CO-2.** Describe DSP algorithms and interfacing capabilities of DSP processors for different applications
**CO-3.** Design applications by interfacing peripherals with DSP Processor
**CO-4.** Identify the trade-offs necessary in algorithm design for real-time DSP implementation
**CO-5.** Design DSP algorithms using a suitable programming language
**CO-6.** Implement and verify DSP algorithms on suitable Digital Signal Processors using development boards and tool kits

## 4. Course Contents

**Unit 1 (Architectures Of Digital Signal Processors):** Overview and applications of digital signal processing, Typical digital signal processing System, Basic Architectural Features of microcontroller, microprocessor and DSP processor, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Speed Issues, Features for External Interfacing

**Unit 2 (Programmable Digital Signal Processors):** Introduction, Commercial Digital Signal-processing Devices, Addressing Modes, Memory, instructions and programming of a DSP

processor, on-Chip peripherals, Interrupts, Pipeline Operation, Program Control.

**Unit 3 (Implementation Of Dsp Algorithms):** Introduction, An FFT Algorithm for DFT Computation, Overflow and Scaling, Bit-Reversed Index Implementation on a DSP processor. Linear and circular buffers, Implementation of FIR and IIR filters on DSP processor, software optimization for efficient algorithm implementation

**Unit 4 (Interfacing Memory And Parallel I/O Peripherals To Dsp Devices):** Memory Space Organization, External Bus Interfacing Signals. Memory Interface, Parallel I/O Interface, Programmed I/O, Interrupts and I/O Direct Memory Access (DMA).

## 5. Course Map (CO-PO-PSO Map)

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | | | | | | | | | | | 2 | 3 | 2 | |
| CO-2 | 3 | | | | | | | | | | | 2 | 3 | 2 | |
| CO-3 | 3 | 3 | 2 | 3 | 2 | | | | | | | 2 | 3 | 3 | |
| CO-4 | 3 | 3 | 3 | 3 | 2 | | | | | | | 2 | 3 | 3 | |
| CO-5 | 3 | 3 | 3 | 3 | 2 | | | | | | | 2 | 3 | 3 | |
| CO-6 | 3 | 3 | 3 | 3 | 3 | | | | | | | 2 | 3 | 3 | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

## 6. Course Teaching and Learning Methods

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 55 |
| **Demonstrations** | | 00 |
| 1. Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 00 |
| 1. Solving Numerical Problems | 00 | |
| **Practical Work** | | 00 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 05 |
| 1. Case Study Presentation | 05 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |

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|---|---|---|
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **70** |

## 7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B.Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3 ), COs are assessed as illustrated in the following Table.

| **For Theory Courses Only** | | | |
|---|---|---|---|
| **Focus of COs on each Component or Subcomponent of Evaluation** | | | |
| | **Component 1: CE (50% Weightage)** | | **Component 2: SEE (50% Weightage)** |
| **Subcomponent ▸** | | | |
| **Subcomponent Type ▸** | **Term Tests** | **Assignments** | **100 Marks** |
| **Maximum Marks ▸** | **50** | **50** | |
| **CO-1** | X | | X |
| **CO-2** | X | | X |
| **CO-3** | X | X | X |
| **CO-4** | | X | X |
| **CO-5** | | X | X |
| **CO-6** | | X | |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

## 8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures |
| 2. | Understanding | Classroom lectures, Self-study |
| 3. | Critical Skills | Assignment |
| 4. | Analytical Skills | Assignment |
| 5. | Problem Solving Skills | Assignment, Examination |
| 6. | Practical Skills | Assignment |
| 7. | Group Work | -- |
| 8. | Self-Learning | Self-study |
| 9. | Written Communication Skills | Assignment, Examination |

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| | | |
|---|---|---|
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | -- |
| 13. | Information Management | Assignment |
| 14. | Personal Management | -- |
| 15. | Leadership Skills | -- |

**9. Course Resources**

**a. Essential Reading**

1. Class Notes
2. P. Lapsley, J. Bier, A. Shoham and E.A.Lee (1996) DSP Processor Fundamentals, Architectures and Features, IEEE Press
3. Venkatramani B., Bhaskar M (2008) Digital Signal Processor, Architecture, Programming and Applications, Tata Macgrow Hill

**b. Recommended Reading**

1. T. B. Welch, C. H. G. Wright and M. G. Morrow (2006) Real-Time Digital Signal Processing from MATLAB to C with the TMS320C6x DSK, Taylor & Francis Group, New York
2. N. Kehtarnavaz, M. Keramat (2000) DSP System Design Using the TMS320C6000, Prentice Hall Openheim Scheafer, Discrete Time Signal Processing, Prentice Hall
3. P.M. Embree (1995) C algorithms for Real-Time DSP, Prentice Hall

**c. Websites**

1. http://www.ti.com/processors/dsp/overview.html

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## Course Specifications: Principles of Medical Imaging

| | |
|---|---|
| **Course Title** | Principles of Medical Imaging |
| **Course Code** | ECE421A |
| **Course Type** | Professional Core Elective |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

### 1. Course Summary

The aim of this course is to introduce the fundamental principles of medical imaging techniques such as Magnetic Resonance Imaging (MRI), X-ray, Computed Tomography (CT), ultrasound (US), Positron Emission Tomography (PET), and Single Photon Emission Computed Tomography (SPECT). For each of these imaging modalities its physical principle, the mathematical methods for image generation and reconstruction, its anatomical andphysiological information content and its limitations are discussed. Students are equippedwith knowledge on Imaging modality and image processing methodology.

### 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 04 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:1:0 |
| **Total Hours of Interaction** | 60 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

### 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

- **CO-1.** Discuss the fundamental principles of medical imaging techniques such as X-ray, CT, Ultrasound, MRI and NMR
- **CO-2.** Discuss the formation and reconstruction of medical images
- **CO-3.** Discuss the artefacts and emerging trends in medical image processing
- **CO-4.** Apply the basic mathematical principles for the generation of tomographic medical images
- **CO-5.** Analyse medical images acquired with the discussed modalities for imaging artefacts
- **CO-6.** Apply and analyse the projection and reconstruction of medical images using Matlab programming

### 4. Course Contents

**Unit 1 (Theory of Image Formation, Fourier Transforms, Radon transform, Interaction of radiation with matter):** Ionizing and Non-ionizing, Attenuation of X and Gamma rays, Coherent Scattering and Compton Scattering

**Unit 2 (X-ray Imaging):** Interaction of x-rays with matter, X-ray generation, Projection images,

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Scatter, Digital Radiography, CT – Imaging. Fundamentals of Image Processing, Fluroscopy **Unit 3 (Ultrasound):** Physics of Ultrasound, Image formation, Doppler scanning, hazards of Ultrasound, Colour Doppler Ultrasound

**Unit 4 (Nuclear Medicine):** Overview of isotopes, generation of Isotopes, Anger Cameras, SPECT Imaging, Positron Emitters and generation, PET Imaging, Clinical aspects of Planar, SPECT and PET Imaging with isotopes.

**Unit 5 (Magnetic Resonance Imaging):** Magnetization, Resonance, Relaxation, Contrast in MR Imaging, Image formation, Image sequences, their appearances and clinical uses, Advances in MR: MR Angiography, Functional Imaging, Safety in MR

**Unit 6 (Emerging Trends in Imaging):** Concepts of Diffuse Optical Tomography, Multimodal Optical Imaging, Acousto-optic imaging, Near infra-red imaging and Spectrally encoded confocal microscopy.

**5. Course Map (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | | | | | | | | | | | | 3 | | |
| CO-2 | 3 | | | | | | | | | | | | 3 | | |
| CO-3 | 3 | | | | | | | | | | | | 3 | 3 | |
| CO-4 | 1 | 2 | 2 | 2 | 2 | 1 | | | | | | | 2 | 3 | |
| CO-5 | 2 | 3 | 1 | 2 | 2 | 1 | | | | | | | 3 | 3 | |
| CO-6 | 3 | 3 | 3 | 3 | 3 | 3 | | | | | | | 2 | 3 | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 55 |
| **Demonstrations** | | 00 |
| 1. Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 00 |
| 1. Solving Numerical Problems | 00 | |
| **Practical Work** | | 00 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 05 |
| 1. Case Study Presentation | 05 | |

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| | | |
|---|---|---|
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **70** |

## 7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B.Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3 ), COs are assessed as illustrated in the following Table.

| **For Theory Courses Only** | | | |
|---|---|---|---|
| **Focus of COs on each Component or Subcomponent of Evaluation** | | | |
| | **Component 1: CE (50% Weightage)** | | **Component 2: SEE (50% Weightage)** |
| **Subcomponent ▸** | | | |
| **Subcomponent Type ▸** | **Term Tests** | **Assignments** | **100 Marks** |
| **Maximum Marks ▸** | **50** | **50** | |
| **CO-1** | X | | X |
| **CO-2** | X | | X |
| **CO-3** | X | | X |
| **CO-4** | | X | X |
| **CO-5** | | X | X |
| **CO-6** | | X | |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

## 8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures |
| 2. | Understanding | Classroom lectures, Self-study |
| 3. | Critical Skills | Assignment |
| 4. | Analytical Skills | Assignment |

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| | | |
|---|---|---|
| 5. | Problem Solving Skills | Assignment, Examination |
| 6. | Practical Skills | Assignment |
| 7. | Group Work | -- |
| 8. | Self-Learning | Self-study |
| 9. | Written Communication Skills | Assignment, Examination |
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | -- |
| 13. | Information Management | Assignment |
| 14. | Personal Management | -- |
| 15. | Leadership Skills | -- |

**9. Course Resources**

**a. Essential Reading**

1. Class Notes

2. Flower M. A. , 2012, Webb's Physics of Medical Imaging, Second Edition,Taylor & Francis
3. Bushberg J.T., Seibert J.A., Leidholdt E.M. and Boone J.M. (2001) The Essential Physics of Medical Imaging, Lippincott Williams & Wilkins

**b. Recommended Reading**

1. Cho Z.H, Jones J.P. and Singh M. (1993) Foundations of medical imaging. Wiley, New York

**c. Magazines and Journals**

1. Journal of X-ray science and technology
2. Journal of Ultrasonic imaging
3. IEEE Transactions in Medical Imaging
4. IEEE Transactions in Biomedical Engineering
5. Physics in Medicine and Biology
6. Medical Physics
7. Radiology
8. Radiation Research
9. International Journal of Radiation Oncology Biology Physics
10. IEEE Computer Society Workshop on Mathematical Methods in Biomedical Image Analysis

**d. Websites**

1. www.indyrad.iupui.edu
2. homepages.inf.ed.ac.uk/rbf/HIPR2/
3. www.kuleuven.ac.be
4. www.med.monash.edu.au/

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**Course Specifications: Electronic Board Design**

| | |
|---|---|
| **Course Title** | Electronic Board Design |
| **Course Code** | ECE422A |
| **Course Type** | Professional Core Elective |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

**1. Course Summary**

This course deals with design, create, capture, simulation and implementation of the high speed interconnects and printed circuit board. Students are taught high frequency signal propagation issues such as crosstalk, reflections, ringing, ground/power bounce and EMI. Analysis, simulation and implementation of various techniques such as termination techniques, crosstalk avoidance and topological design of nets to achieve better signal integrity are emphasised. Students are trained on the design, simulation and development of high speed PCB with better signal integrity using standard Electronic Design Automation (EDA)tools

**2. Course Size and Credits:**

| | |
|---|---|
| **Number of Credits** | 04 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:1:0 |
| **Total Hours of Interaction** | 60 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

**3. Course Outcomes (COs)**

After the successful completion of this course, the student will be able to:

**CO-1.** Explain the concepts associated with high speed interconnects and elements of PCB Fabrication such stack up, process, materials, chemicals etc.

**CO-2.** Describe signal integrity and power integrity in terms of crosstalk, reflection, EMI, power distribution network, IR drop and ground bounce respectively (analytical and theoretical questions)

**CO-3.** Solve numerical based on signal integrity and power integrity in terms of crosstalk, reflection, EMI, and power distribution network

**CO-4.** Perform component library development, schematic capture, component placement, and routing for PCB development of any given circuit design using standard software tools

**CO-5.** Analyse the signal integrity of the designed circuit with respect to crosstalk, reflection, EMI and IR drop (both analytical and tool based)

**CO-6.** Apply design optimization techniques to improve signal integrity of the designed circuit

**4. Course Contents**

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**Unit 1 (Fundamentals of Electronic Board Design):** PCB Design Environment, Major types of PCBs, Parts of PCB, Various Chip packages, multilayer PCB, Steps in PCB Design, PCB Design Considerations, Importance of Interconnect design, Issues in high speed boards, Frequency, Time and Distance, Lumped and Distributed Systems, Inductive and Capacitive coupling

**Unit 2 (Transmission Lines):** Basic definitions, Electromagnetic Signal, Time and Frequency domain concepts, Transmission Lines- Microstrip and Stripline, Transmission lines types - Lumped, Distributed, Odd and Even transmission; Reflection calculations

**Unit 3 (Crosstalk and Impedance in Printed Circuit Board):** Near-end and Far-end Crosstalk, Crosstalk Induced Noise, Effect of crosstalk on transmission line parameters, Termination techniques to reduce crosstalk, Design Guidelines, Crosstalk simulation and analysis

**Unit 4 (Routing and stack up)**: Issues for routing, Routing topologies, Rise and fall time degradation, Termination techniques and reflection analysis, PCB Stack up and Return Path Discontinuities

**Unit 5 (Power Integrity of High-Speed Signal)**: Power rule, power supply for board, Power distribution network and de-coupling capacitor, Design of Decoupling Capacitor, IR drop analysis, IPC Standard (2221-General): Electrical consideration of PCB design

**Unit 6 (EMI/EMC Compliances)**: Definitions, Impact of EMI and EMC, Radiation and Conduction, Types of EMI, EMI characterization, EMI Suppression, Bypassing & Decoupling, Grounding techniques & Trace Routing to avoid interference, and EMI simulation and Analysis

**Unit 7 (Signal Integrity, PCB Materials & Fabrication Process)**: Analysis of signal integrity using IBIS Models, materials used in FPCB, Direct and Indirect Materials, Manufacturing processes for a Multi-layer PCB, IPC Standard (2221-General): Material Consideration and Documentation

**5. Course Map (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | | | | | | | | | | | | 3 | | |
| CO-2 | 3 | 3 | | | | | | | | | | | 3 | 2 | |
| CO-3 | 3 | 3 | 3 | | | | | | | | | | 2 | 2 | |
| CO-4 | 3 | 3 | 3 | 3 | 3 | | | | | | | | 1 | 3 | |
| CO-5 | 3 | 3 | 3 | 3 | 3 | | | | | | | | 2 | 3 | |
| CO-6 | 3 | 3 | 3 | 3 | 3 | | | | | | | | 3 | 3 | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| Face to Face Lectures | | 55 |
| Demonstrations | | 00 |
| 1. Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |

| | | |
|---|---|---|
| **Numeracy** | | 00 |
| 1. Solving Numerical Problems | 00 | |
| **Practical Work** | | 00 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 05 |
| 1. Case Study Presentation | 05 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **70** |

**7. Course Assessment and Reassessment**

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B.Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3 ), COs are assessed as illustrated in the following Table.

| **For Theory Courses Only** | | | |
|---|---|---|---|
| **Focus of COs on each Component or Subcomponent of Evaluation** | | | |
| | **Component 1: CE (50% Weightage)** | | **Component 2: SEE (50% Weightage)** |
| **Subcomponent ▸** | | | |
| **Subcomponent Type ▸** | **Term Tests** | **Assignments** | **100 Marks** |
| **Maximum Marks ▸** | **50** | **50** | |
| **CO-1** | X | | X |
| **CO-2** | X | | X |
| **CO-3** | X | X | X |
| **CO-4** | | X | X |
| **CO-5** | | X | |
| **CO-6** | | X | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

**8. Achieving COs**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Class Room Lectures |
| 2. | Understanding | Class Room Lectures, Self-study |
| 3. | Critical Skills | Assignment |
| 4. | Analytical Skills | Assignment |
| 5. | Problem Solving Skills | Assignment and Exams |
| 6. | Practical Skills | Assignment |
| 7. | Group Work | -- |
| 8. | Self-Learning | Self-study |
| 9. | Written Communication Skills | Assignment |
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | -- |
| 13. | Information Management | Assignment |
| 14. | Personal Management | -- |
| 15. | Leadership Skills | -- |

**9. Course Resources**

**a. Essential Reading**

1. Class Notes
2. Howard. W. Johnson and Martin Graham (2004) High Speed Signal Propagation, An Advanced Black Magic, Prentice Hall
3. Douglas Brooks (2003) Signal Integrity Issues and Printed Circuit Board Design, Prentice Hall
4. Mark I. Montrose (2004) Printed Circuit Board Design Techniques for EMC Compliance: A Handbook for Designers, IEEE Press

**b. Recommended Reading**

1. Eric Bogatin (2004) Signal Integrity-Simplified, Prentice Hall
2. Bruce R. Archambeault (2002) PCB Design for Real-World EMI Control, Kluwer Academic Publishers
3. Stephen H. Hall, Garrett W. Hall and James A. McCall (2000) High-Speed Digital System Design—A Handbook of Interconnect Theory and Design Practices, JohnWiley and Sons
4. Henry W. Ott John (1988) Noise reduction techniques in Electronic Systems, Wiley & Sons
5. Avram Bar-Cohen (1983) Thermal Analysis and Control of Electronic Equipment, Oxford University Press

**c. Magazines and Journals**

1. IEEE Transactions on Microwave Theory and Techniques
2. IEEE Transactions on Antennas and Propagation
3. IEEE Transactions on Industrial Electronics
4. Electronics Letters, Elsevier
5. IEEE Spectrum

**d. Websites**

1. www.sigrity.com
2. www.sigcon.com

**e. Other Electronic Resources**

1. http://www.analog.com/en/analog-dialogue/articles/high-speed-printed-circuit-board-layout.html

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**Course Specifications: Wireless Communications**

| | |
|---|---|
| **Course Title** | Wireless Communications |
| **Course Code** | ECE423A |
| **Course Type** | Professional Core Elective |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

## 1. Course Summary

This course deals with principles of wireless communication and related technologies. A brief overview of current wireless systems and standards are taught. Students are taught to characterize wireless channels and examine their fundamental capacity limits. Digital modulation techniques and their performance under wireless channel impairments are emphasized. Multiple antenna and multicarrier modulation techniques are comprehensively analyzed. The course also emphasizes on coding for wireless channels, adaptive modulation, adaptive coding and multiuser detection. Students are trained to analyze and design transmission and receiving algorithms.

## 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 04 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:1:0 |
| **Total Hours of Interaction** | 60 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

## 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Describe the basic principles various wireless communication systems and standards, principles of cellular communications and cellular processes

**CO-2.** Explain propagation effects such as fading, time delay spread, and Doppler spread, capacity of wireless channels, principles of multicarrier modulation

**CO-3.** Derive and calculate the Bit Error Rate as a function of Signal to Noise Ratio for wired and wireless channels with and without diversity, traffic load of a network

**CO-4.** Design the transmitter and receiver configurations based on the performance required from a wireless communication system

**CO-5.** Analyze the performance of wireless systems with given channel parameters with and without diversity

**CO-6.** Implement wireless communication system using standard software tools and extract the performance plots of the system

## 4. Course Contents

**Unit 1 (Overview of Wireless Communications):** History, Wireless Systems: WiFi, WLAN,

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Bluetooth, ZigBee, Cellular communications: Frequency reuse and Multiple Access Technologies, Cellular Processes - Call Setup, Handover, GSM and LTE standards, Principles of Teletraffic Theory

**Unit 2 (Wireless Channel Modeling):** Path Loss and Shadowing Models, Statistical Narrowband Fading models: Rayleigh/Ricean Fading, BER Performance in Fading Channels, Broadband Wireless Channel Modeling, WSSUS Channel Modeling, RMS Delay Spread, Doppler Fading, Jakes Model and Jakes Spectrum, Capacity of flat fading channels and Water- filling approach

**Unit 3 (Diversity modeling for Wireless Communications):** Diversity in Fading Channels, BER Performance Improvement with diversity, Types of Diversity – Frequency, Time, Space, Receiver Diversity: selection combining, threshold combining, maximum-ratio combining, equal-gain combining, Transmitter Diversity: Precoding and Space Time Block Coding (Alamouti scheme)

**Unit 4(Multiple Antenna and Space-Time Communications):** Narrowband MIMO Model, Parallel Decomposition of MIMO Channel, and Symbol detection using ZF, MMSE and nonlinear interfaces (BLAST), MIMO Channel Capacity

**Unit 5 (Multi-Carrier Modulation and OFDM):** Single Carrier Modulation and Multicarrier Modulation, OFDM: generation of subcarriers using the IFFT, guard time and cyclic extension, symbol detection, choice of OFDM parameters, Applications of OFDM (DAB, DVB, WLAN), MIMO-OFDM Technology for LTE

**5. Course Map (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | | | | | | | | | | | | 3 | | |
| CO-2 | 3 | | | | | | | | | | | | 3 | | |
| CO-3 | 3 | 3 | | | | | | | | | | | 3 | | |
| CO-4 | | 2 | 2 | 2 | 2 | | | | | | | | 2 | | |
| CO-5 | | | 2 | 2 | | | | | | | | | 2 | 2 | |
| CO-6 | | | | 2 | 2 | | | | | | | | | 1 | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 55 |
| **Demonstrations** | | 00 |
| 1. Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 00 |
| 1. Solving Numerical Problems | 00 | |
| **Practical Work** | | 00 |

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| | | |
|---|---|---|
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | |
| 1. Case Study Presentation | 05 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | 05 |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **70** |

## 7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B.Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3 ), COs are assessed as illustrated in the following Table.

| **For Theory Courses Only** | | | |
|---|---|---|---|
| **Focus of COs on each Component or Subcomponent of Evaluation** | | | |
| | **Component 1: CE (50% Weightage)** | | **Component 2: SEE (50% Weightage)** |
| **Subcomponent ▸** | | | |
| **Subcomponent Type ▸** | **Term Tests** | **Assignments** | **100 Marks** |
| **Maximum Marks ▸** | **50** | **50** | |
| **CO-1** | X | | X |
| **CO-2** | X | | X |
| **CO-3** | X | | X |
| **CO-4** | | X | X |
| **CO-5** | | X | X |
| **CO-6** | | X | |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

## 8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following

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teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures, Assignments |
| 2. | Understanding | Classroom lectures, Assignments |
| 3. | Critical Skills | Classroom lectures, Assignments |
| 4. | Analytical Skills | Classroom lectures, Assignments |
| 5. | Problem Solving Skills | Classroom lectures, Assignments |
| 6. | Practical Skills | --- |
| 7. | Group Work | Assignment |
| 8. | Self-Learning | Assignment |
| 9. | Written Communication Skills | Assignment, examination |
| 10. | Verbal Communication Skills | --- |
| 11. | Presentation Skills | --- |
| 12. | Behavioral Skills | Course work |
| 13. | Information Management | Assignment, examination |
| 14. | Personal Management | Course work |
| 15. | Leadership Skills | --- |

**9. Course Resources**

**a. Essential Reading**

1. Class Notes
2. Goldsmith, A, 2005, Wireless Communications. Cambridge: Cambridge University

**b. Recommended Reading**

1. Ghavami, M., Michael,L. B. and Kohno,R, 2007, Ultra-Wideband Signals and Systems in Communication Engineering. John Wiley & Sons, Ltd
2. Tse,D. and Viswanath,P, 2005, Fundamentals of Wireless Communication. Cambridge University Press
3. Duman,T. M. and Ghrayeb,A, 2007, Coding for MIMO Communication Systems. John Wiley & Sons, Ltd.
4. Shieh, W. and Djordjevic, 2009, OFDM for Optical Communications. Elsevier/Academic Press
5. Samii, Y. R. and Kim V, 2006, Implanted Antennas in Medical Wireless Communications. Morgan & Claypool Publishers

**c. Magazines and Journals**

1. IEEE Transactions on Communications
2. IEEE Transactions on Wireless Communications

**d. Websites**

1. http://nptel.ac.in/courses/117102062/

**e. Other Electronic Resources**

1. PC Hardware
2. MATLAB software tool

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**Course Specifications: Speech Processing**

| | |
|---|---|
| **Course Title** | Speech Processing |
| **Course Code** | ECE424A |
| **Course Type** | Professional Core Elective |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

## 1. Course Summary

The aim of this course is to present the fundamentals of speech processing. Students are taught Speech Signal production models, phonetic representation, Hearing and Auditory Perception, Short-Time Analysis of Speech, Speech Spectrogram, Homomorphic Speech Analysis, Linear Predictive Analysis, Digital Speech Coding, Text-to-Speech Synthesis Methods, Automatic Speech Recognition. Students are trained to use software tools for speech signal analysis.

## 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 04 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:1:0 |
| **Total Hours of Interaction** | 60 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

## 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Explain Speech Signal production models, phonetic representation, Hearing and Auditory Perception, Short-Time Analysis of Speech, The Speech Spectrogram

**CO-2.** Describe the Homomorphic Speech Analysis, Linear Predictive Analysis, Digital Speech Coding, Text-to-Speech Synthesis Methods, Automatic Speech Recognition

**CO-3.** Solve simple problems related to speech processing

**CO-4.** Analyse Speech Signal production models, phonetic representation, Hearing and Auditory Perception, Short-Time Analysis of Speech, Speech Spectrogram and Homomorphic Speech Analysis

**CO-5.** Develop algorithms related to Linear Predictive Analysis, Digital Speech Coding, Text-to-Speech Synthesis Methods and Automatic Speech Recognition

**CO-6.** Solve complex problems related to speech processing and analyse using suitable software tools

## 4. Course Contents

**Unit 1 (Fundamentals of Human Speech Production):** The Process of Speech Production, Short-Time Fourier Representation of Speech, The Acoustic Theory of Speech Production, Lossless Tube Models of the Vocal Tract, Digital Models for Sampled Speech Signals

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**Unit 2 (Time-Domain Methods for Speech Processing):** Introduction to Short-Time Analysis of Speech, Short-Time Energy and Short-Time Magnitude, Short-Time Zero-Crossing Rate, The Short-Time Autocorrelation Function, The Modified Short-Time Autocorrelation Function, The Short-Time Average Magnitude Difference Function

**Unit 3 (Frequency Domain Representations):** Discrete-Time Fourier Analysis, Short-Time Fourier Analysis, Speech Spectrogram, Spectrographic Displays, Overlap Addition (OLA), Method of Synthesis, Filter Bank Summation (FBS) Method of Synthesis

**Unit 4 (The Cepstrum and Homomorphic Speech Processing):** Cepstrum and Complex Cepstrum, Short-Time Cepstrum, Computation of the Cepstrum, Short-Time Homomorphic Filtering of Speech, Application to Pitch Detection, Applications to Pattern Recognition

**Unit 5 (Linear Predictive Analysis and Automatic Speech Recognition):** Linear Prediction and the Speech Model, Computing the Prediction Coefficients, the Levinson–Durbin Recursion, LPCSpectrum, Equivalent Representations, Role of Linear Prediction, Building a Speech Recognition System, Challenges in ASR Technology

**5. Course Map (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | | | | | | | | | | | | 2 | | |
| CO-2 | 3 | | | | | | | | | | | | 2 | 2 | |
| CO-3 | 3 | 2 | 2 | 2 | | | | | | | | | 3 | 2 | |
| CO-4 | 3 | 3 | 2 | 2 | 2 | 3 | | | | | | | 3 | 3 | |
| CO-5 | 3 | 3 | 3 | 2 | 3 | 3 | | | | | | | 3 | 3 | |
| CO-6 | 3 | 3 | 3 | 2 | 3 | 3 | | | | | | | 3 | 3 | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 55 |
| **Demonstrations** | | 00 |
| 1. Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 00 |
| 1. Solving Numerical Problems | 00 | |
| **Practical Work** | | 00 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |

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| | | |
|---|---|---|
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | |
| 1. Case Study Presentation | 05 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | 05 |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **70** |

## 7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B.Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3 ), COs are assessed as illustrated in the following Table.

| **For Theory Courses Only** | | | |
|---|---|---|---|
| **Focus of COs on each Component or Subcomponent of Evaluation** | | | |
| | **Component 1: CE (50% Weightage)** | | **Component 2: SEE (50% Weightage)** |
| **Subcomponent ▸** | | | |
| **Subcomponent Type ▸** | **Term Tests** | **Assignments** | **100 Marks** |
| **Maximum Marks ▸** | **50** | **50** | |
| **CO-1** | X | | X |
| **CO-2** | X | | X |
| **CO-3** | X | | X |
| **CO-4** | X | | X |
| **CO-5** | | X | X |
| **CO-6** | | X | |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

## 8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|

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| | | |
|---|---|---|
| 1. | Knowledge | Classroom lectures |
| 2. | Understanding | Classroom lectures, Self-study |
| 3. | Critical Skills | Assignment |
| 4. | Analytical Skills | Assignment |
| 5. | Problem Solving Skills | Assignment, Examination |
| 6. | Practical Skills | Assignment |
| 7. | Group Work | -- |
| 8. | Self-Learning | Self-study |
| 9. | Written Communication Skills | Assignment, Examination |
| 10. | Verbal Communication Skills | -- |
| 11. | Presentation Skills | -- |
| 12. | Behavioral Skills | -- |
| 13. | Information Management | Assignment |
| 14. | Personal Management | -- |
| 15. | Leadership Skills | -- |

**9. Course Resources**

**a. Essential Reading**

1. Course notes
2. Lawrence R. Rabiner, Ronald W. Schafer, 2007, Introduction to Digital Speech Processing, 1st Edition, Now Publishers Inc.
3. Lawrence R. Rabiner, Ronald W. Schafer, 2006, Digital Processing of Speech Signal, 2nd Edition Prentice-Hall
4. Li Deng, Douglas O'Shaughnessy, 2003, Speech Processing: A Dynamic and Optimization-Oriented Approach, CRC Press

**b. Recommended Reading**

1. Lawrence R. Rabiner, 2011, Theory and application of digital signal processing, Pearson Education
2. Xuedong Huang, Alejandro Acero, Hsiao-Wuen Hon, 2001, Spoken Language Processing: A Guide to Theory, Algorithm, and System Development, Prentice Hall PTR
3. Ben Gold, Nelson Morgan,2006, Speech and audio signal processing: processing and perception of speech and music, John Wiley & Sons

**c. Magazines and Journals**

1. IEEE Signal Processing Magazine

**d. Websites**

1. https://www.edx.org/
2. https://www.coursera.org/
3. http://nptel.ac.in/
4. https://ocw.mit.edu/index.htm

**e. Other Electronic Resources**

1. Electronic resources on the course area are available in RUAS library, http://lib.myilibrary.com
2. https://ebookcentral.proquest.com/lib/msruasin/home.action.

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**Course Specifications: Project Work-1**

| | |
|---|---|
| **Course Title** | Project Work -1/Internship |
| **Course Code** | ECP401A/ECI401A |
| **Course Type** | Project |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

**1. Course Summary**

The aim of this course is to give students an experience of identifying an engineering problem, conceptualise a solution, perform basic design calculations, model, solve, analyse and demonstrate its performance in a virtual environment. The students are expected to work in a team of not more than 4 members and are required to develop an appropriate solution by identifying a problem for which a better or new engineering solution is required. The team need to demonstrate the working of the solution and write a technical report. Students are required to choose a project from students projects database available. Alternatively,Student can undergo internship in an industry, business organization, research organization or any other university on a topic of relevance during vacation after 6th semester with prior approval from the department head and faculty dean.

**2. Course Size and Credits:**

| | |
|---|---|
| **Number of Credits** | 06 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 0:0:6 |
| **Total Hours of Interaction** | 120 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

**3. Course Outcomes (COs)**

After the successful completion of this course, the student will be able to:

- **CO-1.** Recognise the need for developing a new or improving an existing engineering product/system through an organised survey of literature
- **CO-2.** Define engineering design specifications
- **CO-3.** Design, model, solve, analyse the product/system to meet the design specifications
- **CO-4.** Evaluate the performance of the modelled system and justify its performance
- **CO-5.** Demonstrate the system working in a virtual environment and make a presentation
- **CO-6.** Write a technical report Alternatively,
- **CO-7.** Write a report on experiences during internship
- **CO-8.** Make a presentation to a panel of examiners

**4. Course Contents**

**Unit 1:** Collection of relevant literature and review of literature

**Unit 2:** Interaction with the users and collection of data

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**Unit 3:** Data Analysis, Formulation of a problem of suitable size

**Unit 4:** Product development planning, cost calculations

**Unit 5:** Detail design calculations

**Unit 6:** Choosing a modeling environment, learning the appropriate tools and techniques

**Unit 7:** Modelling, simulation and analysis of design

**Unit 8:** Defining performance parameters, Evaluation of performance, presentation performance characteristics, Verification of results

**Unit 9:** Developing a working model, testing the model and evaluating its performance Demonstration to the defined audience and making a presentation to the assessing team making a Technical presentation

**Unit 10:** Writing project report

## 5. Course Map (CO-PO-PSO Map)

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 1 | 3 | | 3 | 3 | 3 | 3 | 3 |
| CO-2 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 1 | 3 | | 3 | 3 | 3 | 2 | 3 |
| CO-3 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 1 | 3 | | 3 | 3 | 3 | 2 | 3 |
| CO-4 | 2 | 3 | 2 | 3 | 2 | 1 | 3 | 1 | 3 | | 3 | 3 | 2 | 2 | 3 |
| CO-5 | 1 | 1 | 1 | 3 | 2 | 1 | 3 | 1 | 3 | 3 | | 3 | 1 | 2 | 3 |
| CO-6 | 1 | 1 | 1 | 2 | 2 | 1 | | 1 | 3 | 3 | | 3 | 1 | | 3 |
| CO-7 | 1 | 1 | 1 | 2 | 2 | 1 | | 1 | 3 | 3 | | 3 | 1 | | 3 |
| CO-8 | 1 | 1 | | | 2 | | | 1 | 3 | 3 | | 3 | 1 | | 3 |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

## 6. Course Teaching and Learning Methods

| Teaching and Learning Methods | Approximate Duration in Hours |
|---|---|
| Literature collection, Review of literature, Deciding the sample, for data collection, Developing a questionnaire, Data collection, Analysis of data, Problem formulation and Defining specifications | 20 |
| Development of design concept, Basic design calculations | 40 |
| Selection of tools, techniques and learning on how to use them | 20 |
| Modelling, Simulation, Analysis | 40 |
| Evaluation, Verification of results | 20 |
| Demonstration, Presentation and Technical Report Writing | 20 |
| Total Duration in Hours | 160 |

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## 7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B.Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3 ), COs are assessed as illustrated in the following Table.

| Focus of COs on each Component or Subcomponent of Evaluation | | |
|---|---|---|
| | **Component 1: Presentation (50% Weightage)** | **Component 2: Report (50% Weightage)** |
| **Maximum Marks ▸** | **100** | **100** |
| **CO-1** | X | X |
| **CO-2** | X | X |
| **CO-3** | X | X |
| **CO-4** | X | X |
| **CO-5** | X | |
| **CO-6** | | X |
| **CO-7** | | X |
| **CO-8** | x | |
| The details of SC1, SC2, SC3 are presented in the Programme Specifications Document. | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

## 8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Project Work |
| 2. | Understanding | Project Work |
| 3. | Critical Skills | Project Work |
| 4. | Analytical Skills | Project Work |
| 5. | Problem Solving Skills | Project Work |
| 6. | Practical Skills | Project Work |
| 7. | Group Work | Project Work |
| 8. | Self-Learning | Project Work |
| 9. | Written Communication Skills | Project Work |
| 10. | Verbal Communication Skills | Project Presentation, Viva Voice |
| 11. | Presentation Skills | Project Presentation |

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| | | |
|---|---|---|
| 12. | Behavioral Skills | Project Work |
| 13. | Information Management | Project Report |
| 14. | Personal Management | Project Work |
| 15. | Leadership Skills | Project Work |

**9. Course Resources**

**a. Essential Reading**

1. Presentations made by the Head of the Department on "Importance of Project work and The Methodology to be followed for successful Completion of Project work"

**b. Recommended Reading**

1. Course Notes, Manuals of Tools and Techniques Chosen to Solve the Design Problem

**c. Magazines and Journals**

**d. Websites**

**e. Other Electronic Resources**

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## Course Specifications: Electronic Devices and Appliances

| | |
|---|---|
| **Course Title** | Electronic Devices and Appliances |
| **Course Code** | OEE411A |
| **Course Type** | Open Elective Theory |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

### 1. Course Summary

The aim of the course is to provide students the basic concepts of electronic devices and appliances. The course trains students to understand the essential principles and terminology of electronics and their implications in developing electronic devices and appliances. Students are taught to construct electronic circuits. Students are trained to test, diagnose, troubleshoot and maintain an electronic device or appliance using standard tools

### 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 03 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 2:1:0 |
| **Total Hours of Interaction** | 45 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

### 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Explain concepts of electronics and its subfields
**CO-2.** Apply principles of electronics to construct and analyze electronic circuits and devices
**CO-3.** Identify components and circuits of an electronic device/appliance at sub-circuitry level and realizeits functionality
**CO-4.** Test electronic device/appliance functionality using appropriate tools and procedure
**CO-5.** Solve identified problemof an electronic device/appliance by applying standard diagnostic and troubleshooting procedure

### 4. Course Contents

**Unit 1:** Basic Terminologies Of Electronics (Voltage, Current. Etc.), Passive and Active Components, Basic Circuit Theorms and Laws Of Electronics, Rectifiers, Diodes, FET, BJT, Thyristors, MOSFET and their Applications, Transforms, Voltage Regulators, Regulated Power Supplies, Oscillators and Multivibrators, Analog and Digital Filters

**Unit 2:** Digital Electronics and its application (logic gates, flip-flops), Digital Integrated Circuits (ICs), Timers, Amplifiers and Feedback Amplifiers, Operational Amplifiers (OPAMP) and its Applications, Sensor and Transducers, Microphones, Audio Amplifiers and Speakers, Storage Devices and Memories

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**Unit 3:** Embedded Systems, Microprocessor and Microcontrollers Its Applications ,FPGA and its Application, Data Acquisition System and its Application, Wireless Devices and Systems, Electromechanical Switches and Relays, LED and Displays, Wires, Cables and Connectors,Battery and Battery Chargers, Test and Measuring Instruments,
Waveform Generators

**Unit 4:** Circuit Design And Prototyping, PCB, Fundamentals diagnosis procedure and standard tools, Fundamental Trouble shooting procedure, Preventive maintains and management

**Unit 5:** Electronic Appliances, Working principles of few major electronic appliances (TV, Mobile Phone, Vacuum Cleaner, Microwave Oven, Refrigerator, Air Conditioning, robotic lawn mover and Washing machine, Smart watch etc.)

**Unit 6:** Principles of electronic medical diagnostic equipment (Digital BP meter, Ophthalmoscope, Pulse Oximeter, Vital Sign monitors etc.), Principles of medical imaging equipment (X-ray, MRI, CT, Ultrasound, PET, Fluoroscopy etc.)

## 5. Course Map (CO-PO-PSO Map)

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-1 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 2 | | | | | | | | | | | | 2 | | |
| CO-2 | 1 | 2 | 2 | | | | | | | | | | 2 | | |
| CO-3 | 2 | | | | | | | | | | | | 2 | | |
| CO-4 | 1 | | 2 | | 1 | | | | | | | | 2 | 1 | |
| CO-5 | 1 | 2 | 2 | 2 | 1 | | | | | | | | 2 | 2 | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

## 6. Course Teaching and Learning Methods

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 15 |
| **Demonstrations** | | 06 |
| 1. Demonstration using Videos | 02 | |
| 2. Demonstration using Physical Models / Systems | 04 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 10 |
| 1. Solving Numerical Problems | 30 | |
| **Practical Work** | | **14** |
| 1. Course Laboratory | 06 | |
| 2. Computer Laboratory | 04 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 04 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |

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| | | |
|---|---|---|
| **Others** | | 00 |
| 1. Case Study Presentation | 00 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | **10** |
| **Total Duration in Hours** | | **55** |

## 7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B.Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3 ), COs are assessed as illustrated in the following Table.

| **For Theory Courses Only** | | | |
|---|---|---|---|
| **Focus of COs on each Component or Subcomponent of Evaluation** | | | |
| | **Component 1: CE (50% Weightage)** | | **Component 2: SEE (50% Weightage)** |
| **Subcomponent ▸** | | | |
| **Subcomponent Type ▸** | **Term Tests** | **Assignments** | **50 Marks** |
| **Maximum Marks ▸** | **25** | **25** | |
| **CO-1** | X | | X |
| **CO-2** | X | | X |
| **CO-3** | X | X | X |
| **CO-4** | | X | X |
| **CO-5** | | X | X |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

## 8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Class room lectures |
| 2. | Understanding | Class room lectures, demonstrations |
| 3. | Critical Skills | Class room lectures, Assignment |
| 4. | Analytical Skills | Class room, Examination, Assignment |
| 5. | Problem Solving Skills | Class room, Examination, Assignment |
| 6. | Practical Skills | Examination, Assignment |
| 7. | Group Work | Assignment |

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| | | |
|---|---|---|
| 8. | Self-Learning | Assignment |
| 9. | Written Communication Skills | Examination, Assignment |
| 10. | Verbal Communication Skills | Course Work |
| 11. | Presentation Skills | Examination |
| 12. | Behavioral Skills | Examination, Assignment |
| 13. | Information Management | Course Work |
| 14. | Personal Management | Examination, Assignment |
| 15. | Leadership Skills | Course Work |

**9. Course Resources**

**a. Essential Reading**

1. Class Notes
2. Robert Diffenderfer (2005), Electronic Devices: Systems and Applications, New York, Thomson DelmarLearning
3. Russell E. Smith (2015), Electricity for Refrigeration, Heating, and Air Conditioning, 9th Edition, Stamford, Cengage Learning

**b. Recommended Reading**

1. Eric Kleinert (2012),Troubleshooting and Repairing Major Appliances, McGraw Hill Professional
2. Douglas Kinney (2006), ABeginners Guideto Consumer Electronics Repair: Hand Bookand Tutorial, Lincoln,iUniverse
3. Theodore F. Bogart (2004), Electronic Devices and Circuits, Sixth Edition, New Delhi, Pearson Education
4. RobinPain(1996),PracticalElectronicFaultFindingandTroubleshooting,Oxford, Newnes

**c. Magazines and Journals**

1. Magazine: Electronics For You
2. Journal: IEEE Transactions on Consumer Electronics
3. Journal: IEEE Transactions on Electron Devices

**d. Websites**

1. TroubleshootingandRepairofConsumerElectronic Equipment, http://www.repairfaq.org/sam/tshoot.htm

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## Course Specifications: Fundamentals of Telecommunication

| | |
|---|---|
| **Course Title** | Fundamentals of Telecommunication |
| **Course Code** | OEE412A |
| **Course Type** | Open Elective Theory |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

### 1. Course Summary

The aim of the course is to equip students with fundamentals of various telecommunication systems. Students are taught the concepts of communication theory, radio communication, television broadcasting and voice communication systems. Students are trained to identify the subsystems of communication systems.

### 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 03 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 3:0:0 |
| **Total Hours of Interaction** | 45 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

### 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Explain the working principles of communication system/subsystems
**CO-2.** Describe the functioning of radio, television, voice, cellular communication systems
**CO-3.** Discuss the blocksets of radio, television, voice and cellular communications systems/subsystems
**CO-4.** Differentiate communication methods based on architectures and applications
**CO-5.** Develop system blocks and solve simple problems in designing of radio, television, voice and cellular systems

### 4. Course Contents

**Unit 1 (Communication theory):** Primer to communication theory, Frequency Bands, Applications, Radio waves, Radio wave reception, Ionosphere, Wave propagation, Simplex and Duplex communication, Unicast, Broadcast and Multicast Transmission.

**Unit 2 (Radio Communication):** Basics of radio communication system, Receiver types, transmission techniques, Bandwidth, Interference, Antenna types, Transceiver aspects for radio-communications

**Unit 3 (Television):** Block diagram of television, Working, Modulation schemes for TV, DVB, Satellite Television and new age television systems, television block sets

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**Unit 4 (Voice Communication):** Wired and Wireless Transmission, ISDN blocks, Telecommunication and Switching basic concepts, Access Schemes, Basic Functions in Cellular Communication, GSM/CDMA basics, 2G, 3G, 4G and beyond

## 5. Course Map (CO-PO-PSO Map)

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-1 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | | | | | | | | | | | | 3 | | |
| CO-2 | 3 | | | | | | | | | | | | 3 | 2 | |
| CO-3 | 3 | 2 | 2 | 2 | | | | | | | | | 3 | 2 | |
| CO-4 | 2 | 2 | 2 | 2 | | | | | | | | | 3 | 2 | |
| CO-5 | 2 | 1 | 2 | 1 | | | | | | | | | 2 | 2 | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

## 6. Course Teaching and Learning Methods

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 45 |
| **Demonstrations** | | 00 |
| 1. Demonstration using Videos | 00 | |
| 2. Demonstration using Physical Models / Systems | 00 | |
| 3. Demonstration on a Computer | 00 | |
| **Numeracy** | | 00 |
| 1. Solving Numerical Problems | 00 | |
| **Practical Work** | | 00 |
| 1. Course Laboratory | 00 | |
| 2. Computer Laboratory | 00 | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | 00 | |
| 4. Clinical Laboratory | 00 | |
| 5. Hospital | 00 | |
| 6. Model Studio | 00 | |
| **Others** | | 00 |
| 1. Case Study Presentation | 02 | |
| 2. Guest Lecture | 00 | |
| 3. Industry / Field Visit | 00 | |
| 4. Brain Storming Sessions | 00 | |
| 5. Group Discussions | 00 | |
| 6. Discussing Possible Innovations | 00 | |
| Mid Terms, Laboratory Examination/Written Examination, Presentations | | 10 |
| **Total Duration in Hours** | | **55** |

## 7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B.Tech. (Electronics and Communication

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Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3 ), COs are assessed as illustrated in the following Table.

| For Theory Courses Only | | | |
|---|---|---|---|
| Focus of COs on each Component or Subcomponent of Evaluation | | | |
| | Component 1: CE (50% Weightage) | | Component 2: SEE (50% Weightage) |
| Subcomponent ▸ | | | |
| Subcomponent Type ▸ | Term Tests | Assignments | 50 Marks |
| Maximum Marks ▸ | 25 | 25 | |
| CO-1 | X | | X |
| CO-2 | X | | X |
| CO-3 | X | | X |
| CO-4 | X | | X |
| CO-5 | | X | |
| The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document. | | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

**8. Achieving COs**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Class room lectures |
| 2. | Understanding | Class room lectures, demonstrations |
| 3. | Critical Skills | Class room lectures, Assignment |
| 4. | Analytical Skills | Class room, Examination, Assignment |
| 5. | Problem Solving Skills | Class room, Examination, Assignment |
| 6. | Practical Skills | Examination, Assignment |
| 7. | Group Work | Assignment |
| 8. | Self-Learning | Assignment |
| 9. | Written Communication Skills | Examination, Assignment |
| 10. | Verbal Communication Skills | Course Work |
| 11. | Presentation Skills | Examination |
| 12. | Behavioral Skills | Examination, Assignment |
| 13. | Information Management | Course Work |
| 14. | Personal Management | Examination, Assignment |
| 15. | Leadership Skills | Course Work |

**9. Course Resources**

**a. Essential Reading**

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3. Class Notes
2. Alessandro, B. (2011). Radio Communications.
3. Ian Poole. (1998). Basic radio: principles and technology. Newnes.

**b. Recommended Reading**

1. Blaunstein, N., & Plohotniuc, E. (2008). Ionosphere and applied aspects of radio communication and radar. CRC Press.
2. Basic Amateur Radio Course, (2009), Toronto Emergency Communication (EmComm) Group
3. Morecroft, J. H., Pinto, A., & Curry, W. A. (2015). Principles of radio communication. John

Wiley & sons, Incorporated.

**c. Magazines and Journals**

1. *Spectrum*, IEEE
2. *Elektor*

**d. Websites**

1. http://fcmcvlab.iitkgp.ac.in/
2. http://vlab.co.in/ba_nptel_labs.php?id=1
3. http://iitg.vlab.co.in/?sub=59&brch=163&sim=261&cnt=474

**e. Other Electronic Resources**

1. Demo kits

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**Course Specifications: Project Work-2**

| | |
|---|---|
| **Course Title** | Project Work -2 |
| **Course Code** | ECP402A |
| **Course Type** | Project |
| **Department** | Electronics and Communication Engineering |
| **Faculty** | Engineering and Technology |

## 1. Course Summary

The aim of this course is to give students an experience of identifying an engineering problem, conceptualize a solution, perform basic design calculations, model, solve, analyse and develop a working model (preferably physical) and evaluate its performance and demonstrate its working. The students are expected to work in a team of not more than 4 members and are required to develop an appropriate solution by identifying a problem for which a better or new engineering solution is required. The team need to demonstrate the working of the solution and write a project report. Students are required to choose a project from student projects database available.

## 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 12 |
| **Credit Structure (Lecture: Tutorial: Practical)** | 0:0:12 |
| **Total Hours of Interaction** | 240 |
| **Number of Weeks in a Semester** | 15 |
| **Department Responsible** | Electronics and Communication Engineering |
| **Total Course Marks** | 100 |
| **Pass Criterion** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

## 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Recognize the need for developing a new or improving an existing engineering product/system through an organized survey of literature
**CO-2.** Define engineering design specifications
**CO-3.** Design, model, solve, analyse the product/system to meet the design specifications
**CO-4.** Evaluate the performance of the modelled system and justify its performance
**CO-5.** Demonstrate the system working in a virtual environment and make a presentation
**CO-6.** Write a project report

## 4. Course Contents

**Unit 1:** Collection of relevant literature and review of literature

**Unit 2:** Interaction with the users and collection of data

**Unit 3:** Data analysis, formulation of a problem of suitable size

**Unit 4:** Product development planning, cost calculations

**Unit 5:** Detail design calculations

**Unit 6:** Choosing a modeling environment, learning the appropriate tools and techniques

**Unit 7:** Modelling, simulation and analysis of design

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**Unit 8:** Defining performance parameters, evaluation of performance, presentation performance characteristics, verification of results

**Unit 9:** Developing a working model, testing the model and evaluating its performance, demonstration to the defined audience and making a presentation to the assessing team making a technical presentation

**Unit 10**: Writing project report

## 5. Course Map (CO-PO-PSO Map)

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | 3 | 3 | 2 | 3 | 2 | 1 | 2 | 3 | | 1 | 3 | 3 | 3 | 3 |
| CO-2 | 3 | 3 | 2 | | | | 1 | 2 | 3 | | 1 | 3 | 3 | 2 | 3 |
| CO-3 | 2 | 1 | 3 | 2 | 2 | 2 | | 2 | 3 | | 1 | 3 | 3 | 2 | 3 |
| CO-4 | 2 | | 2 | | 2 | 2 | | | 3 | | | 3 | 2 | 2 | 3 |
| CO-5 | 1 | 1 | 1 | | 2 | 2 | | | 3 | 3 | | 3 | 1 | 2 | 3 |
| CO-6 | 1 | | | | | | | 2 | 3 | 3 | | 3 | 1 | | 3 |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | | |

## 6. Course Teaching and Learning Methods

| Teaching and Learning Methods | Approximate Duration in Hours |
|---|---|
| Literature collection, Review of literature, Deciding the sample, For data collection, Developing a questionnaire, Data collection, Analysis of data, Problem formulation and Defining specifications | 50 |
| Development of design concept, Basic design calculations | 50 |
| Selection of tools, techniques and learning on how to use them | 50 |
| Modelling, Simulation, Analysis | 50 |
| Evaluation, Verification of results | 40 |
| Demonstration, Presentation and Technical Report Writing | 20 |
| Total Duration in Hours | 260 |

## 7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B.Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2, SC3 ), COs are assessed as illustrated in the following Table.

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| Focus of COs on each Component or Subcomponent of Evaluation | | |
|---|---|---|
| | Component 1: Presentation (50% Weightage) | Component 2: Report (50% Weightage) |
| Maximum Marks ▸ | 150 | 150 |
| CO-1 | X | X |
| CO-2 | X | X |
| CO-3 | X | X |
| CO-4 | X | X |
| CO-5 | X | |
| CO-6 | | X |
| The details of SC1, SC2, SC3 are presented in the Programme Specifications Document. | | |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

**8. Achieving COs**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Project Work |
| 2. | Understanding | Project Work |
| 3. | Critical Skills | Project Work |
| 4. | Analytical Skills | Project Work |
| 5. | Problem Solving Skills | Project Work |
| 6. | Practical Skills | Project Work |
| 7. | Group Work | Project Work |
| 8. | Self-Learning | Project Work |
| 9. | Written Communication Skills | Project Work |
| 10. | Verbal Communication Skills | Project Presentation, Viva-Voice |
| 11. | Presentation Skills | Project Presentation |
| 12. | Behavioral Skills | Project Work |
| 13. | Information Management | Project Report |
| 14. | Personal Management | Project Work |
| 15. | Leadership Skills | Project Work |

**9. Course Resources**

**a. Essential Reading**

1. Presentations made by the Head of the Department on "Importance of Projectwork and The Methodology to be followed for successful Completion of Project work"

**b. Recommended Reading**

1. Course Notes, Manuals of Tools and Techniques Chosen to Solve the Design Problem

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