# Pt. Ravishankar Shukla University, Raipur

**CURRICULUM & SYLLABUS**

**(Based on CBCS & LOCF)**

# M.Sc. in Electronics

**(Program code: 0307)**

**Semester System**

**Session: 2024-25 & onwards**

| Approved by: | Board of Studies in Electronics | Academic Council |
|---|---|---|
| Date: | | |



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## M.Sc. Electronics

The Master of Science in Electronics program is a two-year, four semester programs designed to provide depth knowledge of the subject starting from its basic concepts to the state of art technologies in use today. Students are also provided extensive laboratory training on the course content and the current requirements of industries and R and D. In the final semester every student has to undertake a project. Moreover, the course structure intends to inculcate strong laboratory skills so that the student can take up independent projects which will help to be an entrepreneur. The students passed out from the revised course will serve as quality human resource to take up the state of art research work of the Department. This course provides exposure to the students to the technologies in-vogue and trains them to take up projects relevant to the industrial needs, the R&D activities and self-employment opportunities. Advanced papers are offered to the students in the areas of Communications, Photonics, Nano and Opto-Electronic Devices, Laser Technology Digital Signal Processing, Embedded Systems, Power Electronics and Microcontrollers. In addition, the course caters to the requirements of providing complete exposure to NET/SET syllabus for Electronics formed by the U.G.C. The student after passing the M.Sc. course has many opportunities of employment, self-employment and higher studies. Department of Higher Education, Government of Chhattisgarh has declared Electronics as allied subject of Physics for recruitment of Assistant Professor in colleges. The students may opt for UGC AICTE approved MTech. in Optoelectronics & Laser Technology in the department after M.Sc.



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## Program Outcomes (POs):

Upon successful completion of the Master of Science in Electronics program, student will be able to:

| | |
|---|---|
| **PO1:** | **Fundamentals:** Apply knowledge of mathematics, basic science and electronics science. |
| **PO2:** | **Problem analysis:** Identify, formulate and solve real time problems using principles and scientific methods. |
| **PO3:** | **Design:** Design electronics devices useful for public health, safety, cultural, societal and environmental considerations |
| **PO4:** | **Investigation:** Investigate complex problems by analysis and interpreting the data to synthesize valid solution. |
| **PO5:** | **Environment:** Understand the importance of the environment for sustainable development. |
| **PO6:** | **Ethics:** Apply ethical principles and commit to professional ethics, and responsibilities. |
| **PO7:** | **Teamwork:** Function effectively as an individual and as a member or leader in diverse teams and multidisciplinary settings. |
| **PO8:** | **Effective Communication:** Communicate complex Electronics technical ideas and result effectively to both technical and non- technical audience, through written reports, presentation and teaching. |
| **PO9:** | **Management:** Manage projects in multidisciplinary environments as member or a team leader. |
| **PO10:** | **Life-long learning:** Engage in independent lifelong learning in the broadest context of technological change. |
| **PO11:** | **Further Education or Employment:** Engage for further academic pursuits, including Ph.D. programs in Electronics or related fields. Get employment in academia, research institutions, industry, government and other sector. |
| **PO12:** | **Global Perspective:** Recognize the global nature of Electronics research and its impact, appreciating divers' cultural perspective in technical practices. |



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## Program Specific Outcomes (PSOs):

At the end of the program, the student will be able to:

| | |
|---|---|
| **PSO1** | Ability to design and conduct electronics experiments, as well as to analyze and interpret data |
| **PSO2** | Ability to design and manage electronic systems or processes that conforms to a given specification within ethical and economic constraints |
| **PSO3** | Ability to identify, formulate, solve and analyze the problems in various disciplines of electronics |
| **PSO4** | Ability to use techniques, skills and modern technological/scientific/engineering software/tools for professional practices |
| **PSO5** | Skill development by undertaking supervised projects by students with a flexibility to balance between research and application-oriented work that require innovative approaches. |
| **PSO6** | Quality national level tests like NET/GATE etc. |

## M.Sc. ELECTRONICS

| Specification of Courses | Semester | No. of Courses | Credits |
|---|---|---|---|
| Core | I-IV | 17 | 68 |
| Elective | I-IV | 04 | 20 |
| Project work (Core) | IV | 01 | 10 |
| Internship (Core) | III | 01 | 02 |
| Total | I-IV | 23 | 100 |
| **Additional Courses** (Qualifying in nature, for students admitted in School of Studies only) | | | |
| Generic Elective | II, III | 2 | 4 |
| Skill Enhancement (Value Added Course) | IV | 1 | 2 |
| Indian Knowledge System (IKS) | I | 1 | 2 |



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# M.Sc. ELECTRONICS

## PROGRAMME STRUCTURE

| Semester | Course Nature | Course Code | Course Title | Course Type (T/P) | Hrs/ Week | Credits | Marks | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | CIA | ESE | Total |
| Semester I | Core | ELT101 | Analog Integrated Electronics and Physics of Electronic Materials | T | 5 | 5 | 30 | 70 | 100 |
| | Core | ELT102 | Digital Design and Applications | T | 5 | 5 | 30 | 70 | 100 |
| | Core | ELT103 | Signals, Mathematical and computational Methods in Electronics | T | 5 | 5 | 30 | 70 | 100 |
| | Elective 1 (Select any one) | ELT104 | Optical, Quantum and Organic Electronics | T | 5 | 5 | 30 | 70 | 100 |
| | | ELT105 | Electronic Measurements and Instrumentation | T | 5 | 5 | 30 | 70 | 100 |
| | Core | ELT106 | Advanced Analog Electronics lab | P | 4 | 2 | 30 | 70 | 100 |
| | Core | ELT107 | Advanced Digital Electronics lab | P | 4 | 2 | 30 | 70 | 100 |
| Semester II | Core | ELT201 | Network Analysis and Synthesis | T | 5 | 5 | 30 | 70 | 100 |
| | Core | ELT202 | Advance Microprocessor, Microcontroller and Python Programming | T | 5 | 5 | 30 | 70 | 100 |
| | Core | ELT203 | Analog and digital Communication systems | T | 5 | 5 | 30 | 70 | 100 |
| | Elective 2 (Select any one) | ELT204 | Electromagnetic Plane wave, Transmission lines and Microwave Devices | T | 5 | 5 | 30 | 70 | 100 |
| | | ELT205 | Electronic System Design | T | 5 | 5 | 30 | 70 | 100 |
| | Core | ELT206 | Advanced Communications Lab | P | 4 | 2 | 30 | 70 | 100 |
| | Core | ELT207 | Microprocessor And Python Programming Lab | P | 6 | 3 | 30 | 70 | 100 |



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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Semester III | Core | ELT301 | Embedded Systems and Advanced Instrumentation | T | 5 | 5 | 30 | 70 | 100 |
| | Core | ELT302 | Data Communication, Mobile and Wireless Communication | T | 5 | 5 | 30 | 70 | 100 |
| | Core | ELT303 | Power Electronics, Information theory and Coding | T | 5 | 5 | 30 | 70 | 100 |
| | Elective 3 (Select any one) | ELT304 | Photonics | T | 5 | 5 | 30 | 70 | 100 |
| | | ELT305 | Quantum Optics | T | 5 | 5 | 30 | 70 | 100 |
| | Core | ELT306 | Optical Communication and Instrumentation Lab | P | 4 | 2 | 30 | 70 | 100 |
| | Core | ELT307 | Embedded System Programming Lab | P | 4 | 2 | 30 | 70 | 100 |
| | Core | ELT308 | Internship (Two Weeks) | P | 60 (in two weeks) | 2 | 30 Seminar Presentation | 70 Evaluation | 100 |
| Semester IV | Core | ELT401 | Digital Signal Processing | T | 5 | 5 | 30 | 70 | 100 |
| | Core | ELT402 | Optical and Satellite Communication | T | 5 | 5 | 30 | 70 | 100 |
| | Elective 4 (Select any one) | ELT403 | Automatic Control System and Artificial Neural Network | T | 5 | 5 | 30 | 70 | 100 |
| | | ELT404 | Sensors & Actuators | T | 5 | 5 | 30 | 70 | 100 |
| | Core | ELT405 | Project Work & Seminar | P | 18 | 10 | 60 | 140 | 200 |

**Notes:**

1. In place of Elective Course student can choose paper(s) from MOOC Courses (Swayam Portal) subjects to the following conditions:

   a. The chosen paper will be other than the papers offered in the current course structure

   b. The paper will be the PG level with a minimum of 12 weeks duration

   c. The list of courses on Swayam keeps changing, the departmental committee will finalize the list of MOOC courses for each semester.

   d. The paper(s) may be chosen from Swayam Portal on the recommendation of Head of the Department



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2. The candidates who have joined the PG Programme in School of Studies (University Teaching Departments), shall undergo Generic Elective Courses (only qualifying in nature) offered by other departments/ SoS in Semester II and Semester III.

3. The candidates who have joined the PG Programme in School of Studies (University Teaching Departments), shall undergo Skill Enhancement Course/Value Added Course (only qualifying in nature) in Semester IV.

4. The candidates who have joined the PG Programme in School of Studies in Electronics and Photonics, shall undergo Indian Knowledge System (only qualifying in nature) in Semester I.

5. **(a)** Two weeks Internship would be compulsory for PG students during their III semester (only qualifying in nature). Nature of Internship would be in-house (Inter-departmental/ Intra-departmental) or out of the house (Industry/Reputed academic Institution/Reputed Research labs in India)

   **(b)** Evaluation Process: Evaluation Process will be done by the parent department only. Students should submit their Internship certificate along with report.

   **(c)** Report format: Report should be comprised of Introduction, Literature Survey, Materials & Methods, Results, Conclusions, Future scope and References. The no. of pages in the report should be in between 40 to 50 pages.

6. 1 Credit = 15 hrs (Theory), 1 Credit = 30 hrs (Practical)

**Generic Elective Courses:** (Offered to PG students of other Departments/SoS only)

| Semester | Course Code | Course Title | Course Type (T/P) | Hrs/ Week | Credits | Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | CIA | ESE | Total |
| II | ELT501 | Basics of Electronics | T | 2 | 2 | 30 | 70 | 100 |
| III | ELT502 | Fundamentals of Biomedical Equipment | T | 2 | 2 | 30 | 70 | 100 |

**Skill Enhancement/Value Added Courses:** (Offered to the PG students of SoS in Electronics & Photonics)

| Semester | Course Code | Course Title | Course Type (T/P) | Hrs/ Week | Credits | Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | CIA | ESE | Total |
| IV | ELT601 | Basics of Machine Learning Programming | P | 2 | 2 | 30 | 70 | 100 |



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**Indian knowledge System (IKS):** (Offered to the PG students of SoS in Electronics & Photonics)

| Semester | Course Code | Course Title | Course Type (T/P) | Hrs/ Week | Credits | Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | CIA | ESE | Total |
| I | ELT701 | IKS: It's relevance to Electronics & Photonics | T | 2 | 2 | 30 | 70 | 100 |



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## Programme Articulation Matrix:

Following matrix depicts the correlation between all the courses of the programme and Programme Outcomes ✓ ×

| Course Code | POs | | | | | | | | | | | | PSOs | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 |
| ELT101 | ✓ | ✓ | ✓ | ✓ | ✓ | x | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ELT102 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ELT103 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ELT104 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ELT105 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ELP106 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ELT107 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ELT201 | ✓ | ✓ | ✓ | ✓ | x | x | x | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ELT202 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ELT203 | ✓ | ✓ | ✓ | ✓ | x | x | x | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ELT204 | ✓ | ✓ | ✓ | ✓ | ✓ | x | x | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ELT205 | ✓ | ✓ | ✓ | ✓ | ✓ | x | x | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ELT206 | ✓ | ✓ | ✓ | ✓ | x | x | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ELT207 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ELT301 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | x | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ELT302 | ✓ | ✓ | ✓ | ✓ | ✓ | x | x | ✓ | x | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ELT303 | ✓ | ✓ | ✓ | ✓ | ✓ | x | x | ✓ | x | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ELT304 | ✓ | ✓ | ✓ | ✓ | ✓ | x | x | ✓ | x | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ELT305 | ✓ | ✓ | ✓ | ✓ | ✓ | x | x | ✓ | x | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ELT306 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | x | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ELT307 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |



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| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ELT401 | ✓ | ✓ | ✓ | ✓ | ✓ | x | x | ✓ | x | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ELT402 | ✓ | ✓ | ✓ | ✓ | ✓ | x | x | ✓ | x | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ELT403 | ✓ | ✓ | ✓ | ✓ | ✓ | x | x | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ELT404 | ✓ | ✓ | ✓ | ✓ | ✓ | x | x | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ELP405 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **No. of courses mapping the PO/PSO** | **26** | **26** | **26** | **26** | **23** | **12** | **13** | **26** | **19** | **26** | **26** | **26** | **26** | **26** | **26** | **26** | **26** | **26** |



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**DETAILED SYLLABUS**

# Semester -I



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## M.Sc. (Electronics) Semester-I

| Program | Subject | Year | Semester |
|---|---|---|---|
| MSc | Electronics | 1 | I |
| **Course Code** | **Course Title** | | **Course Type** |
| ELT101 | Analog Integrated Electronics and Physics of Electronic Materials | | Core |
| **Credits** | **Total No. of Lectures- Tutorials - Practical ( in hours per week ):** | | |
| | **L** | **T** | **P** |
| 5 | 5 | 1 | 0 |
| **Maximum Marks** | **CIA** | | **ESE** |
| 100 | 30 | | 70 |

**Learning Objectives (LOs):**

| LO No. | Learning Objective |
|---|---|
| 1 | To provide basic knowledge and concepts of Semiconductor materials and devices. |
| 2 | To comprehend the drift and diffusion mode of electrical transport through semiconductor devices and To understand the basic crystal structure |
| 3 | To develop understanding of Analog Devices, ideal Op Amp model, assessing the practical device and design of non-linear applications. |

**Course Outcomes (COs):**

| CO No. | Expected Course Outcome<br>At the end of the course, the students will be able to: | CL |
|---|---|---|
| 1 | Describe the behavior of semiconductor materials | An,U |
| 2 | Understand and appreciate the synergy between quantum mechanics and semiconductor materials, which will eventually lead to a general framework of concepts applicable across a variety of semiconductor devices | An,U |



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| | | |
|---|---|---|
| 3 | Detailed knowledge of various classifications and applications of Multistage and Feedback Amplifiers | Ap,U |
| 4 | Emphasis on Operational amplifier and its applications such as integrator, differentiator, Multivibrator, Schmitt trigger and Triangular wave generator | An,U |
| 5 | Understand the fundamentals and areas of applications for the Integrated Circuits and analyze important types of integrated circuits of day-to-day requirements | An |

CL: Cognitive Levels (R-Remember; U- Understand; Ap- Apply; An- Analyze; E- Evaluate; C- Create)

**COs-POs/PSOs Mapping for the course:**

| POs / COs | POs | | | | | | | | | | | | PSOs | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 |
| CO-1 | 2 | 1 | 3 | 2 | 1 | - | 2 | 3 | 3 | 1 | 3 | 2 | 2 | 2 | 3 | - | - | 2 |
| CO-2 | 3 | 2 | 3 | 2 | - | - | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | - | 2 | 2 |
| CO-3 | 3 | 3 | 3 | 2 | - | - | 1 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | - | 2 | 3 |
| CO-4 | 3 | 2 | 3 | 2 | - | - | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 3 |
| CO-5 | 3 | 3 | 3 | 2 | 1 | - | 1 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 3 |

"3"- Strong; "2"- Moderate; "1"- Low; "-" No correlation

**Detailed Syllabus:**

| Unit | Topics | No. of Lectures |
|---|---|---|
| 01 | Crystal structures, classification of crystals, lattices, reciprocal lattice, Miller indices, amorphous materials. Lattice Vibration and Phonons, Bloch theorem, Phonons, Nearly Free electron theory. Dielectric properties, electronic polarizability, Clausius Mossotti relation, dielectric Constant static and frequency dependent. Introduction to Fermi Dirac and Bose Einstein Statistics.<br><br>Semiconductors: Direct and indirect band gap methods to determine the Forbidden gap, mobility and conductivity, intrinsic and extrinsic semiconductor, Impurities, carrier concentration, electrical properties of | 15 |



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| | | |
|---|---|---|
| | Ge and Si, experimental methods to study the electrical parameters, Drift and Diffusion, Hall effect, electrons and phonons in semiconductors. | |
| 02 | Uncertainty principle, Experiments on duality, Schrodinger's equation and its applications to square well potential, square potential barrier (1D), Infinite array of potential wells, Kronig-Penny model, Barrier penetration, applications to tunnel diode, Josephson effect, Perturbation theory and its applications, Scattering.<br><br>Transistor at low frequency - Analysis of a transistor amplifier circuit using h- parameter, Emitter follower, comparison of transistor amplifier configurations, Millers Theorem and its dual, cascading transistor amplifiers, High Electron Mobility Transistor (HEMT). Basics of Transistor biasing and stabilization | 15 |
| 03 | Transistor at high frequencies, Hybrid – pi model, gain bandwidth product. Multistage Amplifiers Analysis - Introduction, frequency response of an amplifier, band pass of cascaded stages, Coupling scheme - RC coupled, transformer coupled and direct coupled amplifiers, low frequency response of RC coupled stage, effect of emitter bypass capacitor on low frequency response, high frequency response of two cascaded CE transistor stages. Feedback Amplifiers Basic concept, types of feedback method of analysis of a feedback amplifier. | 15 |
| 04 | Basic operational amplifier and its characteristics, characteristics of ideal and practical operation amplifier, parameters of operational amplifier, measurement of operational amplifier parameters, frequency response of operational amplifier, Linear and Nonlinear Circuits analysis using operational amplifier - Inverting and Non inverting Amplifiers, Differentiator, Integrator, Voltage to current converter, Instrumentation amplifier, Sine wave Oscillator, Low pass and band pass filters, Comparator, Multivibrator and Schmitt trigger, Triangular wave generator, Log and Antilog amplifiers | 15 |
| 05 | IC fabrication crystal growth, epitaxy, oxidation, lithography, doping, etching, isolation methods, metallization, bonding, MOS technology and VLSI, scaling of MOS devices, NMOS and CMOS structures and fabrication, Characteristics of MOS transistors and threshold voltage, NMOS and CMOS inverters, Charge-Coupled Device (CCD) structure, charge storage and transfer, Basics of VLSI design, stick diagrams, Layout design rules. | 15 |
| | | |



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**Suggested Study material:**


1. Physics of Electronic Materials: Principles and Applications Jørgen Rammer Cambridge University Press,
2. Electronic Devices and Circuit Theory, 9th ed. Boylestad & Nashelsky PHI
3. Microelectronics - Jacob Millman, Arvin Grabel, Tata Macgraw- Hill
4. Physics of Semiconductor Devices: Shur PHI
5. A Textbook of Applied Electronics (M.E.) Sedha R S, S. Chand Pub.
6. Physics of Semiconductor Devices: Sze
7. Ramakant A.Gayakwad, 'OP-AMP and Linear IC's', Prentice Hall
8. Introduction to Quantum Mechanics J. Griffiths David Pearson
9. Quantum Mechanics Statistical Mechanics & Solid State Chattopadhyay D. and Rakshit P.C. S Chand & Company
10. Integrated electronics – Analog and digital circuits and systems Jacob Millman, Cristos, C. Halkias, Tata Macgraw- Hill




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## M.Sc. (Electronics) Semester-I

| Program | Subject | Year | Semester |
|---|---|---|---|
| MSc | Electronics | 1 | I |
| **Course Code** | **Course Title** | | **Course Type** |
| ELT102 | Digital Design and Application | | Core |
| **Credits** | **Total No. of Lectures- Tutorials - Practical ( in hours per week ):** | | |
| | **L** | **T** | **P** |
| 5 | 5 | 1 | 0 |
| **Maximum Marks** | **CIA** | | **ESE** |
| 100 | 30 | | 70 |

**Learning Objectives (LOs):**

| LO No. | Learning Objective |
|---|---|
| 1 | To develop a digital logic and apply it to solve real life problems. |
| 2 | Analyze, design and implement combinational and sequential logic circuits. |
| 3 | To develop understanding of Analog Devices, ideal Op Amp model, assessing the practical device and design of non-linear applications. |

**Course Outcomes (COs):**

| CO No. | Expected Course Outcome<br>At the end of the course, the students will be able to: | CL |
|---|---|---|
| 1 | Develop a digital logic and apply it to solve real life problems | An,U |
| 2 | Analyze, design and implement combinational and sequential logic circuits | An,U |
| 3 | To understand the limitations and difficulties in modern digital design, including wiring constraints, high-speed, etc | U,Ap |



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| | | |
|---|---|---|
| 4 | Able to design and analyze the shift registers, counters and A/D & D/A converters, digital semiconductor memories and programmable logic devices | Ap,An |
| 5 | To learn techniques and tools for programmable logic design. Through the practical assignments, experience will be achieved from both using tools as well as designing their own system | U,An |

CL: Cognitive Levels (R-Remember; U- Understand; Ap- Apply; An- Analyze; E- Evaluate; C- Create)

**COs-POs/PSOs Mapping for the course:**

| POs / COs | POs | | | | | | | | | | | | PSOs | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 |
| CO-1 | 2 | 3 | 2 | 2 | 2 | - | 2 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 3 |
| CO-2 | 2 | 2 | 3 | 2 | - | - | - | 3 | 2 | 3 | 3 | 3 | 2 | - | 1 | 2 | 1 | 3 |
| CO-3 | 2 | 2 | 3 | 2 | - | - | - | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 |
| CO-4 | 2 | 2 | 2 | 2 | - | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 3 |
| CO-5 | 2 | 3 | 2 | 2 | - | 1 | - | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 |

"3"- Strong; "2"- Moderate; "1"- Low; "-" No correlation

**Detailed Syllabus:**

| Unit | Topics | No. of Lectures |
|---|---|---|
| 01 | Introduction of basic gates, universal gates, number systems and codes, Boolean algebra, switching characteristics of semiconductor devices, logic gate characteristics - speed of operation, power dissipation , figure of merit, fan in, fan out, noise margin. Logic families -RTL, DTL, TTL, ECL interfacing, ECL and TTL, MOS logic - MOSFET NAND and NOR gates, CMOS inverters, CMOS - NAND and NOR gates, interfacing CMOS and TTL, inter facing CMOS and ECL, comparison of logic families. | 15 |
| 02 | Simplification of Boolean algebra using K- map, minterm and maxterm, design of binary adder, subtractor , digital comparator, parity generator/checkers, priority encoder, BCD to 7 - segments decoder, multiplexer , multiplexer tree, demultiplexer and demultiplexer tree. | 15 |



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| | | |
|---|---|---|
| 03 | Excitation table of flip flops S - R, J-K, Master-Slave – JK, D and T flip-flops, clocked flip flop design conversion of one form of flip flop to another type. Analysis of clocked sequential circuits - State equation, state table, state diagram, state input equations, analysis with - flip flops, JK flip flops and T flip flops. State reduction and assignment, design procedure – synthesis using D flip flops, JK Flip flops and T flip flops. | 15 |
| 04 | Registers - Shift registers, application of shift registers, serial to parallel converter, parallel to serial converter. Counters - Ring counter, modulo-n- counter, synchronous counter –ripple counter (binary, BCD) and up-down counter, asynchronous counters - ripple counter (binary , BCD) and up-down counter. Other counters – counter with unused states, ring counter, Johnson counter. A/D, D/A Converters – D/A weighted register type, R/2R ladder type, D/A converter specifications, A/D converters - successive approximation type, parallel comparator, dual slop ADC using voltage to frequency conversion and frequency to time conversion. | 15 |
| 05 | General Memory Operation; CPU-Memory Connections; ROM: Architecture, Timing, Types: MROM PROM, EPROM, EEPROM, Flash Memory; RAM: Architecture & Operation of SRAM, DRAM; Memory Expansion; Introduction to Programmable Logic Devices (PLDs): PLA, PAL, GAL, CPLD, FPGA. Analysis and Design of digital circuits using HDL. | 15 |

**Suggested Study material:**


1. T. L. Floyd & R. P. Jain, Digital fundamentals, Pearson Education India, New Delhi.
2. M. Moris Mano, Digital Design, PHI Learning Pvt. Ltd. New Delhi.
3. A. P. Malvino & D. P. Leach, Digital Principals and Applications, Tata McGraw Hill, New Delhi.
4. A. P. Malvino & J. A. Brown, Digital Computer Electronics, Tata McGraw Hill, New Delhi.
5. A. Anand Kumar, Fundamentals of Digital Circuits, PHI Pvt. Ltd. New Delhi.
6. R. J. Tocci & N. S. Widmer, Digital Systems, Pearson Education India, New Delhi.
7. John. M. Yarbough, Digital Logic: Applications and Design, Thomson Brooks/Cole, Boston.
8. John F. Wakerly, Digital Design Principles and Practices, Pearson Education India, New Delhi.
9. M. Moris Mano, Computer System Architecture, PHI Pvt. Ltd. New Delhi.




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## M.Sc. (Electronics) Semester-I

| Program | Subject | Year | Semester |
|---|---|---|---|
| MSc | Electronics | 1 | I |
| **Course Code** | **Course Title** | | **Course Type** |
| ELT103 | Signals, Mathematical and Computational Methods in Electronics | | Core |
| **Credits** | **Total No. of Lectures- Tutorials - Practical ( in hours per week ):** | | |
| | **L** | **T** | **P** |
| 5 | 5 | 1 | 0 |
| **Maximum Marks** | **CIA** | | **ESE** |
| 100 | 30 | | 70 |

**Learning Objectives (LOs):**

| LO No. | Learning Objective |
|---|---|
| 1 | To improve and summarized the Signals, mathematical and computational techniques among the students |
| 2 | To familiarize the students with the classification of continuous time signals and systems and their analysis |
| 3 | To enable the students to understand the concepts of Fourier series and Fourier transform probability theory, and state variable approach |
| 4 | To introduce mathematical and computational methods used in Electronics |

**Course Outcomes (COs):**

| CO No. | Expected Course Outcome<br>At the end of the course, the students will be able to: | CL |
|---|---|---|
| 1 | Use mathematics as a tool for solving/modeling systems in electronics | Ap |



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| | | |
|---|---|---|
| 2 | Understand about various types of signals and systems, classify them, analyze them, and perform various operations on them | An,U |
| 3 | Understand use of transforms in analysis of signals and system in continuous and discrete time domain | An,U |
| 4 | Understand basic concept of probability theory; differentiate between discrete and continuous random variables, Random and Markov processes | An,U |
| 5 | Able to solve ordinary differential equations using Laplace Transform, special function and numerical methods; numerical differentiation and integration | An,Ap |
| 6 | Understand different techniques for simulation & modeling of electronic circuits | U,Ap |

CL: Cognitive Levels (R-Remember; U- Understand; Ap- Apply; An- Analyze; E- Evaluate; C- Create)

**COs-POs/PSOs Mapping for the course:**

| POs / COs | POs | | | | | | | | | | | | PSOs | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 |
| CO-1 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 1 | 3 | 3 |
| CO-2 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 3 |
| CO-3 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 3 |
| CO-4 | 3 | 3 | - | 3 | 2 | 2 | - | 3 | 2 | 2 | 2 | 2 | - | - | 2 | 2 | 3 | 3 |
| CO-5 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 3 |
| CO-6 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 3 |

"3"- Strong; "2"- Moderate; "1"- Low; "-" No correlation

**Detailed Syllabus:**

| Unit | Topics | No. of Lectures |
|---|---|---|
| 01 | Introduction – Classification of signals and systems, some ideal signals, energy signal, Power signals, energy and power spectral densities. Fourier | 15 |

| | | |
|---|---|---|
| | Series, Complex Fourier Spectrum, The Fourier Transform, Continuous Spectrum, Fourier Transform involving Impulse Function, Properties of Fourier Transform, Fourier Transform of Periodic Functions, Convolution, Sampling Theorem. | |
| **02** | Introduction, System Function (Transfer Function), Distortion less Transmission, Paley- Wiener criterion, Correlation, Autocorrelation State Variables· Techniques - State variable concepts, form of the state equations, time domain and frequency domain solution of state equations, state transition matrix, state equations for networks, state equations from transfer functions. | **15** |
| **03** | Introduction, set theory, Introduction to Probability, Conditional Probability Statistical Impedance, Bayes Theorem, Random variables, Discrete and Continuous Random Variables, Joint Distributions, Characteristics of Random Variables, Binomial, Poisson and normal Distributions, Uniform and other Distributions, Random and Markov Processes. | **15** |
| **04** | Laplace Transform – Definition, transform of elementary function, properties of Laplace transform, convolution theorem, application to differential equation, simultaneous Linear equations with constant coefficients, unit step and unit impulse function Special Function - Bessel equations, recurrence formula, expansion for Jo and J1, values of J1/2, generating function for Jn(x), equation reducible to Bessel equation | **15** |
| **05** | Numerical Differentiation and Integration Finite Differences, Derivatives using Forward, Backward and Central Difference Formulae, Newton-Cote's Quadrature formula, Trapezoidal rule, Simpson's rules, Weddle's rule. Numerical methods for Solution of Ordinary Differential Equation-Picards Method, Taylor Series Method , Eulers and Modified Eulers methods, Runge and Runge Kutta Methods , Newton- Raphson Method, Gauss Elimination Method Predictor and Corrector Method | **15** |

**Suggested Study material:**


1. Communication System- Analog and Digital - R.P.Singh & S.D. Sapre TMH.
2. Signal and System - Nagrath, Sharan and Ranjan. Mcgraw hill Publishing
3. Signal and Systems - Rodger E. Ziemer. Continuous and Discrete 2nd ed.Maxwell Macmillan Int. Edition,
4. Higher Engineering Mathematics - B.S. Grewal, Khanna Publications
5. Numerical Methods - Kandaswami,Thilagavathi and Gunavathi, S.Chand & Co.
6. An introduction to Numerical methods: A MATLAB approach by Abde/Wahab Kharab, Ronald B Guenther




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## M.Sc. (Electronics) Semester-I

| Program | Subject | Year | Semester |
|---|---|---|---|
| MSc | Electronics | 1 | I |
| **Course Code** | **Course Title** | | **Course Type** |
| ELT104 | Optical, Quantum and Organic Electronics | | Elective |
| **Credits** | **Total No. of Lectures- Tutorials - Practical ( in hours per week ):** | | |
| | **L** | **T** | **P** |
| 5 | 5 | 1 | 0 |
| **Maximum Marks** | **CIA** | | **ESE** |
| 100 | 30 | | 70 |

**Learning Objectives (LOs):**

| LO No. | Learning Objectives |
|---|---|
| 1 | Introduction: how light is generated, outline and need for the laser, scope of course.<br>Interaction of EM Radiation with Matter: two-level system, spectral line-shapes, finite lifetime, Doppler effects, absorption and decay processes, spontaneous and stimulated emission |
| 2 | Amplification Criteria: amplification conditions, Lorentzian line-shapes, Gaussian line-shapes, simple cavity model, laser use of Fabry-Perot, laser gain conditions, laser modes, homogeneous broadening, inhomogeneous broadening, control of modes, examples of lasers |
| 3 | To study light sources, photo-detectors, and organic materials. Laser namely Ruby Laser, He-Ne laser, Ar-ion laser, Co2 laser, Solid State Laser, and Nd-YAG laser |
| 4 | To introduce Plasma, LED and LCD devices and to get acquainted with the Electro-Optic Effect, Acousto-Optic Effect, and Magneto-Optic Effect |



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**Course Outcomes (COs):**

| CO No. | Expected Course Outcome<br>At the end of the course, the students will be able to: | CL |
|---|---|---|
| 1 | To demonstrate understand and be able to solve problems on absorption and spontaneous and stimulated emission in two level system, the effects of homogeneous and inhomogeneous line broadening, and the conditions for laser amplification | An |
| 2 | To understand operations and basic properties of the most common laser types, He-Ne, Argon-ion, and carbon-dioxide, ruby, titanium sapphire, neodymium YAG and glass, knowledge of other main laser types | An,U |
| 3 | Develop the ability to understand the working principle of display devices | U,Ap |
| 4 | Comprehend and analyze the light sources and detectors | U,An |
| 5 | To understand various types of effects on light such as the Electro-Optic Effect, Acousto-Optic Effect, and Magneto-Optic Effect | U,An |

CL: Cognitive Levels (R-Remember; U- Understand; Ap- Apply; An- Analyze; E- Evaluate; C- Create)

**COs-POs/PSOs Mapping for the course:**

| POs / COs | POs | | | | | | | | | | | | PSOs | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 |
| CO-1 | 3 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | - | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |
| CO-2 | 3 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | - | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |
| CO-3 | 3 | 3 | 3 | - | 3 | 3 | - | 3 | 3 | 2 | 3 | 3 | 3 | 2 | - | 1 | 2 | 3 |
| CO-4 | 3 | 3 | 3 | - | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | - | - | - | 2 |
| CO-5 | 3 | 3 | 3 | - | 3 | 3 | 1 | 2 | 1 | 3 | 2 | 2 | 2 | 2 | - | - | - | 2 |

"3"- Strong; "2"- Moderate; "1"- Low; "-" No correlation



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**Detailed Syllabus:**

| Unit | Topics | No. of Lectures |
|---|---|---|
| 01 | Coherent light sources, basic principle of lasers, laser pumping, stimulated emission, light amplification, threshold condition, Einstein's coefficient, laser rate equations for two, three and four level laser systems, variation of power around threshold, rectangular cavity, open plane resonator, mode locking and Q- switching of lasers. | 15 |
| 02 | Types of Lasers - Ruby Laser, He- Ne laser, Ar- ion laser, Co2 laser, Solid State Laser: Host material and its characteristics, doped ions Nd:YAG laser, Liquid laser: Dye laser, Semiconductor laser Laser Applications - Laser in manufacturing, laser cutting of material, laser marking, laser transmitter, measurement of distance through Laser | 15 |
| 03 | Optical Display Devices - LED- Basic principle of operation, radiative recombination process, the spectrum of recombination process, the internal quantum efficiency, double hetrostructure, response time of LED, carrier configuration and modulation bandwidth, edge emitting LED, LED design. Liquid Crystal Display - construction, basic principle of emission, Plasma Display- construction, basic principle of emission | 15 |
| 04 | Photodiodes- General Principles, quantum efficiency, silicon P- N photodiodes, hetrojunction photodiodes, Schottkey barrier diode, P- I- N photodiodes, avalanche photodiodes, and phototransistors. Introduction to Organic Electronics, Organic versus Inorganic solids, Molecular materials, Organic Semiconductors, Electronic states in conjugated molecules, Conjugated polymers, Basics of OLED | 15 |
| 05 | Nonlinear Optics: Origin of nonlinearity, susceptibility tensor, phase matching, second harmonic generation, methods of enhancement, frequency mixing processes, nonlinear optical materials. Electro- Optic Effect - Kerr effect, Pockels effect, Farady effect, Electro- Optic Modulator- Electro- optic phase modulator, electro- optic amplitude modulator, kerr modulator Acousto- Optic Effect - Raman- Nath and Bragg Diffraction, Raman- Nath acousto optic Modulator, bragg modulator, acousto- optic modulator. Magneto- Optic Effect - Faradays effect, magneto- optic modulator | 15 |

**Suggested Study material:**


1. Optical Electronics - Ghatak Thyagarajan, University Press
2. Optoelectronics - An Introduction - J.Wilson and J.F.B. Hawkes, PHI Publication.
3. Semiconductor Optoelectronic Devices, 2nd ed. Bhattacharya PHI




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| | |
|---|---|
| 4. | Pope and Swenburg, Electronic Processes in organic crystals and polymers, 2 nd Ed., Oxford |
| 5. | Optoelectronics & Photonics Principles and Practices S.O. Kasap Pearson |
| 6. | Optical Processes in Solids Mark Fox Oxford Press |
| 7. | Optoelectronics and Optical Fiber Sensors A B Maity PHI |




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## M.Sc. (Electronics) Semester-I

| Program | Subject | Year | Semester |
|---|---|---|---|
| MSc | Electronics | 1 | I |
| **Course Code** | **Course Title** | | **Course Type** |
| ELT105 | Electronics Measurement & Instrumentation | | Elective |
| **Credits** | **Total No. of Lectures- Tutorials - Practical ( in hours per week ):** | | |
| | **L** | **T** | **P** |
| 5 | 5 | 1 | 0 |
| **Maximum Marks** | **CIA** | | **ESE** |
| 100 | 30 | | 70 |

**Learning Objectives (LOs):**

| LO No. | Learning Objectives |
|---|---|
| 1 | To equip the students with rigorous theoretical and practical knowledge to analyze and synthesize networks |
| 2 | To analyze the given electronics circuit/network problems using mesh/ loop methods, network theorems and graph theory |
| 3 | To introduce the basic knowledge of network analysis with initial conditions, magnetically coupled circuits, Waveform synthesis and network transfer functions |
| 4 | To analyze the one port, two-port networks |

**Course Outcomes (COs):**

| CO No. | Expected Course Outcome<br>At the end of the course, the students will be able to: | CL |
|---|---|---|
| 1 | Explain the principle of operation of generalized measurement system and different sources of errors in measurements | An,U |



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| | | |
|---|---|---|
| 2 | Analyze different static and dynamic characteristics of instrument & based on this will able to select particular instrument for measurement | An |
| 3 | Design AC bridges for relevant parameters measurement and application of electronic voltmeter | Ap,An |
| 4 | Classify and select transducer for particular applications | An,U |
| 5 | Demonstrate the use of different types of Display devices, Digital Voltmeter, Recorders and CRO | Ap,An |

CL: Cognitive Levels (R-Remember; U- Understand; Ap- Apply; An- Analyze; E- Evaluate; C- Create)

**CO-POs/PSOs Mapping for the courses:**

| POs / COs | POs | | | | | | | | | | | | PSOs | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 |
| CO-1 | 3 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | - | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |
| CO-2 | 3 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | - | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |
| CO-3 | 3 | 3 | 3 | - | 3 | 3 | - | 3 | 3 | 2 | 3 | 3 | 3 | 2 | - | 1 | 2 | 3 |
| CO-4 | 3 | 3 | 3 | - | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | - | - | - | 2 |
| CO-5 | 3 | 3 | 3 | - | 3 | 3 | 1 | 2 | 1 | 3 | 2 | 2 | 2 | 2 | - | - | - | 2 |

"3"- Strong; "2"- Moderate; "1"- Low; "-" No correlation

**Detailed Syllabus:**

| Unit | Topics | No. of Lectures |
|---|---|---|
| 01 | Measurements and Measurement System: Measurements, Significance, Methods, Instruments and measurement system: Mechanical, Electrical, Electronic instruments, Classification of instruments, Mode of operation, Applications, Characteristics of instrument and measurement system, Elements of a generalized measurement system, Accuracy and precision, Types of error, Probability of error, Limiting error. | 15 |
| 02 | Electromechanical Indicating Instruments: Operating forces, Construction, Torque/weight ratio, Control system, Damping, D'Arsonaval galvanometer, | 15 |



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| | | |
|---|---|---|
| | Response of galvanometer, Ballistic galvanometer, PMMC-construction, Torque equation, Voltage/current measurement: Ammeter, Voltmeter, Ohmmeter, Multimeter (V.O.M.), Q-meter Measurement: | |
| **03** | AC Bridge: Introduction, Sources and detectors, General equation for bridge balance, General form, Maxwell's bridge, Hay's bridge, Anderson's bridge, De-Sauty's bridge, Schering bridge, Wien'sbridge. Electronic Instruments: Introduction, Advantage of electronic voltmeter, VTVM, Differential voltmeter, Electronic voltmeter using rectifier, True RMS reading voltmeter, Calorimeter. | **15** |
| **04** | Instrument: Classification of transducer, Potentiometer, loading effect, Strain Gauge, Thermistor, Thermocouple, LVDT, RVDT, Capacitive Transducer, Piezo-electric transducer, Hall effect Transducer, Capacitive Transducer, Pressure Transducer, Mechanical sensors, fiber-optic sensors, nano-sensors, magnetic field, microwave and radiation sensors. | **15** |
| **05** | Display devices: Digital display method, Segmental display- 7segment & 14 segment display, dot matrix, LED, LCD, TFT, Plasma display, DLP. Digital voltmeter (DVM), Recorders, CRO: Introduction, Oscilloscope block diagram, CRT, Functional block diagram of sampling, Storage, Dual trace and dual beam oscilloscope. | **15** |

**Suggested Study material:**


1. W. D. Cooper & A. D. Helfrick, "Modern Electronic Instrumentation and Measurement Technique", PHI 2000.
2. A Course in Electrical and Electronic Measurements and Instrumentation, A K Sawhney, Dhanpat Rai & Sons, 2010
3. Eric Udd, Fiber Optics Sensors, Wiley Publishers
4. Krishna kumar, Sensors and instruments in Agriculture: Microprocessor based Instrumentation for Agriculture industry, PHI Publication




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## M.Sc. (Electronics) Semester-I

| Program | Subject | Year | Semester |
|---|---|---|---|
| MSc | Electronics | 1 | I |
| **Course Code** | **Course Title** | | **Course Type** |
| ELT106 | Advanced Analog Electronics lab | | Core |
| **Credits** | **Total No. of Lectures- Tutorials - Practical ( in hours per week ):** | | |
| | **L** | **T** | **P** |
| 2 | 0 | 0 | 4 |
| **Maximum Marks** | **CIA** | | **ESE** |
| 100 | 30 | | 70 |

**Learning Objective (LO):**

| LO No. | Learning Objective |
|---|---|
| 1 | To understand the complex analog circuitry through hands-on experimentation. |
| 2 | To develop the ability to design and implement advanced analog circuits using discrete components and integrated circuits. |
| 3 | learn to identify and rectify common issues such as biasing problems, oscillations, and signal distortion, enhancing their ability to work effectively in real-world engineering scenarios. |
| 4 | Students will gain proficiency in using advanced test and measurement equipment such as oscilloscopes, function generators, and spectrum analyzers to characterize analog circuits. |



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**Course Outcomes (COs):**

| CO No. | Expected Course Outcome<br>At the end of the course, the students will be able to: | CL |
|---|---|---|
| 1 | Identify relevant information to supplement to the Analog Electronic Circuits | An,U |
| 2 | Set up testing strategies and select proper instruments to evaluate performance characteristics of electronic circuit | An |
| 3 | Choose testing and experimental procedures on different types of electronic circuit and analyze their operation different operating conditions | An |
| 4 | Evaluate possible causes of discrepancy in practical experimental observations in comparison to theory | E,An |
| 5 | Practice different types of wiring and instruments connections keeping in mind technical, Economical, safety issues | Ap |
| 6 | Prepare professional quality textual and graphical presentations of laboratory data and Computational results, incorporating accepted data analysis and synthesis methods, Mathematical software and word-processing tools | Ap,An |

CL: Cognitive Levels (R-Remember; U- Understand; Ap- Apply; An- Analyze; E- Evaluate; C- Create)

**COs-POs/PSOs Mapping for the course:**

| POs / COs | POs | | | | | | | | | | | | PSOs | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 |
| CO-1 | 3 | 2 | 2 | 2 | - | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 2 |
| CO-2 | 2 | 3 | 3 | 2 | - | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 1 | 3 | 3 | 2 |
| CO-3 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 1 | 3 | 3 | 2 |
| CO-4 | 2 | 3 | 3 | 2 | - | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 2 |
| CO-5 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 1 | 2 | 2 | 2 | 1 | 2 | 3 | 1 | 2 | 3 | 2 |
| CO-6 | 2 | - | 2 | 3 | - | 2 | 2 | 1 | 2 | 2 | 2 | 1 | 2 | 3 | 1 | 2 | 3 | 2 |

"3"- Strong; "2"- Moderate; "1"- Low; "-" No correlation



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**List of experiments:**

| S.N. | Name of Experiments |
|---|---|
| 1. | (a) Study of op-amp characteristics: CMRR and Slew rate |
| | (b) Designing of an amplifier of given gain for an inverting and non-inverting configuration using an op-amp |
| 2. | (a) Designing of analog adder and subtractor circuit |
| | (b) Designing of an integrator using op-amp for a given specification and study its frequency response |
| 3. | Designing of a differentiator using op-amp for a given specification and study its frequency response |
| 4. | (a) Designing of a First Order Low-pass filter using op-amp |
| | (b) Designing of a First Order High-pass filter using op-amp |
| 5. | (a) Designing of a RC Phase Shift Oscillator using op-amp |
| | (b) Study of IC 555 as an astable multivibrator |
| | (c) Study of IC 555 as monostable multivibrator |
| 6. | To study the Astable and Monostable Multivibrator using IC741 |
| 7. | (a) To study the RC Phase Shift Oscillator by determining its frequency of oscillation and compare calculated and observed frequency |
| | (b) To study the Schmitt Trigger using transistor and IC7413 by observing the output Waveform |
| | (c) To study the Colpit Oscillator, determine its frequency of oscillation and compare the Calculated and observed frequency |
| 8. | To study the Negative Feedback Amplifier by measuring closed loop gain and gain bandwidth product |
| 9. | Calculation of barrier height and ideality factor at room temperature (for Si and GaAs devices) from the I-V characteristics |
| 10. | Calculation of diode parameters at varying frequency from the C-V characteristics |
| 11. | (a) Calculation of semiconductor conductivity type and carrier concentration using Hall Effect |
| | (b) Calculation of semiconductor resistivity and band gap using Four-Probe method. |
| | (c) Calculation of carrier mobility and drift velocity using an experimental setup |
| 12. | To study and plot the MOSFET characteristics |
| 13. | Construct a Wein Bridge Oscillator and determine its frequency of oscillation and compare calculated and observed frequency |



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| | |
|---|---|
| **14.** | To study the Clipping and Clamping circuits as positive and negative logic |
| **15.** | To Study the phototransistor characteristics |
| **16.** | To study the comparison of Schmitt trigger and phototransistor |
| **17.** | To study the characteristics of JFET (Junction field effect transistor) in common source configuration & evaluate— 1. AC drain resistance, 2. Amplification factor and 3. Drain Resistance |
| **18.** | To study the operation of Class B Amplifier |
| **19.** | To study the Op – Amp as voltage to current converter |
| **20.** | To study the Active High pass filter and to evaluate:- -<br>Low cutoff frequency, (2) Bandpass gain, and (3) Plot the frequency response (4) Quality factor |
| **21.** | To study, identify and testing the electronic components using Physical and electronic equipment (CRO, Digital Multi Meter) |
| **22.** | (a) To study transfer characteristic and functional verification of a Weighted Resistor D/A Converter |
| | (b) To study transfer characteristic and functional verification of a Integrated D/A Converter |
| | (c) To study transfer characteristic and functional verification of a Ladder Network D/A Converter |
| **23.** | (a) To study and testing the working of a counter A/D converter |
| | (b) To study and testing the working of a monolithic A/D converter |
| | (c) To study and analysis of comparator operational amplifier |
| **24.** | (a) To study of operational amplifier as Integrator and Differentiator |
| | (b) To study of operational amplifier as Square Wave Generator |
| | (c) To study and observe buffer operational amplifier |
| **25.** | (a) To Study and Analyze the Half wave Rectifier (HWR) using ExpEYES-17 Kit |
| | (b) To Study and Analyze the Full wave Rectifier (FWR) using ExpEYES-17 Kit |
| | (c) To study the Clipping and Clamping circuits as positive and negative logic using expEYES-17 kit |

**Note: Student have to perform at least 15 experiment. Any other experiment of the same standard can be added.**



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## M.Sc. (Electronics) Semester-I

| Program | Subject | Year | Semester |
|---|---|---|---|
| MSc | Electronics | 1 | I |
| Course Code | Course Title | | Course Type |
| ELT107 | Advanced Digital Electronics lab | | Core |
| Credits | Total No. of Lectures- Tutorials - Practical ( in hours per week ): | | |
| | L | T | P |
| 2 | 0 | 0 | 4 |
| Maximum Marks | CIA | | ESE |
| 100 | 30 | | 70 |

**Learning Objectives (LOs):**

| LO No. | Learning Objective |
|---|---|
| 1 | To advance students' proficiency in designing and implementing complex digital systems using programmable logic devices (PLDs) and digital integrated circuits. |
| 2 | To translate algorithmic descriptions into hardware implementations, optimizing for factors such as performance, area, and power consumption. |
| 3 | Students will learn advanced verification and testing techniques for digital circuits and systems. |

**Course Outcomes (COs):**

| CO No. | Expected Course Outcome<br>At the end of the course, the students will be able to: | CL |
|---|---|---|
| 1 | Identify relevant information to supplement to the Analog Electronic Circuits | U,An |
| 2 | Set up testing strategies and select proper instruments to evaluate performance characteristics of electronic circuit | Ap |



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| | | |
|---|---|---|
| 3 | Choose testing and experimental procedures on different types of electronic circuit and analyze their operation different operating conditions. | An |
| 4 | Evaluate possible causes of discrepancy in practical experimental observations in comparison to theory | E,An |
| 5 | Practice different types of wiring and instruments connections keeping in mind technical, Economical, safety issues | Ap |
| 6 | Prepare professional quality textual and graphical presentations of laboratory data and Computational results, incorporating accepted data analysis and synthesis methods, Mathematical software and word- processing tools | An |

CL: Cognitive Levels (R-Remember; U- Understand; Ap- Apply; An- Analyze; E- Evaluate; C- Create)

**COs-POs/PSOs Mapping for the course:**

| POs / COs | POs | | | | | | | | | | | | PSOs | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 |
| CO-1 | 3 | 2 | 2 | 2 | - | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 |
| CO-2 | 2 | 3 | 3 | 2 | 1 | 3 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 2 |
| CO-3 | 2 | 3 | 3 | 2 | - | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 1 | 3 | 3 | 2 |
| CO-4 | 2 | 2 | 3 | 2 | - | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 |
| CO-5 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 1 | 3 | 3 | 2 |
| CO-6 | 2 | - | 2 | 3 | - | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 1 | 3 | 3 | 2 |

"3"- Strong; "2"- Moderate; "1"- Low; "-" No correlation

**List of experiments:**

| S.N. | Name of Experiments |
|---|---|
| 1. | To study the operation of shift register as serial in parallel and parallel in serial mode. |
| 2. | To study the operation of shift register as parallel in parallel and serial in serial mode. |
| 3. | To study write/read operation of digital data into semiconductor memory using IC 7489. |



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| | |
|---|---|
| | Store and retrieve some set of data. (RAM) |
| **4.** | To study the characteristics of C- MOS integrated circuits, verify the operation of C- MOS Inverter/NAND gate ICs and study the voltage level of C- MOS for proper ON/OFF (logic 1 or logic 0) condition. |
| **5.** | To study the interfacing of C- MOS to TTL IC's and vice- versa. Different TTL logic gates and C- MOS logic gates with pull up resistance are provided for interfacing. |
| **6.** | To study the master slave J- K flip- flop and verify truth table. |
| **7.** | To study the operation and application of a modern LSI D/A converter. Parallel binary<br>Inputs from switches are applied to DAC, which in turn converts the binary number into a proportional output voltage. |
| **8.** | To study the operation of modulo- n- counter as MOD 3 & MOD 4 and verify the Truth Table. |
| **9.** | To study the operation of modulo- n- counter as MOD 8 & MOD 9 and verify the Truth Table. |
| **10.** | To study the operation of a Presetable Divide by N Counter and verify its truth table. |
| **11.** | To study the operation of Multiplexer IC having 16: 1 channels. |
| **12.** | To study the operation of Demultiplexer IC having 1:16 channels and 4 select inputs. |
| **13.** | To study the operation of BCD Up- Down Counter. |
| **14.** | To study the operation of BCD to 7-segment decoder & display. |
| **15.** | To study and verify the truth table of Parity Generator and Checker. |
| **16.** | Verification of operation of IC 74190 as mod- N programmable counter. |
| **17.** | To study the Binary to BCD converter. |
| **18.** | To study the BCD to Decimal converter. |
| **19.** | To study the Binary to Gray code converter and Gray to Binary code converter. |
| **20.** | To study the 4- bit Synchronous binary up/down counter. |
| **21.** | To study the 4- bit Asynchronous binary up/down counter. |
| **22.** | To verify the truth table of one bit and two bit comparators using logic gates. |

**Note: Student have to perform at least 15 experiment. Any other experiment of the same standard can be added.**



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**DETAILED SYLLABUS**

# Semester -II



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## M.Sc. (Electronics) Semester-II

| Program | Subject | Year | Semester |
|---|---|---|---|
| MSc | Electronics | 1 | II |
| **Course Code** | **Course Title** | | **Course Type** |
| ELT201 | Course Title: Network Analysis and Synthesis | | Core |
| **Credits** | **Total No. of Lectures- Tutorials - Practical ( in hours per week ):** | | |
| | **L** | **T** | **P** |
| 5 | 5 | 1 | 0 |
| **Maximum Marks** | **CIA** | | **ESE** |
| 100 | 30 | | 70 |

**Learning Objectives (LOs):**

| LO No. | Learning Objective |
|---|---|
| 1 | To equip the students with rigorous theoretical and practical knowledge to analyze and synthesize networks |
| 2 | To analyze the given electronics circuit/network problems using mesh/ loop methods, network theorems and graph theory |
| 3 | To introduce the basic knowledge of network analysis with initial conditions, magnetically coupled circuits, Waveform synthesis and network transfer functions |
| 4 | To analyze the one port, two-port networks |

**Course Outcomes (COs):**

| CO No. | Expected Course Outcome<br>At the end of the course, the students will be able to: | CL |
|---|---|---|
| 1 | Apply the knowledge of basic circuital law and simplify the network using reduction technique | Ap,U |



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| | | |
|---|---|---|
| 2 | Apply the knowledge of various circuit/network analysis techniques such as mesh analysis, nodal analysis, and network theorems to investigate the given network, Kirchhoff's law and network theorem | Ap |
| 3 | Able to solve the networks using graphical approach and able to analyze the given network by transforming from time domain to S domain. | An,U |
| 4 | Design and analyze one port, two-port networks. | An,Ap |
| 5 | Comprehend the basic concepts and synthesis the RL, RC and LC networks using Foster and Causer forms | U,An |

CL: Cognitive Levels (R-Remember; U- Understand; Ap- Apply; An- Analyze; E- Evaluate; C- Create)

**COs-PO/PSO Mapping for the courses:**

| PO / CO | POs | | | | | | | | | | | | PSOs | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 |
| CO-1 | 2 | 2 | 3 | 3 | - | - | - | 3 | 2 | 2 | 3 | 1 | 3 | 3 | 3 | 2 | 3 |
| CO-2 | 3 | 2 | 3 | 3 | - | - | - | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO-3 | 3 | 2 | 3 | 3 | - | - | - | 3 | 2 | 1 | 3 | 2 | 3 | 3 | 3 | 2 | 3 |
| CO-4 | 3 | 2 | 3 | 3 | - | - | - | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO-5 | 3 | 2 | 3 | 3 | - | - | - | 3 | 2 | 1 | 3 | 2 | 3 | 3 | 3 | 2 | 3 |

"3"- Strong; "2"- Moderate; "1"- Low; "-" No correlation

**Detailed Syllabus:**

| Unit | Topics | No. of Lectures |
|---|---|---|
| 01 | Mesh and Node Analysis - Kirchhoff's laws , Star and Delta conversion, source transformation, mesh and node analysis of electric circuits, response of the network by differential equation and Laplace transform method ,initial conditions in the network.<br><br>Network Theorems - Thevenin's theorem, Norton's Theorem, Superposition, Millman theorem, Maximum power transfer theorem, and Reciprocity theorem, Tellegen theorem and Substitutions theorem . | 15 |



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| | | |
|---|---|---|
| **02** | Coupled Circuit, Waveform Synthesis and Graph Theory Coupled Circuit –Dot convention and magnetic coupling Waveform Synthesis – Standard signals, unit step function, ramp function, impulse function, initial and final value of f(t) from F(s), the convolution integral. Graph Theory - Concept of a network graph, twigs and links, trees, co trees ,formation of incidence matrix ,cut- set matrix, tie- set matrix and loop currents, analysis of networks, network equilibrium equation ,duality, network transformation | **15** |
| **03** | Network Function - Network function for one port and two port, the calculation of network functions - ladder networks and general networks, pole and zero of network functions, restrictions on pole and zero locations for driving point functions ,restrictions on pole zero locations ,time domain behavior from the pole and zero plot, stability of active networks. Frequency Response Plots- Magnitude and Phase plots, Root Loci, Bode Diagrams, Nyquist- Stability Criterion | **15** |
| **04** | Relationship of two port variable , Z- parameters, Y- parameters, Hybrid parameters, ABCD parameters, conditions of reciprocity and symmetry, inter- relationship between parameter of two port network, different types of interconnections of two port networks. | **15** |
| **05** | Concept, Procedure of Synthesis, Reactive Networks, Properties of Expressions of Driving point Admittances of L- C Networks, Pole-Zero Interpretations in L- C Networks. L- C Networks Synthesis- Foster's Canonic Form (First and Second Foster form), Significance of Elements in the Foster form, Cauer Canonic form of Reactive Networks- First and Second form of Cauer Networks, Applicability of Foster and Cauer forms, R- L & R- C Network Synthesis by Foster form, Identification of foster form , Identification of Admittance, R-L& R- C Network Synthesis by Cauer form, Identification of Admittance Function in Cauer form, Determination of end elements in Foster and Cauer R- L & R- C Networks. | **15** |

**Suggested Study material:**


1. Networks and System - D. Roy Choudhary, New Age International
2. Network Analysis: M.E. Van Valkenburg.PHI
3. Circuit theory (analysis and synthesis) - A. Chakrabarti, Dhanpat Rai and co.
4. Network Synthesis: M.E. Van Valkenburg.PHI




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## M.Sc. (Electronics) Semester-II

| Program | Subject | Year | Semester |
|---|---|---|---|
| MSc | Electronics | 1 | II |
| **Course Code** | **Course Title** | | **Course Type** |
| ELT202 | Course Title: Advance Microprocessors, Microcontroller and Python Programming | | Core |
| **Credits** | **Total No. of Lectures- Tutorials - Practical ( in hours per week ):** | | |
| | **L** | **T** | **P** |
| 5 | 5 | 1 | 0 |
| **Maximum Marks** | **CIA** | | **ESE** |
| 100 | 30 | | 70 |

**Learning Objectives (LOs):**

| LO No. | Learning Objective |
|---|---|
| 1 | To introduce the basic idea about architecture and the working principle of microprocessor 8085 |
| 2 | Students will get acquainted with the assembly language programming using the instruction set of microprocessor 8085 |
| 3 | Understand the basic concepts of python programming language |

**Course Outcomes (COs):**

| CO No. | Expected Course Outcome<br>At the end of the course, the students will be able to: | CL |
|---|---|---|
| 1 | Comprehend and analyze the architectures of 16 bit microprocessors and 8 bit microcontroller | U,An |



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| | | |
|---|---|---|
| 2 | Understand and implement the assembly language programming of 8086 microprocessor and 8051 microcontrollers | Ap,U |
| 3 | Comprehend the memory organization of 8086 microprocessor and 8051 microcontrollers | U,Ap |
| 4 | Showcase the skill, knowledge and ability of programming using instruction set of 8086 microprocessor and 8051 microcontrollers | Ap |
| 5 | Understand the python programming language and apply the programming skills | U,An |

CL: Cognitive Levels (R-Remember; U- Understand; Ap- Apply; An- Analyze; E- Evaluate; C- Create)

**COs-POs/PSOs Mapping for the course:**

| POs / COs | POs | | | | | | | | | | | | PSOs | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 |
| CO-1 | 3 | 3 | 3 | 3 | 2 | 1 | - | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 |
| CO-2 | 3 | 3 | 3 | 3 | 2 | 2 | - | 3 | 2 | 2 | 1 | 3 | 3 | 3 | - | 3 | 3 | 3 |
| CO-3 | 3 | 3 | - | 3 | 2 | 2 | 1 | 3 | 2 | 3 | 3 | 3 | - | - | 2 | 3 | 2 | 3 |
| CO-4 | 3 | 3 | 2 | 3 | 2 | 2 | 1 | 3 | 1 | 3 | 3 | 2 | - | - | 2 | 3 | 3 | 3 |
| CO-5 | 2 | 2 | - | 3 | 2 | 3 | - | 3 | 1 | 3 | 3 | 3 | 2 | - | - | 3 | 3 | 3 |

"3"- Strong; "2"- Moderate; "1"- Low; "-" No correlation

**Detailed Syllabus:**

| Unit | Topics | No. of Lectures |
|---|---|---|
| 01 | 8086 internal architectures; memory organization, 8086 basic configurations: minimum mode, maximum mode, 8284 clock generator, 8288 bus controller, system bus timings for minimum and maximum modes. Introduction to 8088, 80186, 80286, 80386, 80486. 8086 addressing modes, Instruction formats, instruction set: data transfer instructions, arithmetic instructions: binary, packed and unpacked arithmetic; branch instructions: conditional and unconditional branch instruction loop instructions, | 15 |



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| | | |
|---|---|---|
| | flag manipulation instructions, shift and rotate instructions, byte and string; assembler directives. | |
| **02** | Basic interfacing concepts; Interfacing memories: I/O mapped I/O, memory mapped I/O, 8086 memory interface, I/O operations: programmed I/O, Interrupt I/O, Direct memory access, ProCO-6mming and interfacing of peripheral devices: programmable peripheral interface (8255), Interrupt controller (8259), DMA controller (8257); Coprocessor (8087): architecture, data types, and interfacing | **15** |
| **03** | 8051 architecture: oscillator and clock, PC and data pointers, CPU registers, flags, and PSW; internal RAM; stack and stack pointer, SFRs, internal ROM, I/O ports; external memory; Counters and timers: timer counter interrupts, timing, timer modes of operation, counting, Serial Data I/O: serial data interrupts, data transmission, data reception, serial data transmission modes, Interrupts: timer flag interrupt, serial port interrupt, external interrupts, reset, interrupt control, interrupt priority, interrupt destinations, software generated interrupts | **15** |
| **04** | Instruction set: Moving data: addressing modes, external data moves, code memory read-only data moves, push and pop opcodes; Logical operations: byte and bit level logical operations, rotate and swap operations; Arithmetic operations: flags, incrementing and decrementing, addition, subtraction, multiplication and division, decimal arithmetic; Jump and call instructions: jump and call program range, jumps, calls and subroutines, interrupts and returns; simple programming examples. Interfacing of LCD modules, Stepper Motors with 8051 Microcontroller | **15** |
| **05** | Introduction to python programming, History, Features, the advantages of using python, what is Program, Debugging, Formal and Natural Language, Keywords, Python identifier, Variables, statements, Python Operators and operands, Strings, String Functions, Conditional Execution: If-else, The Nested if –else, While loop, for loop, Boolean Expressions, Iteration, List, Tuple, Functions in Python, Types of Functions in Python, Functions vs. Methods, Arguments vs parameters, Defining User Functions, Calling a Function, Python Function Arguments, File handling, Classes and Objects | **15** |

**Suggested Study material:**


1. Microprocessor Architecture Programming - Ramesh S. Gaonkar & Application with 8085/8080 Penram Int. Pub2
2. 0000 to 8085: Introduction to Microprocessors for Engineers and Scientists, 2nd ed. Ghosh & Sridhar PHI
3. Fundamentals of Microcomputer & Microprocessor r - B.Ram, Dhanpat Roy Pub.
4. Oliver R. Simpson , Python Programming Language for Beginners(ebook)




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5. Allen Downey, Jeffrey Elkner, Chris Meyers, How to Think Like a Computer Scientist : Learning with Python, Dreamtech Press; 1st edition



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## M.Sc. (Electronics) Semester-II

| Program | Subject | Year | Semester |
|---|---|---|---|
| MSc | Electronics | 1 | II |
| Course Code | Course Title | | Course Type |
| ELT203 | Course Title: Analog and Digital Communication Systems | | Core |
| Credits | Total No. of Lectures- Tutorials - Practical ( in hours per week ): | | |
| | L | T | P |
| 5 | 5 | 1 | 0 |
| Maximum Marks | CIA | | ESE |
| 100 | 30 | | 70 |

**Learning Objectives (LOs):**

| LO No. | Learning Objective |
|---|---|
| 1 | The fundamentals of basic communication system, types of noise affecting communication system and noise parameters |
| 2 | To help to understand the principle of analog and digital communication. Need of modulation, modulation processes and different analog and digital modulation techniques with generation and detection methods, transmitter, and receiver systems in detail |
| 3 | Need of sampling and different sampling techniques |
| 4 | Generation and detection of pulse modulation techniques and multiplexing and to introduce the knowledge of the Monochrome and Color Television system |

**Course Outcomes (COs):**

| CO No. | Expected Course Outcome<br>At the end of the course, the students will be able to: | CL |
|---|---|---|



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| | | |
|---|---|---|
| 1 | Understand different blocks in communication system and how noise affects communication using different parameters | U,An |
| 2 | Analyze generation and detection of FM signal and comparison between amplitude and angle modulation schemes | An |
| 3 | Identify different radio receiver circuits and role of AGC and sample analog signal to recover original | U,Ap |
| 4 | To understand different type of analog and digital modulation for communication system | An,U |
| 5 | Understand the fundamental concepts of television transmitter and receiver systems, the transmission of video signals and importance of television standards to effectively work with broadcasting applications, trouble shooting of television systems | Ap,U |

CL: Cognitive Levels (R-Remember; U- Understand; Ap- Apply; An- Analyze; E- Evaluate; C- Create)

**COs-POs/PSOs Mapping for the course:**

| POs / COs | POs | | | | | | | | | | | | PSOs | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 |
| CO-1 | 3 | 3 | 3 | 3 | - | - | - | 3 | 3 | 2 | 2 | 1 | 3 | 2 | 2 | 3 | 3 |
| CO-2 | 3 | 3 | 3 | 3 | - | - | - | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |
| CO-3 | 3 | 3 | 3 | 3 | - | - | - | 3 | 3 | 2 | 2 | 1 | 3 | 2 | 2 | 3 | 3 |
| CO-4 | 3 | 3 | 3 | 3 | - | - | - | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 |
| CO-5 | 3 | 3 | 3 | 3 | - | - | - | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 |

"3"- Strong; "2"- Moderate; "1"- Low; "-" No correlation

**Detailed Syllabus:**

| Unit | Topics | No. of Lectures |
|---|---|---|
| 01 | Radiation and Propagation of Waves - Electromagnetic Radiation – Effect of environment, Propagation of waves –Ground Wave and Sky- | 15 |



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| | | |
|---|---|---|
| | wave Propagation – The ionosphere – Space waves – Tropospheric scatter propagation – Extraterrestrial communications<br><br>Introduction to Communication Systems - Block diagram of communication system –<br><br>Transmitter, Receiver, Modulation, Bandwidth requirements<br><br>Noise - Source of Noise, External Noise –Atmospheric Noise, Extra Terrestrial Noise, Industrial Noise, Internal Noise- Shot Noise, Resister or Johnson Noise ,Calculation of noise in Linear Systems, Noise Bandwidth, Power, Noise Temperature, Noise in Two Port Networks, Noise Figure, Cascaded stages, Measurement of Noise Figure, Signal in presence of Noise, Narrowband Noise. | |
| **02** | Amplitude Modulation - Frequency spectrum of AM wave, Representation of AM wave, Power relation in AM wave, Single side band techniques – Suppression of carrier, suppression of side bands, vestigial side band, Transmitters - Classification of radio transmitter, AM radio transmitter, Generation of AM- Transistor as AM Generator, balanced modulator, filter method, phase shift method, third method. Receivers – Classification of radio receiver, basic function of AM receiver, tuned radio frequency receiver, super heterodyne receiver, AM demodulation RC demodulator, square law demodulator. Noise in Amplitude Modulated Systems, Comparison of various AM systems | **15** |
| **03** | Angle Modulation Frequency modulation, analysis of FM waveform, frequency spectrum, Bessel function, Narrowband FM and Wide Band FM, Phase modulation FM Modulators and Transmitters - Method of frequency modulation – Direct method –reactance modulator (FET and varactor diode method), Indirect Method, pre- emphasis and de-emphasis FM Demodulators and Receivers – Super heterodyne FM receiver – block diagram, amplitude limiter, FM demodulator –phase discriminator, ratio detector, PLL demodulator. Comparison of AM, FM and PM, , frequency division multiplexing(FDM) | **15** |
| **04** | Pulse Amplitude Modulation - Natural Sampling, flat top sampling, equalization signal recovery to holding, PAM modulator and demodulator. Pulse time modulation (PTM)- Generation of PTM signals, PTM modulator and Demodulator, time division multiplexing (TDM). Pulse Code Modulation- Quantization of signals, quantization error, pulse code modulation (PCM), companding, Bandwidth of PCM System, Noise in PCM System, Differential pulse code modulation, Delta modulation, Adaptive Delta modulation. Digital Modulation Techniques - Introduction, Binary Phase Shift Keying (BPSK), Differential Phase Shift Keying (DPSK), Quadrature Phase Shift | **15** |



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| | | |
|---|---|---|
| | Keying (QPSK), Quadrature Amplitude Shift Keying (QASK) and Binary Frequency Shift Keying (BFSK). | |
| **05** | Monochrome and Colour Television Elements of a TV System - Concept of Picture and sound transmission and reception, Flicker, Composite Video Signal, signal transmission and Channel bandwidth, Monochrome picture tube, Television Camera tube - Vidicon and CCD. Monochrome TV transmitter and receiver (Block Diagram), Essentials of Colour TV - Three Colour theory, Luminance, Hue and saturation, Triniton Colour Picture tube, Block diagram of Colour TV transmitter and receiver, PAL Colour TV System. CCTV, HDTV, CATV and DTH, Concepts of Home Theatre | **15** |

**Suggested Study material:**


1. Principles of Communication Systems - Taub & Schilling, TMH
2. Principles of Communication Systems - George Kennedy, TMH
3. Communication System- Analog and Digital - R.P.Singh & S.D. Sapre TMH
4. Radio Engineering - G. K. Mithal G.K. Pub.
5. Monochrome and Colour Television - R.L. Gulati, New Age International, Wiley Eastern Ltd. New Delhi.
6. Advanced Electronic Communication Systems: Tomasi PHI
7. Television Engineering – A.M. Dhake, TMH
8. Electronic communication, Roddy and Coolen, PHI, New Delhi,




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## M.Sc. (Electronics) Semester-II

| Program | Subject | Year | Semester |
|---|---|---|---|
| MSc | Electronics | 1 | II |
| **Course Code** | **Course Title** | | **Course Type** |
| ELT204 | Electromagnetic Plane Wave, Transmission Lines and Microwave Devices | | Elective |
| **Credits** | **Total No. of Lectures- Tutorials - Practical ( in hours per week ):** | | |
| | **L** | **T** | **P** |
| 5 | 5 | 1 | 0 |
| **Maximum Marks** | **CIA** | | **ESE** |
| 100 | 30 | | 70 |

**Learning Objectives (LOs):**

| LO No. | Learning Objective |
|---|---|
| 1 | To introduce the basic concepts of electromagnetic plane wave, transmission lines and antennas |
| 2 | To teach different types of waveguide, components and understand the distribution of electromagnetic fields within waveguides using Maxwell's equations |
| 3 | To understand the importance of microwave components, circuits and applications |
| 4 | To comprehend operational principles of microwave sources and to characterize microwave networks and to design and analyze various passive and active microwave devices and circuits |



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**Course Outcomes (COs):**

| CO No. | Expected Course Outcome<br>At the end of the course, the students will be able to: | CL |
|---|---|---|
| 1 | Understand the uniform plane wave, its reflection and propagation in free space, lossless and lossy dielectric | An,U |
| 2 | Design and interpret the impedance matching transmission line sections using single stub, double stub and LC sections using Smith Chart | Ap,An |
| 3 | Analyze the field components of different waveguides and planar transmission lines based on various modes of E and H field | An |
| 4 | Understand the working principle of operation of microwave sources like Klystron, Magnetron and microwave measurement techniques | Ap,U |
| 5 | Developed understanding of Microwave semiconducting and avalanche transit time devices | An,U |

CL: Cognitive Levels (R-Remember; U- Understand; Ap- Apply; An- Analyze; E- Evaluate; C- Create)

**COs-POs/PSOs Mapping for the course:**

| POs / COs | POs | | | | | | | | | | | | PSOs | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 |
| CO-1 | 3 | 3 | 3 | 3 | 1 | - | - | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 3 |
| CO-2 | 3 | 3 | 2 | 1 | - | - | - | 3 | 1 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |
| CO-3 | 3 | 2 | 3 | 2 | - | - | - | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |
| CO-4 | 2 | 3 | 3 | 3 | 2 | - | - | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 |
| CO-5 | 3 | 3 | 3 | 3 | 1 | - | - | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 3 |

"3"- Strong; "2"- Moderate; "1"- Low; "-" No correlation



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**Detailed Syllabus:**

| Unit | Topics | No. of Lectures |
|---|---|---|
| 01 | Electromagnetic Plane Wave - Electron motion in electric field , electron motion in magnetic field , electron motion in electromagnetic field, electric and magnetic wave equations, Maxwell equation, Poynting theorem, uniform plane wave and reflection, uniform plane wave propagation in free space and lossless dielectric, plane wave propagation in lossy media, Ionospheric propagation, conductors and dielectrics, skin depth, polarization, phase velocity and group velocity. | 15 |
| 02 | Transmission Line - Basic equation , reflection and transmission coefficient , standing wave and standing wave ratio , line impedance and admittance, Determination of characteristics impedance, Fundamental of Smith Chart, Impedance Matching: Single and Double Stub Matching, microwave Coaxial Connectors. Antennas The Radiation mechanism, Current and Voltage distribution, Antennas gain, Antenna resistance, Bandwidth, Beam width and Polarization, effects of Antenna height, Dipole arrays, Folded dipole. Microwave Antennas - Parabolic reflector, Horn and Lens antenna, Special purpose antennas - Yagi, Log periodic and Loop antennas. Radar– block diagram of Radar, frequencies and power used, Radar range equation. | 15 |
| 03 | Waveguides - Rectangular Wave guide – TE and TM modes , power transmission, excitation in rectangular wave guide , circular wave guides – TE,TM and TEM mode, Microwave Components - Waveguide Tee - E- plane tee, H- plane tee, Hybrid tee, scattering parameters (s- matrix), circulators, isolators , directional couplers. | 15 |
| 04 | Microwave Sources - Reflex Klystron - principle of operation of velocity modulation, power output and efficiency, electronic admittance, Cylindrical Magnetron – principle of operation, equation of electron motions, cyclotron angular frequency , power output and efficiency. Microwave measurement techniques, - Microwave bench, precautions, power measurement, bolometric method, attenuation, VSWR, impedance, frequency and Q of the cavity, standing wave measurements, impedance measurement, cavity resonator, dielectric measurements | 15 |
| 05 | Microwave Semiconducting Devices<br><br>Microwave Transistor Microwave Bipolar Transistor principle and amplification phenomenon, power frequency limitation, Microwave Tunnel Diode principle and characteristics of microwave tunnel | 15 |



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| | | |
|---|---|---|
| | diodes, JFET operation and characteristics. Microwave integrated circuit design, introduction, hybrid microwave integrated circuits (HMIC), monolithic microwave integrated circuit (MMIC), MIC materials, substrate material, conductor material, dielectric materials, resistive films, types of MICS, microwave monolithic integrated circuits (MMIC'S).<br><br>Transferred Electron Devices – Gunn Effect Diodes, GaAs diode Ridley Watkins Hilsum (RWH) theory – Differential negative resistance<br><br>Avalanche Transit - Time Devices - Read Diode - Avalanche multiplication, carrier current and external current, output power and quality factor. IMPATT Diodes and TRAPATT Diodes- Principles of operation, power output and efficiency | |

**Suggested Study material:**

1. Microwave Devices and Circuits – Samuel Y. Liao, PHI Pub
2. Microwave Engineering – Annapurna Das, Sisir K. Das, Tata Mc Graw Hill.
3. Microwave and Radar Engineering - M. Kulkarni, Umesh Publication
4. Electronic Communication Systems - George Kennedy, 3rd Edition TMH
5. Introduction to electrodynamics by David J. Griffithe , PHI
6. Elements of engineering electromagnetics by Narayaaa Rao, PHI



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## M.Sc. (Electronics) Semester-II

| Program | Subject | Year | Semester |
|---|---|---|---|
| MSc | Electronics | 1 | II |
| **Course Code** | **Course Title** | | **Course Type** |
| ELT205 | ELECTRONIC SYSTEM DESIGN | | Elective |
| **Credits** | **Total No. of Lectures- Tutorials - Practical ( in hours per week ):** | | |
| | **L** | **T** | **P** |
| 5 | 5 | 1 | 0 |
| **Maximum Marks** | **CIA** | | **ESE** |
| 100 | 30 | | 70 |

**Learning Objectives (LOs):**

| LO No. | Learning Objective |
|---|---|
| 1 | To provide students with a comprehensive understanding of electronic systems at a higher level. |
| 2 | Students will learn how to integrate hardware and software components to design complete electronic systems. |
| 3 | To familiarize students with various design methodologies and tools used in electronic system design, system modeling and simulation. |
| 4 | To apply theoretical knowledge to real-world electronic system design challenges. |

**Course Outcomes (COs):**

| CO No. | Expected Course Outcome<br>At the end of the course, the students will be able to: | CL |
|---|---|---|
| 1 | Apply strategies for the minimization of logic functions, Design logic circuits for incompletely specified functions, Implement multiple output circuits, | Ap |



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| | | |
|---|---|---|
| | Demonstrate proficiency in multilevel synthesis and analysis of digital circuits | |
| 2 | Understand variables and functions in the context of logic circuits, Synthesize logic gates and networks for digital systems, Gain an introduction to VHDL | An,U |
| 3 | Design and implement combinational circuits as building blocks for digital systems, Implement multiplexers, decoders, encoders, and code converters, Apply VHDL programming for the implementation of these circuits | Ap |
| 4 | Follow basic design steps for synchronous sequential circuits, Understand and implement Mealy state models, Design finite state machines (FSM) and implement them using VHDL programming | Ap,U |
| 5 | Analyze asynchronous sequential circuits, Synthesize asynchronous sequential circuits, Perform state reduction and state assignment, Identify and mitigate hazards in digital circuits | An |
| 6 | Understand fault models for logic circuits, Apply path sensitizing techniques for testing, Implement random testing strategies | Ap,U |

CL: Cognitive Levels (R-Remember; U- Understand; Ap- Apply; An- Analyze; E- Evaluate; C- Create)

**COs-POs/PSOs Mapping for the course:**

| POs / COs | POs | | | | | | | | | | | | PSOs | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 |
| CO-1 | 3 | 2 | 2 | 3 | 1 | - | - | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 3 |
| CO-2 | 2 | 3 | 2 | 3 | - | - | - | 2 | 2 | 3 | 3 | 2 | 1 | 3 | 2 | 3 | 3 | 2 |
| CO-3 | 3 | 2 | 2 | 3 | - | - | - | 2 | 3 | 3 | 2 | 2 | 1 | 3 | 2 | 2 | 3 | 3 |
| CO-4 | 2 | 2 | 2 | 3 | - | - | - | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 3 |
| CO-5 | 1 | 3 | 2 | 3 | - | - | - | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 1 | 3 | 3 | 2 |
| CO-6 | 2 | 2 | 2 | 3 | 1 | - | - | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 3 |

"3"- Strong; "2"- Moderate; "1"- Low; "-" No correlation



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**Detailed Syllabus:**

| Unit | Topics | No. of Lectures |
|---|---|---|
| 01 | DESIGN CONCEPTS: Digital Hardware, Design Process, Design of Digital Hardware, OPTIMIZED IMPLEMENTATION OF LOGIC FUNCTIONS: Strategy for minimization, Incompletely specified functions, Multiple output circuits, Multilevel synthesis & Analysis. | 15 |
| 02 | LOGIC CIRCUITS: Variables & Functions, Logic gates & Networks synthesis, Introduction to VHDL, COMBINATIONAL CIRCUITS: Building Block, Multiplexers Decoders, Encoders Code Converters and their implementation in VHDL. | 15 |
| 03 | SYNCHRONOUS SEQUENTIAL CIRCUITS: Basic Design Steps, Mealy state Model, Design of FSM and their implementation using VHDL programming | 15 |
| 04 | ASYNCHRONOUS SEQUENTIAL CIRCUITS: Analysis, Synthesis, State Reduction, State Assignment, Hazards | 15 |
| 05 | TESTING OF LOGIC CIRCUITS: Fault Model, Path sensitizing, Random testing, Circuits with Tree Structure | 15 |

**Suggested books:**


1. Digital Design: Principles and Practices" by John F. Wakerly
2. Digital Design and Computer Architecture" by David Money Harris and Sarah L. Harris
3. Digital System Design with VHDL" by Mark Zwolinski
4. Foundations of Electronics: Circuits & Devices" by Dr. B. L. Theraja and Dr. R. S. Sedha




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## M.Sc. (Electronics) Semester-II

| Program | Subject | Year | Semester |
|---|---|---|---|
| MSc | Electronics | 1 | II |
| **Course Code** | **Course Title** | | **Course Type** |
| ELT206 | Advanced Communications Lab | | Core |
| **Credits** | **Total No. of Lectures- Tutorials - Practical ( in hours per week ):** | | |
| | **L** | **T** | **P** |
| 2 | 0 | 0 | 4 |
| **Maximum Marks** | **CIA** | | **ESE** |
| 100 | 30 | | 70 |

**Learning Objectives (LOs):**

| LO No. | Learning Objective |
|---|---|
| 1 | To understanding of advanced modulation schemes such as quadrature amplitude modulation (QAM), phase shift keying (PSK), and frequency shift keying (FSK). |
| 2 | To learn techniques for characterizing communication channels, including channel impulse response estimation, channel capacity analysis, and channel equalization methods. |
| 3 | Students will gain hands-on experience in designing and implementing error control coding and decoding algorithms, analyzing their performance in noisy communication channels, and optimizing parameters for efficient error correction. |

**Course Outcomes (COs):**

| CO No. | Expected Course Outcome<br>At the end of the course, the students will be able to: | CL |
|---|---|---|
| 1 | Design analog modulation circuits as amplitude and frequency modulation. | An,U |
| 2 | Design various pulse modulation techniques as PAM, PPM, PWM | Ap,U |



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|---|---|---|
| 3 | Design the circuit to sample an analog signal. | An,U |
| 4 | Use of different modulation and demodulation techniques used in analog communication | Ap |
| 5 | Identify and solve basic communication problems | An,U |
| 6 | Analyze transmitter and receiver circuits | An |

CL: Cognitive Levels (R-Remember; U- Understand; Ap- Apply; An- Analyze; E- Evaluate; C- Create)

**COs-POs/PSOs Mapping for the course:**

| POs / COs | POs | | | | | | | | | | | | PSOs | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 |
| CO-1 | 3 | 2 | 3 | 2 | - | - | 1 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 |
| CO-2 | 2 | 3 | 2 | 2 | - | - | 1 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 1 | 2 | 3 | 3 |
| CO-3 | 3 | 2 | 3 | 2 | - | - | - | 2 | 3 | 3 | 2 | 2 | 2 | 3 | 1 | 2 | 2 | 3 |
| CO-4 | 3 | 3 | 3 | 2 | - | - | 1 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 2 |
| CO-5 | 2 | 3 | 2 | 2 | - | - | 1 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 |
| CO-6 | 3 | 3 | 3 | 2 | - | - | 1 | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 3 |

"3"- Strong; "2"- Moderate; "1"- Low; "-" No correlation

**List of Experiments:**

| S.N. | Name of Experiments |
|---|---|
| 1. | To Generate the DSB-SC Modulated wave and to Observe the Phase Reversal at the Zero Crossing of the Modulating Signal [MOD-13] |
| 2. | To study the operation of balanced modulator DSBSC using IC 1496 |
| 3. | To study amplitude modulation and demodulation and construct and AM generator and a diode detector and observe its operations under various conditions |



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| | |
|---|---|
| **4.** | Study of signal sampling and reconstruction techniques and to verify Nyquist criteria and tracing |
| **5.** | To Generate the SSB-SC Modulation and Demodulation |
| **6.** | To Generate Pulse Amplitude Modulated (PAM) Signal and Demodulate it |
| **7.** | Study of pulse code modulation and demodulation techniques. |
| **8.** | Study of delta modulation methods |
| **9.** | Study adaptive- delta modulation methods |
| **10.** | Study of Frequency Division Multiplexing and Demultiplexing. |
| **11.** | Verification of following network theorems (1) Superposition (2) Thevenin`s (3) Nortan`s theorem. |
| **12.** | To generate Pulse Width Modulated (PWM/PTM/PLM/PDM) Signal and Demodulate it. |
| **13.** | To Generate the DSB-SC Demodulated wave and to Observe the Phase Reversal at the Zero Crossing of the Modulating Signal. |
| **14.** | To demonstrate (i) use of 4046 PLL as an FM modulator. (ii) Use of 4046 PLL IC as an FM demodulator. |
| **15.** | To study the phase modulation using IC 2206 and calculate the modulation index. |
| **16.** | Verification of the Maximum Power Transfer theorem. |
| **17.** | To Generate Pulse Position Modulated (PPM) Signal and Demodulate it. |
| **18.** | Study of Phase Shift Keying Modulation and Demodulation Technique. |
| **19.** | Study of Amplitude Shift Keying Modulation and Demodulation Technique. |
| **20.** | To study the Z parameter of a passive Two Port Network |

**Note: Student have to perform at least 15 experiment. Any other experiment of the same standard can be added.**



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## M.Sc. (Electronics) Semester-II

| Program | Subject | Year | Semester |
|---|---|---|---|
| MSc | Electronics | 1 | II |
| **Course Code** | **Course Title** | | **Course Type** |
| ELT207 | Microprocessor And Python Programming Lab | | Core |
| **Credits** | **Total No. of Lectures- Tutorials - Practical ( in hours per week ):** | | |
| | **L** | **T** | **P** |
| 3 | 0 | 0 | 6 |
| **Maximum Marks** | **CIA** | | **ESE** |
| 100 | 30 | | 70 |

**Learning Objectives (LOs):**

| LO No. | Learning Objective |
|---|---|
| 1 | To understand the architecture, instruction set, memory organization, and I/O interfacing of microprocessors, and applying this knowledge to write efficient and effective code for various applications. |
| 2 | To develop students' proficiency in programming microprocessors using assembly language |
| 3 | To exchange data between microprocessors and external devices, implement higher-level system functionalities. |
| 4 | To learn python programming for embedded applications, enabling them to leverage the flexibility and ease of use of Python for rapid prototyping, data processing, and system integration tasks in embedded systems projects. |

**Course Outcomes (COs):**



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| CO No. | Expected Course Outcome<br>At the end of the course, the students will be able to: | CL |
|---|---|---|
| 1 | Simple programs to understand the instruction set of 8085 microprocessors. | Ap |
| 2 | Simple programs to understand the study cards. | Ap |
| 3 | Interface various I/O devices with microprocessor and microcontroller. | Ap,An |
| 4 | Prepare the technical report on the experiments carried | An,U |
| 5 | Learn programs to understand the python programming | U,Ap |

CL: Cognitive Levels (R-Remember; U- Understand; Ap- Apply; An- Analyze; E- Evaluate; C- Create)

**COs-POs/PSOs Mapping for the course:**

| POs / COs | POs | | | | | | | | | | | | PSOs | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 |
| CO-1 | 3 | 2 | 3 | 2 | - | 1 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 2 |
| CO-2 | 2 | 3 | 3 | 2 | 1 | 2 | 2 | 1 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 3 | 2 |
| CO-3 | 3 | 2 | 3 | 3 | - | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 2 |
| CO-4 | 2 | 3 | 3 | 2 | 1 | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 2 |
| CO-5 | 3 | 2 | 3 | 2 | - | 2 | 2 | 1 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 2 |

"3"- Strong; "2"- Moderate; "1"- Low; "-" No correlation

**List of Experiments:**

| S.N. | Name of Experiments |
|---|---|
| 1. | Write a program of 8086 to multiply two 16- bit data and store the result in memory location. |
| 2. | Write a program of 8086 to divide 16- bit data by 8- bit and store the result in memory location. |
| 3. | Write a program of 8086 to divide 32- bit data by 16- bit store the result in memory location. |



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|---|---|
| **4.** | Write a program of 8086 to divide 32- bit data by 16- bit store the result in memory location. |
| **5.** | Write a program of 8086 to search the memory location of 05H data in a data string of length of 16 byte and store the result in memory location |
| **6.** | Write a program of 8086 to search the memory location of 05H data in a data string of length of 16 byte and store the result in memory location |
| **7.** | Write a program of 8086 to search number of 05H data in a string length of 16 byte and store the result in memory location |
| **8.** | Write a program of 8086 to find the largest number and the smallest number in a 16 byte data array |
| **9.** | Write a program of 8086 to count the number of zeros, positive and negative number in a series of 16 byte length |
| **10.** | Write a program of 8086 to arrange the data array in ascending order and descending order |
| **11.** | Write a program of 8086 to calculate a factorial using subroutine |
| **12.** | Write a program of 8086 to count even and odd numbers in a data array |
| **13.** | Write a program of 8086 to find the square root of a two digit number. Assume that the number is perfect square |
| **14.** | Write a python program for generation and plotting of elementary signals in discrete time. |
| **15.** | Write a python program for generation and plotting of discrete time exponential sequence. |
| **16.** | Write a python program to find the multiplication of two discrete time signals. |
| **17.** | Write a python program to find the even and odd component of the sequence $y(n) = u(n)-u(n-10)$ |
| **18.** | Write a python program to find and plot the Convolution of two sequences. |
| **19.** | Write a python program to find Fourier transform and Inverse Fourier transform of a given sequence. |
| **20.** | Write a python program to find and plot Fourier transform of $u(t+0.5) - u(t-0.5)$ |
| **21.** | Write a python program to find and plot Fourier series representation of a full wave rectified wave. |

**Note: Student have to perform at least 15 program. Any other experiment of the same standard can be added.**



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**DETAILED SYLLABUS**

# Semester -III



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## M.Sc. (Electronics) Semester-III

| Program | Subject | Year | Semester |
|---|---|---|---|
| MSc | Electronics | 2 | III |
| **Course Code** | **Course Title** | | **Course Type** |
| ELT301 | Embedded Systems and Advanced Instrumentation | | Core |
| **Credits** | **Total No. of Lectures- Tutorials - Practical ( in hours per week ):** | | |
| | **L** | **T** | **P** |
| 5 | 5 | 1 | 0 |
| **Maximum Marks** | **CIA** | | **ESE** |
| 100 | 30 | | 70 |

**Learning Objectives (LOs):**

| LO No. | Learning Objective |
|---|---|
| 1 | To introduce the architectures of embedded systems, PIC microcontrollers, FPGA and ARM processor |
| 2 | To introduce the basic concept of electronic instrumentation and measurement |
| 3 | To introduce the architectures of embedded systems, PIC microcontrollers, FPGA and ARM processor |
| 4 | To introduce the architectures of embedded systems, PIC microcontrollers, FPGA and ARM processor |

**Course Outcomes (COs):**

| CO No. | Expected Course Outcome<br>At the end of the course, the students will be able to: | CL |
|---|---|---|
| 1 | Understand the requirement of the embedded system, ARM processor, and IoT | An,U |



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| | | |
|---|---|---|
| 2 | Understand general-purpose processing and principles of PIC microcontrollers, FPGA and ARM processor | U,An |
| 3 | Developed the ability to work with different types of sensors | Ap |
| 4 | Understand working of basic electronics instrumentation and develop the ability to handle instrument like digital multimeter, Digital Storage Oscilloscope, Spectrum analyzers, and impedance analyzers | An,U |
| 5 | Understand functioning of biomedical Electronic Instrumentation like electrocardiography, plethysmography | An,U |

CL: Cognitive Levels (R-Remember; U- Understand; Ap- Apply; An- Analyze; E- Evaluate; C- Create)

**COs-PO/PSO Mapping for the courses:**

| POs / COs | POs | | | | | | | | | | | | PSOs | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 |
| CO-1 | 2 | 1 | 3 | 2 | 2 | - | - | 2 | 2 | 1 | 3 | 2 | 3 | 2 | 2 | 3 | 3 | 2 |
| CO-2 | 2 | 2 | 3 | 1 | 1 | 1 | - | 3 | 2 | 1 | 3 | 2 | 3 | 3 | 1 | 3 | 3 | 3 |
| CO-3 | 3 | 2 | 3 | 2 | 2 | - | - | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 2 | 2 |
| CO-4 | 3 | 2 | 3 | 1 | 2 | - | - | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 |
| CO-5 | 2 | 1 | 2 | 2 | 1 | 1 | - | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 3 | 2 | 1 | 2 |

"3"- Strong; "2"- Moderate; "1"- Low; "-"- No correlation

**Detailed Syllabus:**

| Unit | Topics | No. of Lectures |
|---|---|---|
| 01 | Introduction, Application Areas, Categories of embedded systems, Overview of embedded systems architecture, Specialties of embedded systems, challenges and issues in embedded software development Recent Trends, hardware architecture, Software architecture, core platform development, boot sequence, development/testing tools.<br><br>Fundamentals of Internet of Things (IoT) for communication and Cloud Computing | 15 |
| 02 | FPGA Architecture Introduction to Programmable logic, Basic Components of FPGA (LUT, CLB, Switch Matrix, IOB), Basic FPGA Architecture PIC Microcontrollers Introduction to PIC 16C6x/7x family microcontrollers, | 15 |



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| | | |
|---|---|---|
| | Architecture, Registers, Register File Structure, Addressing Modes, Instruction set. Interrupt Structure, Timers, Counters, I/O Port Concepts, Peripheral Interfacing and Applications, Basics of ARM Architecture: Introduction to ARM microprocessor and its features, Architecture, Programming model. CISC and RISC architecture comparison, advantages of RISC, Power saving methods | |
| **03** | Basic concept of Measurement, Performance & Static Characteristics, Error in Measurement, Types of Errors- Gross, Systematic & Random, Fundamental Concept Transducers – Resistance, Inductance, Capacitance, Piezoelectric, Thermoelectric, Hall effect, Photoelectric, Measurement of displacement, velocity, acceleration, force, torque, strain, temperature, pressure, flow, humidity, thickness, pH. Measuring Equipment – Measurement of R, L and C, Bridge and Potentiometers, voltage, current, power, energy, frequency/time, phase | **15** |
| **04** | Instrumentation Amplifiers, Basic Characteristics, D.C. Amplifiers, Isolation Amplifiers, Feedback Transducers system, feedback Fundamentals, Inverse Transducers, Temperature Balance System. Digital Multimeters, CRO, Digital Storage Oscilloscope, Spectrum Analyzer., Impedance analyzer, Advanced Instrumentation Systems Semiconductor sensors; smart sensors; micro sensors; IR radiation sensors; ultrasonic sensors; fibre optic sensors; chemical sensors; bio sensors; thermometry and thermography; nano instrumentation; environmental pollution monitoring | **15** |
| **05** | Introduction to biomedical instrumentation, sources of bioelectric potentials, electrodes- electrode theory, biopotential electrodes, biochemical transducers, cardiovascular measurements- electrocardiography, measurement of blood pressure, blood flow and heart sound, plethysmography, the elements of intensive care monitoring; calibration and reparability of patient monitoring equipment, pace makers. MEMS and its applications Sensors for IoT applications | **15** |

**Suggested Study material:**


1. Data Communication & Networking - Behrouz A Foruzon.
2. Wireless communications and networking" William Stallings, PHI
3. Data and Computer Communications – By William Stalling., 7th Ed., PHI
4. Mobile communications"- by Johan schiller, PEA, 2nd ED
5. Mobile and personal communications systems and services" Rajpandya, PHI
6. Computer Networks - Tanenbaum, PHI.
7. Data Communications and Distributed Networks, 3rd ed. Black PHI
8. Computer Networks: Protocols, Standards and Interfaces, 2nd ed. Black PHI




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## M.Sc. (Electronics) Semester-III

| Program | Subject | Year | Semester |
|---|---|---|---|
| MSc | Electronics | 2 | III |
| **Course Code** | **Course Title** | | **Course Type** |
| ELT302 | Data Communications, Mobile and Wireless Communication | | Core |
| **Credits** | **Total No. of Lectures- Tutorials - Practical ( in hours per week ):** | | |
| | **L** | **T** | **P** |
| 5 | 5 | 1 | 0 |
| **Maximum Marks** | **CIA** | | **ESE** |
| 100 | 30 | | 70 |

**Learning Objectives (LOs):**

| LO No. | Learning Objective |
|---|---|
| 1 | This paper aims to learn the basics of Data Communication, Mobile, and Wireless Communication |
| 2 | To introduce analysis and design of computer and communication networks |
| 3 | To understand the concept of mobile and broadcast systems, cellular systems, GSM models and satellite systems |
| 4 | To understand the infrastructure and ad-hoc networks, GPRS, Bluetooth, 3G technologies like UMTS, and mobile network and transport layers protocols |

**Course Outcomes (COs):**

| CO No. | Expected Course Outcome<br>At the end of the course, the students will be able to: | CL |
|---|---|---|
| 1 | Understand the types of communication modes, switching circuits, Network protocols and detailed knowledge of the network topology | U,An,Ap |



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| | | |
|---|---|---|
| 2 | Know modern multiple access schemes, the concept of frequency reuse, channel assignment strategies and estimate trucking and GOS | U,An |
| 3 | Understand GSM, CDMA concepts, architecture, frame structure, system capacity | U,An |
| 4 | Understand evolution of mobile communication generations 2G, 2.5G, and 3G with their characteristics and limitations | An,U |
| 5 | Understand emerging technologies required for fourth generation mobile system such as SDR, MIMO | An,U |
| 6 | Students will also able to build the basic concepts and ideas need to realize the working of 3G, Bluetooth, GPRS, and various network protocols | An,U,E |

CL: Cognitive Levels (R-Remember; U- Understand; Ap- Apply; An- Analyze; E- Evaluate; C- Create)

**COs-PO/PSO Mapping for the courses:**

| POs / COs | POs | | | | | | | | | | | | PSOs | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 |
| CO-1 | 3 | 3 | 2 | 2 | 1 | - | - | 3 | - | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 3 |
| CO-2 | 2 | 3 | 3 | 3 | - | - | - | 2 | - | 2 | 2 | 1 | 2 | 1 | 2 | 2 | 3 |
| CO-3 | 3 | 2 | 3 | 2 | 1 | - | - | 3 | - | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 |
| CO-4 | 2 | 3 | 2 | 2 | - | - | - | 3 | - | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 3 |
| CO-5 | 3 | 2 | 3 | 3 | - | - | - | 2 | - | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 3 |
| CO-6 | 3 | 3 | 3 | 2 | 1 | - | - | 3 | - | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 |

"3"- Strong; "2"- Moderate; "1"- Low; "-" No correlation

**Detailed Syllabus:**

| Unit | Topics | No. of Lectures |
|---|---|---|
| 01 | Data Signal, Signaling & Data Transmission Media, Communication Mode- Half Duplex/Full Duplex, Data Communication System- Synchronous/Asynchronous Transmission, Serial/Parallel Data, | 15 |



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| | | |
|---|---|---|
| | Switching & Multiplexing- Circuit Switching, Message Switching, Packet Switching, Network Topology- Bus/Star/Ring/Mesh Topology, LAN, OSI Reference Model, Network Protocol (TCP/IP) | |
| **02** | Mobile and wireless devices, history, applications wireless transmission, frequencies for radio transmission, regulations, signals, antennas, signal propagation, multiplexing, modulation, wireless LANs and wireless WANs, spread spectrum, FHSS and DSSS spread spectrum technology, cellular systems, medium access control, specialized MAC | **15** |
| **03** | GSM, mobile services, system architecture, GSM subsystems, GSM communication frame, localization and calling, handover, security, new data services, satellite systems applications, GEO, LEO. MEO, routing, localization, broadcast systems, cyclic repletion of data | **15** |
| **04** | Wireless LAN, infrared v/s radio transmission, infrastructure and adhoc networks, IEEE 802.11, architecture (details of protocol not required), DFWMAC schemes, MAC frames, MAC management, roaming, HIPERLAN (just basics, frame and protocol details not required), Bluetooth, applications, physical layer, modes MAC layer, packet format, networking security, link management, brief discussions (frame details and protocols not required) on GPRS, DECT, TETRA, UMTS, IMT-2000, CDPD | **15** |
| **05** | Mobile network layer, requirements, entities, IP packet delivery, agent advertisement and discovery, registration, encapsulation and tunneling, optimization, messages, reverse tunneling, IPv6, DHCP, Mobile IP, DHCP, ad-hoc networks, mobile transport layer, traditional TCP, indirect TCP, snooping TCP, mobile TCP, fast transmit/fast recovery, transmission/time out freezing, selective retransmission, transaction oriented TCP | **15** |

**Suggested Study material:**


1. Data Communication & Networking - Behrouz A Foruzon.
2. Wireless communications and networking" William Stallings, PHI
3. Data and Computer Communications – By William Stalling., 7th Ed., PHI
4. Mobile communications"- by Johan schiller, PEA, 2nd ED
5. Mobile and personal communications systems and services" Rajpandya, PHI
6. Computer Networks - Tanenbaum, PHI.
7. Data Communications and Distributed Networks, 3rd ed. Black PHI
8. Computer Networks: Protocols, Standards and Interfaces, 2nd ed. Black PHI




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## M.Sc. (Electronics) Semester-III

| Program | Subject | Year | Semester |
|---|---|---|---|
| MSc | Electronics | 2 | III |
| Course Code | Course Title | | Course Type |
| ELT303 | Power Electronics, Information Theory and Coding | | Core |
| Credits | Total No. of Lectures- Tutorials - Practical ( in hours per week ): | | |
| | L | T | P |
| 5 | 5 | 1 | 0 |
| Maximum Marks | CIA | | ESE |
| 100 | 30 | | 70 |

**Learning Objectives (LOs):**

| LO No. | Learning Objective |
|---|---|
| 1 | To introduce the students with the working of thyristor family. |
| 2 | To introduce the controlled rectifiers, AC Voltage Controllers, DC Choppers, inverters, UPS, AC motor, DC motor, and power conditioners |
| 3 | To acquaint students with the basics of probability, information and its properties |
| 4 | To familiarize students with different channel models and their capacity |

**Course Outcomes (COs):**

| CO No. | Expected Course Outcome<br>At the end of the course, the students will be able to: | CL |
|---|---|---|
| 1 | Able to understand the vital requirement of solid-state power electronics components and get acquainted with the working of thyristors, their characteristics and applications | Ap,U |



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| | | |
|---|---|---|
| **2** | Learned about the working of the controlled rectifiers, AC Voltage Controllers, DC Choppers, Inverters, UPS, AC motor, DC motor, and power conditioners | An,Ap,U |
| **3** | Comprehend and analyze the basics of probability, information and its properties | An,U |
| **4** | Examine different types of channels and determine their capacity | An |
| **5** | Understand the requirement of Shannon-Fano-Coding, Huffman Coding, Error-Control Coding | Ap,U |

CL: Cognitive Levels (R-Remember; U- Understand; Ap- Apply; An- Analyze; E- Evaluate; C- Create)

**COs-POs/PSOs Mapping for the course:**

| POs / COs | POs | | | | | | | | | | | | PSOs | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** | **4** | **5** |
| **CO-1** | 3 | 3 | 3 | 2 | 1 | - | - | 3 | - | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 3 |
| **CO-2** | 3 | 2 | 3 | 2 | 2 | - | - | 3 | - | 1 | 3 | 3 | 3 | 2 | 3 | 2 | 3 |
| **CO-3** | 2 | 3 | 3 | 3 | - | - | - | 3 | - | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 2 |
| **CO-4** | 2 | 2 | 3 | 2 | - | - | - | 2 | - | 1 | 2 | 2 | 3 | 3 | 2 | 3 | 3 |
| **CO-5** | 2 | 3 | 2 | 1 | 1 | - | - | 2 | - | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 3 |

"3"- Strong; "2"- Moderate; "1"- Low; "-" No correlation

**Detailed Syllabus:**

| Unit | Topics | No. of Lectures |
|---|---|---|
| **01** | Thyristors – Thyristor Characteristics, Two- transistor model of Thyristor, Turn ON and Turn OFF of Thyristor, di/dt protection, dv/dt protection, Type of Thyristors, Series operation and Parallel operation of Thyristors, Thyristor Firing Circuits,<br><br>Unijunction Transistor. Controlled Rectifiers – Single Phase semiconverter with RL load, Single Phase full converter with RL load | **15** |



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| | | |
|---|---|---|
| | Thyristor Commutation Techniques Natural Commutation, Forced Commutation, Self Commutation, Complementary Commutation, External Pulse Commutation, | |
| **02** | AC Voltage Controllers –Introduction, Principle of ON- OFF control, Principle of Phase control, Single Phase bi- directional controllers with inductive loads, Cycloconverters. C Choppers – Principle of operation, Classification of Choppers – Class A, Class B, Class C, Class D and Class E Choppers. Inverters- Introduction, classification of Invertors, Single phase, full bridge Voltage source inverter with RL load | **15** |
| **03** | DC Motor Basic Characteristics, Speed control of DC motors Armature voltage, Armature Resistance and Field flux controls, Solid state speed control of DC motor Single Phase half wave converter, Single phase full wave converter. AC Motor (Induction Motor) Construction & Principle, Speed control of Induction motor Stator voltage, Stator frequency, Pole changing, Rotor resistance and Slip power recovery control, Basic Construction and principle of Stepper motor and Servo motor | **15** |
| **04** | EMI/ RFI filter, CVT, Voltage regulators, Solid state regulators, UPS online & OFF line, reliability of UPS system. Batteries used for UPS, Important terms related to the UPS System & comparison of UPS system. Applications of Power Electronics: Electronic ballast, Power factor correction, Induction heating, Dielectric heating | **15** |
| **05** | Information Theory :Introduction, Unit of Information, Entropy, Rate of Information, Joint Entropy and Conditional Entropy, Mutual Information, Channel Capacity-noise-free channel, symmetric channel, Binary Symmetric channel & cascaded channel, Shannon's Theorem, Continuous Channel, Capacity of a Gaussian Channel: Shannon Hartley Theorem, Bandwidth S/N Trade- off.<br><br>Coding – Introduction, Coding Efficiency, Shannon- Fano Coding, Huffman Coding, Error- Control Coding, Block Codes, Convolution Codes | **15** |

**Suggested Study material:**


1. Power Electronics - Muhammad H. Rashid, Prentice Hall of India, Second Edition, New Delhi
2. Power Electronics - A.K. Gupta & L.N. Singh, Dhanpat Rai Publishing Company, 1st Edition
3. Power Electronics - J. Asger, PHI Publication.
4. Communication System - R.P.Singh & S.D. Sapre TMH Analog and Digital
5. Power Electronics - R.M. Jalnekar & N.B. Pasalkar




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6. Pspice Simulation of Power Electronic Circuits: Raymond Ramshaw
7. Communication Systems-Simon Haykin, John Wiley & sons, NY, 4th Edition
8. Information theory- F.M Reza, McGraw Hill
9. A Text book of Electrical Technology (Volume –II) - B. L. Thereja & A K Theraja, S Chand & Co. Ltd (2006)
10. Principles of Electrical Machines- V K Mehta & Mehta,S Chand & Co. Ltd (2006)
11. Elecrtrical Machines – A Hussain, Dhanpat Rai & Co



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## M.Sc. (Electronics) Semester-III

| Program | Subject | Year | Semester |
|---|---|---|---|
| MSc | Electronics | 2 | III |
| **Course Code** | **Course Title** | | **Course Type** |
| ELT304 | Photonics | | Elective |
| **Credits** | **Total No. of Lectures- Tutorials - Practical ( in hours per week ):** | | |
| | **L** | **T** | **P** |
| 5 | 5 | 1 | 0 |
| **Maximum Marks** | **CIA** | | **ESE** |
| 100 | 30 | | 70 |

**Learning Objectives (LOs):**

| LO No. | Learning Objective |
|---|---|
| 1 | To understand photonic devices which have emerged as the key technology for optical communications, environmental sensing, and biomedical diagnostics in the life sciences, energy-efficient lighting, and solar energy harvesting |
| 2 | To understand light as an electromagnetic wave and various Interaction between a photon and electron and its relevance to laser and various other optoelectronic devices |
| 3 | To understand optical radiation, radiometry & photometry, photovoltaic devices. Advanced photonics phenomena like Raman scattering, photorefractive effect, Photo thermal deflection effect, and Ultra-fast phenomena |
| 4 | To understand Solar Photovoltaic Technology and its generations |



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**Course Outcomes (COs):**

| CO No. | Expected Course Outcome<br>At the end of the course, the students will be able to: | CL |
|---|---|---|
| 1 | Understand the concept of light as a wave and the relevance of this to optical effects such as interference and diffraction and hence to lasers and optical fibers | Ap,U |
| 2 | Understand the area of silicon photonics which is an upcoming area of photonic integration with Electronics | U,E |
| 3 | Understand nonlinear optical processes and their applications | An,U |
| 4 | Understand the physical principles of the photovoltaic (PV) solar cell and what are its sources of losses | An,U |
| 5 | Understand and apply the basic concepts of solar radiation necessary for dimensioning (sizing) PV systems installations and know the electrical characteristics of solar cell, panel or generator and how the environment parameters influence it | U,Ap |
| 6 | Understand the concept, functioning and design of most photonic devices in use | U,Ap |

CL: Cognitive Levels (R-Remember; U- Understand; Ap- Apply; An- Analyze; E- Evaluate; C- Create)

**COs-POs/PSOs Mapping for the course:**

| POs / COs | POs | | | | | | | | | | | | PSOs | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 |
| CO-1 | 2 | 3 | 3 | 2 | 2 | - | - | 2 | - | - | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 |
| CO-2 | 2 | 3 | 3 | 3 | - | - | - | 2 | - | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 3 |
| CO-3 | 3 | 2 | 3 | 3 | - | - | - | 3 | - | - | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| CO-4 | 3 | 2 | 2 | 3 | 2 | - | - | 3 | - | 2 | 3 | 3 | 3 | 1 | 3 | 3 | 2 | 2 |
| CO-5 | 2 | 3 | 2 | 2 | 2 | - | - | 2 | - | 1 | 3 | 2 | 3 | 2 | 3 | 2 | 2 | 3 |
| CO-6 | 2 | 3 | 3 | 2 | - | - | - | 2 | - | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 |

"3"- Strong; "2"- Moderate; "1"- Low; "-" No correlatio



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**Detailed Syllabus:**

| Unit | Topics | No. of Lectures |
|---|---|---|
| 01 | Theory of Light, Light as Electromagnetic wave, Polarization of Light, Principle of superposition, Interference, Diffraction, Scattering, Photon nature of light, Light wave in homogeneous medium, Plane Electromagnetic Wave, Maxwells Wave equation and Diverging Waves. Basics of LED, and flexible display devices. Thin film deposition and characterization Techniques: XRD, TEM, SEM, EDX, Thin film active and passive devices | 15 |
| 02 | Optical fiber theory and applications, ages and disadvantages, parameters and types of optical fibers, Propagation of light through optical fiber ,single mode step index fiber, multimode step index fibers, multimode graded index fibers, Comparison of Three types of Optical fibers, Acceptance angle and acceptance cone, Numerical Aperture, , construction of optical fiber cables, Transmission Characteristics of Optical Fiber: Attenuation in Optical Fibers, loss mechanisms - absorption and Rayleigh scattering, Radiation losses, Wavelength dispersion, intermodal and intramodal, Bending losses, Coupling losses: misalignment and mismatch losses | 15 |
| 03 | Solar Photovoltaics: Solar cell materials and their properties. Solar cell research: technology (silicon, organic, Dye sensitized, peroviakites), applications and limitations. Characterization and analysis: ideal cell under illumination- solar cell parameters, optical losses; electrical losses, surface recombination velocity, quantum efficiency -measurements of solar cell parameters; I-V curve & L-I-V characteristics, internal quantum yield measurements effects of series and parallel resistance and temperature - loss analysis. Solar photovoltaic(PV) modules from solar cells, series and parallel connections, design and structure of PV modules | 15 |
| 04 | Non Linear Optical processes Introduction, Second Harmonic Generation,, susceptibility tensor, phase matching, propagation of EMW through second order nonlinear media, experimental technique in study second order non linearity Self Focussing and Defocussing, Optical Parametric Interactions, Chirped pulse amplifier, parametric oscillations, Optical Mixing, Four Wave Mixing, Multiphoton Absorption | 15 |
| 05 | Advances in Photonics and photonic Materials Emerging materials for future Devices: Graphene, Carbon Nano tubes (CNT), ZnO, SiC etc. Low dimensional semiconductor devices – quantum wells, quantum wires, quantum dots Silicon Photonics: Motivation towards silicon photonics, | 15 |



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| | | |
|---|---|---|
| | Silicon on Insulator (SOI) waveguides or nanowires .Optical fiber to silicon waveguide: edge, grating, evanescent coupling, spot-size converters. III-V integration with silicon photonics. Photonic modulators: electro-optical and thermo-optical effects. Raman Scattering, Photrefractive effect, Photothermal Deflection effect, Photorefraction in diffusing medium, Squeezed state, Optical Solitons, Optical Bistability, Optical interconnect, Photonic switches, Optical Computers, Ultrafast phenomena | |

**Suggested Study material:**


1. Optical Electronics - Ghatak Thyagarajan, University Press
2. Optoelectronics An Introduction: Wilson & Hawkes PHI
3. Optoelectronics & Photonics S.O.Kasap, Pearson
4. Optoelectronics Devices & Systems - S.C. Gupta, PHI Publication
5. Photonics Sasi Kumar PHI




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## M.Sc. (Electronics) Semester-III

| Program | Subject | Year | Semester |
|---|---|---|---|
| MSc | Electronics | 2 | III |
| **Course Code** | **Course Title** | | **Course Type** |
| ELT305 | Quantum Optics | | Elective |
| **Credits** | **Total No. of Lectures- Tutorials - Practical ( in hours per week ):** | | |
| | **L** | **T** | **P** |
| 5 | 5 | 1 | 0 |
| **Maximum Marks** | **CIA** | | **ESE** |
| 100 | 30 | | 70 |

**Learning Objectives (LOs):**

| LO No. | Learning Objective |
|---|---|
| 1 | To provide students with a deep understanding of quantum mechanics as applied to optical systems. |
| 2 | To learn about the generation, manipulation, and characterization of quantum states of light, including single photons, squeezed states, and coherent states. |
| 3 | To explore applications of quantum optics in quantum information processing and quantum communication. |
| 4 | To learn about optical measurement techniques for characterizing quantum states of light and optical devices. |

**Course Outcomes (COs):**

| CO No. | Expected Course Outcome<br>At the end of the course, the students will be able to: | CL |
|---|---|---|
| 1 | Discuss the basic theory of nonlinear optics including sum and difference frequency generation | An,U |



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| | | |
|---|---|---|
| 2 | Analyze the origin of optical bistability and its implications | Ap,An |
| 3 | Examine different mathematical transforms used in optical signal processing and compute the transforms of given functions | U,An,Ap |
| 4 | Construct spatial filtering geometries based on the Fourier transform property of lens | Ap,E |
| 5 | Describe the basic concepts of optical computing and optical neural networks and their practical implementation | U,An |

CL: Cognitive Levels (R-Remember; U- Understand; Ap- Apply; An- Analyze; E- Evaluate; C- Create)

**COs-POs/PSOs Mapping for the course:**

| POs / COs | POs | | | | | | | | | | | | PSOs | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 |
| CO-1 | 3 | 3 | 3 | 2 | 2 | - | - | 2 | - | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 1 | 3 |
| CO-2 | 3 | 2 | 2 | 3 | 1 | - | - | 1 | - | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 1 |
| CO-3 | 2 | 2 | 3 | 3 | - | - | - | 2 | - | 2 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 2 |
| CO-4 | 2 | 3 | 2 | 3 | - | - | - | 3 | - | 3 | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 3 |
| CO-5 | 3 | 3 | 3 | 2 | 2 | - | - | 2 | - | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 |

"3"- Strong; "2"- Moderate; "1"- Low; "-" No correlation

| Unit | Topics | No. of Lectures |
|---|---|---|
| 01 | Introduction: What is quantum optics, A brief history of quantum optics Classical optics Maxwell's equations and electromagnetic waves ,Electromagnetic fields ,Maxwell's equations ,Electromagnetic waves , Polarization , Diffraction and interference | 15 |
| 02 | Formalism of quantum mechanics , The Schrodinger equation, Properties of wave functions m, Measurements and expectation | 15 |



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| | | |
|---|---|---|
| | values, the uncertainty principle, The Stern–Gerlach experiment ,The band theory of solids | |
| **03** | Radiative transitions in atoms, Einstein coefficients, Radiative transition rates , Selection rules Photon statistics : Introduction, Photon-counting statistics, Coherent light, Classification of light by photon statistics, Coherent states and squeezed light , Light waves as classical harmonic oscillators , Light as a quantum harmonic oscillator , Coherent states , Squeezed states , Detection of squeezed light | **15** |
| **04** | Quantum information processing, Quantum cryptography, Classical cryptography , Basic principles of quantum cryptography Quantum key distribution according to the BB84 protocol , System errors and identity verification , Error correction , Identity verification , Practical demonstrations of quantum cryptography ,Quantum cryptography in optical fibres | **15** |
| **05** | Quantum computing: Introduction , Quantum bits (qubits) ,The concept of qubit, Quantum logic gates and circuits , Preliminary concepts Single-qubit gates , Two-qubit gates , Practical implementations of qubit operations optical realization of some quantum gates. | **15** |

**Reference Books:**


1. Quantum Optics by M. Fox, Oxford Master series in Atomic, Optical and Laser physics
2. Introductory Quantum Optics by C.C. Gerry and P.L. Knight, Cambridge University Press
3. Quantum Optics by M.O. Scully and M.S. Zubairy, Cambridge University Press
4. Quantum Theory of Light by R. Loudon, Oxford science publication




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## M.Sc. (Electronics) Semester-III

| Program | Subject | Year | Semester |
|---|---|---|---|
| MSc | Electronics | 2 | III |
| Course Code | Course Title | | Course Type |
| ELT306 | Optical Communication and Instrumentation Lab | | Core |
| Credits | Total No. of Lectures- Tutorials – Practical ( in hours per week ): | | |
| | L | T | P |
| 2 | 0 | 0 | 4 |
| Maximum Marks | CIA | | ESE |
| 100 | 30 | | 70 |

**Learning Objectives (Los):**

| LO No. | Learning Objective |
|---|---|
| 1 | To learn various optical components used in communication and instrumentation systems, such as lasers, optical fibers, modulators, detectors, and optical amplifiers. |
| 2 | To learn design and implement optical communication systems, including point-to-point links, wavelength-division multiplexing (WDM) systems, and fiber-optic networks. |
| 3 | To learn various optical instrumentation techniques used for measurement, analysis, and characterization of optical signals and devices. |
| 4 | Students will develop skills in system integration and troubleshooting in real-world optical communication and instrumentation scenarios. |



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**Course Outcomes (COs):**

| CO No. | Expected Course Outcome<br>At the end of the course, the students will be able to: | CL |
|---|---|---|
| 1 | Perform experiments based on the phenomenon of light/photons | Ap |
| 2 | Measure the parameters such as wavelength, resolving power, numerical aperture etc. using the appropriate photonic/optical technique | Ap |
| 3 | Understand Electronic instruments for experimentation | U,An |
| 4 | Apply the fundamental principles of optics and light wave to design optical fiber communication systems | Ap |
| 5 | Differentiate losses in optical fiber link and state transmission characteristics of optical fiber | An |
| 6 | Design optical fiber communication links using appropriate optical fibers light sources, detectors | An,E |

CL: Cognitive Levels (R-Remember; U- Understand; Ap- Apply; An- Analyze; E- Evaluate; C- Create)

**COs-POs/PSOs Mapping for the course:**

| POs / COs | POs | | | | | | | | | | | | PSOs | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 |
| CO-1 | 1 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO-2 | 3 | 2 | 3 | 3 | - | 3 | 2 | 3 | - | 2 | 3 | 2 | 3 | 2 | 1 | 3 | 2 | 3 |
| CO-3 | 3 | 2 | 2 | 2 | - | 2 | 2 | 2 | - | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 2 | 3 |
| CO-4 | 2 | 3 | 2 | 3 | - | 1 | 1 | 3 | - | 2 | 3 | 3 | 2 | 3 | 1 | 2 | 3 | 2 |
| CO-5 | 2 | 3 | 2 | 2 | 1 | 3 | 2 | 3 | - | 3 | 2 | 3 | 2 | 3 | 1 | 2 | 3 | 2 |
| CO-6 | 1 | 3 | 3 | 2 | 2 | 1 | 2 | 2 | - | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 |

"3"- Strong; "2"- Moderate; "1"- Low; "-" No correlation



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**List of Experiments:**

| S.N. | Name of Experiments |
|---|---|
| 1. | Study of setting up a fiber Optic Analog Link |
| 2. | Study of setting up a fiber Optic Digital Link |
| 3. | Study of Losses in Optical Fiber |
| 4. | Measurement of Numerical aperture of a optical fiber |
| 5. | Study of Manchester Coding & Decoding of optical signal |
| 6. | Study of Time Division Demultiplexing through fiber optic link –B |
| 7. | Measurement of Bit Error Rate of an optical signal through fiber optic link - B |
| 8. | Study of Eye Pattern of fiber through fiber optic ling –B |
| 9. | Design a Virtual Instrument of Half adder digital circuit using LabView/other simulator |
| 10. | Design a Virtual Instrument of Full adder digital circuit using LabView/other simulator |
| 11. | Design a Virtual Instrument of Half subtractor digital circuit using LabView/other simulator |
| 12. | Design a Virtual Instrument of Full subtractor digital circuit using LabView/other simulator |
| 13. | Design a Virtual Instrument. To find maximum & minimum amplitude of given waveform using LabView/other simulator |
| 14. | Design a Virtual Instrument to generate 81ultitoned waveform (sine & square) using LabView/other simulator |
| 15. | Design a Virtual Instrument to convert Analog waveform to Digital waveform using LabView/other simulator |
| 16. | Design a Virtual Instrument to convert Celcius into equivalent Fahrenheit using LabView/other simulator |

**Note: Student have to perform at least 15 experiment. Any other experiment of the same standard can be added.**



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## M.Sc. (Electronics) Semester-III

| Program | Subject | Year | Semester |
|---|---|---|---|
| MSc | Electronics | 2 | III |
| **Course Code** | **Course Title** | | **Course Type** |
| ELT307 | Embedded System Programming Lab | | Core |
| **Credits** | **Total No. of Lectures- Tutorials – Practical ( in hours per week ):** | | |
| | **L** | **T** | **P** |
| 2 | 0 | 0 | 4 |
| **Maximum Marks** | **CIA** | | **ESE** |
| 100 | 30 | | 70 |

**Learning Objectives (LOs):**

| LO No. | Learning Objective |
|---|---|
| 1 | To understand the embedded system architecture, including microcontrollers, peripherals, memory systems, and communication interfaces using programming. |
| 2 | Students will develop proficiency in programming embedded systems using Assembly languages. |
| 3 | To develop applications for embedded systems using real-time operating systems (RTOS) |
| 4 | Through hands-on exercises, students will learn to identify and resolve common software bugs and improve the overall efficiency of embedded system applications. |

**Course Outcomes (COs):**

| CO No. | Expected Course Outcome<br>At the end of the course, the students will be able to: | CL |
|---|---|---|
| 1 | Understand the requirement of the embedded system | U,Ap,An |



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| | | |
|---|---|---|
| 2 | Simple programs to understand the working of embedded system. | Ap |
| 3 | Interface various I/O devices with microcontroller. | Ap |
| 4 | Prepare the technical report on the experiments carried | An,E |
| 5 | Developed the ability to work with different types of sensors | Ap,An,E |

CL: Cognitive Levels (R-Remember; U- Understand; Ap- Apply; An- Analyze; E- Evaluate; C- Create)

**COs-POs/PSOs Mapping for the course:**

| POs / COs | POs | | | | | | | | | | | | PSOs | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 |
| CO-1 | 3 | 2 | 3 | 2 | 1 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 |
| CO-2 | 2 | 3 | 2 | 2 | - | 2 | 2 | 2 | 1 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 |
| CO-3 | 3 | 2 | 3 | 3 | - | 3 | 2 | 3 | 1 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 3 |
| CO-4 | 2 | 2 | 3 | 2 | - | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 2 |
| CO-5 | 3 | 3 | 3 | 1 | 1 | 3 | 2 | 3 | 1 | 2 | 3 | 2 | 3 | 2 | 2 | 2 | 2 | 3 |

"3"- Strong; "2"- Moderate; "1"- Low; "-" No correlation

**List of Experiments:**

| S.N. | Name of Experiments |
|---|---|
| 1. | Write a Program to find Multiplication of two 8- Bit Numbers. |
| 2. | Write a Program to find Division of two 8- Bit Numbers. |
| 3. | Write a Program to find the Factorial of a given numbers. |
| 4. | Write a Program to find out no. of Even & Odd no. in a given Data Series. |
| 5. | Write a Program to count Zero, Positive, Negative no. in a given Data Series. |
| 6. | Write a program to count the numbers which are divisible by 3 in a given Data Series. |
| 7. | Write a program to convert Binary Number to BCD Number. |
| 8. | Write a program to convert Binary Number to ASCII Number. |



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| | |
|---|---|
| **9.** | To Study & Analyze the Interfacing of 16×2 LCD. |
| **10.** | To Study & Analyze the Interfacing of 5×7 LED Matrix. |
| **11.** | To Study & Analyze the Interfacing of Seven Segment Display. |
| **12.** | To Study & Analyze the Interfacing of ADC & DAC Module. |
| **13.** | To Study & Analyze the Interfacing of DC Motor. |
| **14.** | To Study & Analyze the Interfacing of Stepper Motor. |
| **15.** | To Study & Analyze the Interfacing of LEDs. |
| **16.** | Find the Fourier transform and Inverse Fourier transform of a given sequence. |
| **17.** | Study the Linear convolution using DFT. |
| **18.** | Study the frequency shifting property of DTFT. |
| **19.** | Calculation of the DFT of a given sequence using FFT. |
| **20.** | Plotting of DFT of sinusoidal wave. |
| **21.** | find Z- Transform and Inverse Z-Transform of given signal. |
| **22.** | Find Inverse Z-Transform by the polynomial division method of<br>x(z) = (1+2*z^(-1)+z^(-2)/1-z^(-1)+0.3561*z^(-2)) |
| **23.** | find the parallel form realization of IIR filter. |
| **24.** | Study the response of low pass FIR Filter using Hanning Window. |
| **25.** | Plotting of pole-zero plot of FIR Filter<br>H(z) = 2+10Z^(-1)+23Z^(-2)+34Z^(-3)+31Z(-4)+16Z^(-5)+4Z^(-6) |

**Note: Student have to perform at least 15 program. Any other experiment of the same standard can be added.**



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**DETAILED SYLLABUS**

# Semester -IV



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## M.Sc. (Electronics) Semester-IV

| Program | Subject | Year | Semester |
|---|---|---|---|
| MSc | Electronics | 2 | IV |
| **Course Code** | **Course Title** | | **Course Type** |
| ELT401 | Digital Signal Processing | | Core |
| **Credits** | **Total No. of Lectures- Tutorials - Practical ( in hours per week ):** | | |
| | **L** | **T** | **P** |
| 5 | 5 | 1 | 0 |
| **Maximum Marks** | **CIA** | | **ESE** |
| 100 | 30 | | 70 |

**Learning Objectives (LOs):**

| LO No. | Learning Objective |
|---|---|
| 1 | To learn and understand the impact of digital signal processing (DSP). |
| 2 | Analyze the concepts of discrete time signals and systems in time and frequency domain with corresponding transformations |
| 3 | To introduce the diverse structures for realizing FIR and IIR digital filters |
| 4 | To introduce the digital of IIR, FIR filters with given specifications |

**Course Outcomes (COs):**

| CO No. | Expected Course Outcome<br>At the end of the course, the students will be able to: | CL |
|---|---|---|
| 1 | Comprehend, classify and analyze the discrete time signals and systems, also transform the time domain signals to frequency domain for analyzing system response | U,Ap |



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| | | |
|---|---|---|
| 2 | Able to understand and simplify DTFT,DFS, DFT and FFT computations | Ap,An |
| 3 | Comprehend the various mapping techniques for IIR filter design and their digitization | U,An,E |
| 4 | Able to design FIR digital filters | An,Ap |
| 5 | Able to realize digital filters using delay elements, summer, etc | Ap,E |
| 6 | Able to analyze and exploit the speech signal processing applications | An,Ap |

CL: Cognitive Levels (R-Remember; U- Understand; Ap- Apply; An- Analyze; E- Evaluate; C- Create)

**COs-POs/PSOs Mapping for the course:**

| POs / COs | POs | | | | | | | | | | | | PSOs | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 |
| CO-1 | 3 | 2 | 3 | 3 | 1 | - | - | 1 | - | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO-2 | 3 | 2 | 3 | 3 | - | - | - | 2 | - | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 3 |
| CO-3 | 2 | 2 | 3 | 3 | - | - | - | 2 | - | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 3 |
| CO-4 | 2 | 2 | 3 | 2 | 1 | - | - | 2 | - | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 2 | 3 |
| CO-5 | 2 | 2 | 3 | 2 | - | - | - | 2 | - | 1 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 |
| CO-6 | 2 | 2 | 3 | 3 | 1 | - | - | 1 | - | 1 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |

"3"- Strong; "2"- Moderate; "1"- Low; "-" No correlation

**Detailed Syllabus:**

| Unit | Topics | No. of Lectures |
|---|---|---|
| 01 | Discrete Time Signals, Systems and Z- Transform<br><br>Discrete Time Signals, Systems- An introduction to analog signal processing, Discrete time signals & systems- discrete time signals (sequences), Linear shift, Invariant systems, Stability & Causality, linear constant coefficient Differential equations, Frequency domain representation of discrete time systems & signals, Sampling of continuous time signals. | 15 |



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| | | |
|---|---|---|
| | Z- Transform- Introduction, Z- transforms (of finite length sequences, Right sided, left sided & two sided sequences) Inverse Z- transform, Z-transform theorems & properties –Region of convergence of rational Z-transform, Linearity, Shift of a sequence, multiplication by an exponential sequence, Initial value theorem, Convolution of sequences, system functions | |
| **02** | Discrete time Fourier transform (DTFT), Representation of periodic sequence - Discrete Fourier series(DFS), Properties of the Discrete Fourier series- Linearity, Shift of a sequence, symmetry properties, periodic convolution; Fourier representation of finite duration sequences- The Discrete Fourier transform(DFT), Properties of discrete Fourier transform<br>- Linearity, Circular shift of a sequence, Symmetry Properties, Circular convolution, Linear Convolution using the Discrete Fourier Transform | **15** |
| **03** | Fast Fourier Transform (FFT), Inverse DFT, Radix FFT.<br>Signal Flow Graph Representation of Digital Network, Matrix Representation of digital Networks, Basic network structures for IIR systems (Direct form, cascaded form, and parallel form) Transposed forms, Basic network structures for FIR systems (direct form, cascaded form) | **15** |
| **04** | Digital filter design techniques- design of IIR digital filters from analog filters, impulse invariance, Bilinear Transformation, Design examples: Analog- Digital Transformation –Digital Butterworth Filters (impulse invariance, bilinear transformation), Digital Chebyshev filters (impulse invariance, bilinear transformation), Comparison of IIR and FIR Digital Filters | **15** |
| **05** | Finite impulse response (FIR) Filter Design, Rectangular, Triangular, Hanning, Hamming, Blackman and Kaiser Window, Linear phase and Optimal Filter . Application Digital Signal Processing-speech processing, speech analysis- short term Fourier analysis, cepstral analysis & linear predictive analysis, speech coding, channel vocoder | **15** |

**Suggested Study material:**


1. Digital Signal Processing - A.V. Oppenheim & Schafer. PHI
2. Discrete Time Signal Processing - A.V. Oppenheim & Schafer. PHI
3. Digital Signal Processing - Johny Jonson, Pearson PHI
4. Digital Signal Processing - Proakis
5. Digital Signal Processing - Vallavaraj, Salivahanan, Ghanapriya, THM




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## M.Sc. (Electronics) Semester-IV

| Program | Subject | Year | Semester |
|---|---|---|---|
| MSc | Electronics | 2 | IV |
| Course Code | Course Title | | Course Type |
| ELT402 | Optical and Satellite Communication | | Core |
| Credits | Total No. of Lectures- Tutorials - Practical ( in hours per week ): | | |
| | L | T | P |
| 5 | 5 | 1 | 0 |
| Maximum Marks | CIA | | ESE |
| 100 | 30 | | 70 |

**Learning Objective (LO):**

| LO No. | Learning Objective |
|---|---|
| 1 | Apply the fundamental principles of optics and light wave to design optical fiber communication systems |
| 2 | Design optical fiber communication links using appropriate optical fibers light sources, detectors |
| 3 | Fabrication process of fiber optic cables |
| 4 | To understand different kinds of losses, signal attenuation in optical fibres & other dispersion factor |

**Course Outcomes (COs):**

| CO No. | Expected Course Outcome<br>At the end of the course, the students will be able to: | CL |
|---|---|---|
| 1 | Apply the fundamental principles of optics and light wave to design optical fiber communication systems | Ap |



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| | | |
|---|---|---|
| 2 | Understand the types and fabrication process of fiber optic cable, calculation of losses during transmission in fiber, optical source, and detector require for optical communication | U,An |
| 3 | Differentiate losses in optical fiber link and state transmission characteristics of optical fiber for designing and operating of modern optical systems and networks | An |
| 4 | Students will be able to design Satellite Link, calculate the satellite's Look Angles and Antenna parameters like Gain, Resistance, Bandwidth, Beam-width. Explain and analyzes link budget of satellite signal for proper communication | An |
| 5 | Use the different application of satellite communication | Ap |

CL: Cognitive Levels (R-Remember; U- Understand; Ap- Apply; An- Analyze; E- Evaluate; C- Create)

**COs-POs/PSOs Mapping for the course:**

| POs / COs | POs | | | | | | | | | | | | PSOs | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 |
| CO-1 | 2 | 3 | 1 | 3 | 3 | - | - | 2 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 |
| CO-2 | 3 | 3 | 3 | 3 | 1 | - | - | 1 | - | 3 | 2 | 2 | 2 | 1 | 1 | 3 | 3 | 2 |
| CO-3 | 2 | 3 | 3 | 2 | 2 | - | - | 1 | - | 2 | 3 | 3 | 3. | 2 | 2 | 3 | 2 | 3 |
| CO-4 | 3 | 3 | 2 | 3 | 1 | - | - | 1 | - | 3 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 2 |
| CO-5 | 2 | 2 | 3 | 3 | 2 | - | - | 2 | - | 2 | 3 | 2 | 3 | 2 | 1 | 3 | 2 | 3 |

"3"- Strong; "2"- Moderate; "1"- Low; "-" No correlation

**Detailed Syllabus:**

| Unit | Topics | No. of Lectures |
|---|---|---|
| 01 | Optical Fiber Communication System Block Diagram<br>Optical sources: Heterojunction LED, Edge emitting LEDs, Injection Laser LEDs<br>Light Detectors: PIN Diode and Avalanche Photodiode, Structure of In, GaAs APDs Characteristics of Light Detectors, Connector types | 15 |



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| | | |
|---|---|---|
| | and splices, Optical Fiber System Link Budget, Optical fiber manufacturing processes. Optical fiber testing and parameter (cut off Wavelength, loss per unit length, numerical aperture, bending loss, connector/spliceloss) measurement | |
| **02** | Typical Fiber Optic Communication System, Optical Transmitter, Optical Receiver, Optical Repeaters, Optical Amplifiers, semiconductor optical amplifiers, EDFA, Raman Amplifier. Basic idea of WDM and DWDM systems, System Architecture: Point to point link, Distributed Network, AN Fiber Optic Sensors in Health care, Optical Computing, Optical Logic Gates | **15** |
| **03** | Guide Wave Integrated Optic Devices: Planar and channel waveguides, Waveguide platforms on various materials and their fabrication techniques. Waveguide directional couplers, tapered waveguides and Y-junction splitters/combiners, Ring resonators, Mach-Zehnder interferometers/modulators. Sagnac interferometer/gyroscope. Coupling in and out of Photonic Integrated Circuits: Optical mode converters, prism and grating couplers. Wavelength-division multiplexing components: Mulitplexers, Demultiplexers, Multimode interferometers, Arrayed waveguide gratings | **15** |
| **04** | Satellite Communication Introduction, Keplers laws, orbit, Power systems, Satellite Frequency Allocations and Band Spectrum, Elements of a Satellite Communication System, Active and Passive Satellites, Modem and Codec, Communication Satellite Link Design General Link Design Equations, Effective Isolated Radiated Power (EIRP), System Noise Temperature, C/N and G/T ratio, Atmospheric and Ionosphere Effects on Link Design, Uplink Design, Complete Link Design, Interference Effects on complete link design, Earth Station parameters | **15** |
| **05** | Satellite orbits – synchronous orbit, orbital parameters, Satellite location with respect to the earth, Look Angles, Earth coverage and Slant range. Satellite Transponder model, Satellite RF Front End, Satellite Carrier Processing, Antenna – Antenna parameters, Gain, Resistance, Bandwidth, Beam-width and polarization, Parabolic antenna, Application of Satellite Communication in Television - Direct Home Broadcast, Telephone services and Data Communication | **15** |

**Suggested Study material:**

1. Optical Fiber Communication - G. Keiser, Mc. Graw Hill
2. Fiber Optics Communication - D. C. Agrawal
3. Satellite Communication - D.C. Agrawal, Khanna Pub.



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4. Satellite Communication - R.M. Gagliardi
5. Fundamentals of Optical Fibre Communication: Satish Kumar PHI
6. Optical fibre and Laser Anuradha De New Age International Publishers
7. Optical Fiber Communication: V.S.Bagad Technical Publications
8. Optical Fiber Communications', John Senior: PHI.
9. Electronic communications, Roddy and Coolen, PHI, New Delhi,



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## M.Sc. (Electronics) Semester-IV

| Program | Subject | Year | Semester |
|---|---|---|---|
| MSc | Electronics | 2 | IV |
| **Course Code** | **Course Title** | | **Course Type** |
| ELT403 | Automatic Control System and Artificial Neural Network | | Elective |
| **Credits** | **Total No. of Lectures- Tutorials - Practical ( in hours per week ):** | | |
| | **L** | **T** | **P** |
| 5 | 5 | 1 | 0 |
| **Maximum Marks** | **CIA** | | **ESE** |
| 100 | 30 | | 70 |

**Learning Objective (LO):**

| LO No. | Learning Objective |
|---|---|
| 1 | To provide adequate knowledge in the time response of systems and steady state error analysis along with the understanding of closed loop and open loop in frequency domain |
| 2 | To understand the use of transfer function models for the analysis of physical systems and to introduce the components of control system |
| 3 | To introduce single-layered- feed-forward and multi-layered feed-forward neural network, multi-layered perceptions model with the back-propagation algorithm |
| 4 | To introduce state variable representation of physical systems and study the effect of state feedback |

**Course Outcomes (COs):**

| CO No. | Expected Course Outcome<br>At the end of the course, the students will be able to: | CL |
|---|---|---|



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| | | |
|---|---|---|
| 1 | Differentiate real-time applications as open loop or closed loop systems and analyze the system from the transfer function | An,E |
| 2 | Design of controllers and find the stability of these control systems | An,E |
| 3 | Ability to compute steady state and transient response of the different order of the system and also to analyze its error coefficients | An,Ap |
| 4 | Analyze the frequency domain response of the control systems | An,U |
| 5 | Analyze the controllability and observability of the system in state modeling | An,U |

CL: Cognitive Levels (R-Remember; U- Understand; Ap- Apply; An- Analyze; E- Evaluate; C- Create)

**COs-POs/PSOs Mapping for the course:**

| POs / COs | POs | | | | | | | | | | | | PSOs | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 |
| CO-1 | 3 | 2 | 2 | 2 | 1 | - | - | 3 | 1 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 3 |
| CO-2 | 2 | 3 | 2 | 3 | 1 | - | - | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 1 | 3 |
| CO-3 | 3 | 2 | 1 | 2 | - | - | - | 2 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO-4 | 2 | 3 | 2 | 3 | 1 | - | - | 2 | 2 | 1 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 3 |
| CO-5 | 3 | 2 | 1 | 2 | - | - | - | 3 | 2 | 1 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 3 |

"3"- Strong; "2"- Moderate; "1"- Low; "-" No correlation

**Detailed Syllabus:**

| Unit | Topics | No. of Lectures |
|---|---|---|
| 01 | Basic Definition, Classification of Control System, Open Loop & Closed loops System, Effect of feedback on System response, Impulse Response & Transfer Function, Block diagram, Block Diagram Reduction Techniques. Signal Flow Graph- Basic Definition in SFG, Rule for SFG, Properties of SFG, Masons Gain Formula | 15 |



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| | | |
|---|---|---|
| **02** | Time Response of Continuous Data system, test Signal, Steady State Errors and error constants, Unit Step response, Time Domain specifications, time Response of first order System, Transient Response of Prototype second order System, effect of adding a zero to the system, Stability of Linear Control System- Absolute Stability, Relative Stability, Routh- Hurwitz Criterion- Ruth Tabulation, Special Cases | **15** |
| **03** | Frequency Domain Analysis - Frequency Response of closed loop control System, Frequency Domain Specifications of prototype Second Order System, Nyquist Stability Criterion and plot, Root Loci- basic properties, Relative Stability- Gain Margin & Phase Margin, Correlation Between Time & Frequency response, Polar Plot, Bode Plot | **15** |
| **04** | State Variable Analysis and Design – Concept of state variables, state model, state model for linear continuous time system, diagonalization, solution of state equations, concept of controllability and observability, PID Controller, Theory of lag, lead and lag-lead compensators | **15** |
| **05** | Introduction to ANS Technology- Models of a neuron, neural networks, viewed as directed graph, feedback from neurons to ANS, Learning and training- Hebbian, memory based, competitive, error- correction and learning. Assignment problem supervised and unsupervised learning. Network architectures- Single layered- feed forward networks, multi-layered feed forward networks, Activation and Synaptic Dynamic. Stability and convergence- single layered perception - least mean square algorithm, multilayered perceptions - back propagation algorithm | **15** |

**Suggested Study material:**


1. Control systems Theory & Application - Samarajit Ghosh (Pearson Edu)
2. Control System Engineering - B.C.Kuo(PHI)
3. Control Systems Engineering - I.J. Nagrath, M. Gopal
4. Artificial Neural networks - B. Yagna Narayan
5. Neural Computing - Philips D. Wasserman Theory and practice - Vannostrand Reinhold




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## M.Sc. (Electronics) Semester-IV

| Program | Subject | Year | Semester |
|---|---|---|---|
| MSc | Electronics | 2 | IV |
| **Course Code** | **Course Title** | | **Course Type** |
| ELT404 | Sensors & Actuators | | Elective |
| **Credits** | **Total No. of Lectures- Tutorials - Practical ( in hours per week ):** | | |
| | **L** | **T** | **P** |
| 5 | 5 | 1 | 0 |
| **Maximum Marks** | **CIA** | | **ESE** |
| 100 | 30 | | 70 |

**Learning Objective (LO):**

| LO No. | Learning Objective |
|---|---|
| 1 | To understand the principles underlying sensors and actuators, including sensing mechanisms, transduction techniques, and actuation principles. |
| 2 | Learn to select appropriate sensors and actuators for specific applications based on criteria such as sensing range, resolution, accuracy, response time, power consumption, and environmental conditions. |
| 3 | To learn calibration and characterization techniques for sensors and actuators to ensure accurate and reliable operation. |

**Course Outcomes (COs):**

| CO No. | Expected Course Outcome<br>At the end of the course, the students will be able to: | CL |
|---|---|---|
| 1 | Describe fundamental physical and technical base of sensors and actuators | U,An |
| 2 | Illustrate the concept of inductor & capacitor transducer | An,U |



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| | | |
|---|---|---|
| 3 | Analyze various premises, approaches, procedures and results related to sensors and actuators | An,U |
| 4 | Create analytical design and development solutions for micro sensors and micro actuators | E,An |
| 5 | Comprehend the basics of sensor materials & processing techniques | U,Ap,E |

CL: Cognitive Levels (R-Remember; U- Understand; Ap- Apply; An- Analyze; E- Evaluate; C- Create)

**COs-POs/PSOs Mapping for the course:**

| POs / COs | POs | | | | | | | | | | | | PSOs | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 |
| CO-1 | 3 | 2 | 2 | 2 | 1 | - | - | 3 | 1 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 3 |
| CO-2 | 2 | 3 | 2 | 3 | 1 | - | - | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 1 | 3 |
| CO-3 | 3 | 2 | 1 | 2 | - | - | - | 2 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO-4 | 2 | 3 | 2 | 3 | 1 | - | - | 2 | 2 | 1 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 3 |
| CO-5 | 3 | 2 | 1 | 2 | - | - | - | 3 | 2 | 1 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 3 |

"3"- Strong; "2"- Moderate; "1"- Low; "-" No correlation

**Detailed Syllabus:**

| Unit | Topics | No. of Lectures |
|---|---|---|
| 01 | Sensors: Difference between sensor, Transmitter and transducer, Primary measuring elements, Selection and characteristics: Range, Resolution, Sensitivity, Error, Repeatability, Linearity and accuracy, Impedance, Backlash, Response time, Dead band.<br><br>Signal transmission: Types of signal, Principle of operation, Construction details, Characteristics and applications of potentiometer, Proving rings, Strain gauges, Resistance thermometer, Thermistor, Hot-wire anemometer, Resistance hygrometer, Photo-resistive sensor. | 15 |
| 02 | Inductive & Capacitive Transducer: Inductive transducers: Principle of operation, construction details, characteristics and applications of LVDT, | 15 |



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| | | |
|---|---|---|
| | Induction potentiometer, Variable reluctance transducer, Synchros, Microsyn. Capacitive transducers: Principle of operation, construction details, characteristics of capacitive transducers, Different types & signal conditioning, Applications: capacitor microphone, capacitive pressure sensor, proximity sensor. | |
| **03** | Actuators: Definition, Types and selection of actuators, Linear, Rotary, Logical and continuous actuators, Pneumatic actuator, Electro-pneumatic actuator, Cylinder, Rotary actuators, Mechanical actuating system: Hydraulic actuator, Control valves, Construction, characteristics and types, Selection criteria. Electrical actuating systems: Solid-state switches, Solenoids, Electric motors- Principle of operation and its application: D.C motors, AC motors, Single phase & 3 phase induction motor, Synchronous motor, Stepper motors, Piezoelectric actuator. | **15** |
| **04** | Micro Sensors and Micro Actuators Micro Sensors: Principles and examples, Force and pressure micro sensors, Position and speed micro sensors, Acceleration micro sensors, Chemical sensors, Biosensors, Temperature micro sensors and flow micro sensors. Micro Actuators: Actuation principle, Shape memory effects-one way, Two way and pseudo elasticity, Types of micro actuators. | **15** |
| **05** | Sensor Materials and Processing Techniques: Materials for sensors: Silicon, Plastics, metals, Ceramics, Glasses, Nano materials, Processing techniques: vacuum deposition, sputtering, chemical vapor deposition, electro plating, photolithography, silicon micro machining, Bulk silicon micro machining, Surface silicon micro machining, LIGA process. | **15** |

**Suggested Study material:**


1. Patranabis.D, "Sensors and Transducers", Wheeler publisher, 1994.
2. Sergej Fatikow and Ulrich Rembold, "Microsystem Technology and Macrobiotics", First edition, Springer –Verlag NEwyork, Inc, 1997.
3. Jacob Fraden, "Hand Book of Modern Sensors: Physics, Designs and Application" Fourth edition, Springer, 2010.
4. Robert H Bishop, "The Mechatronics Hand Book", CRC Press, 2002.
5. Thomas. G. Bekwith and Lewis Buck.N, Mechanical Measurements, Oxford and IBH publishing Co. Pvt. Ltd.,
6. Massood Tabib and Azar, "Micro actuators Electrical, Magnetic, thermal, optical, mechanical, chemical and smart structures", First edition, Kluwer academic publishers, Springer, 1997.
7. Manfred Kohl, "Shape Memory Actuators", first edition, Springer.




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## M.Sc. (Electronics) Semester-IV

| Program | Subject | Year | Semester |
|---|---|---|---|
| MSc | Electronics | 2 | IV |
| **Course Code** | **Course Title** | | **Course Type** |
| ELT405 | Project Work & Seminar | | Core |
| **Credits** | **Total No. of Lectures- Tutorials - Practical ( in hours per week ):** | | |
| | **L** | **T** | **P** |
| 10 | 0 | 0 | 18 |
| **Maximum Marks** | **CIA** | | **ESE** |
| 200 | 60 | | 140 |

| Learning Objective: |
|---|
| The course is designed to facilitate the student to acquire special/advanced knowledge, such as supplement study/support study/ solving / analyzing /exploring a real life situation / difficult problem into a project work. The candidate studies this course on his own with an advisory support by a teacher/faculty member. |

**Course Outcomes (COs):**

| CO No. | Expected Course Outcome<br>At the end of the course, the students will be able to: | CL |
|---|---|---|
| 1 | Survey and study of published literature on the assigned topic | U,An |
| 2 | Working out a preliminary Approach to the Problem relating to the assigned topic | An,U,E |
| 3 | Conducting preliminary Analysis/ Modelling/ Simulation/ Experiment/ Design/ Feasibility | Ap,U,E |



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| | | |
|---|---|---|
| 4 | Preparing a Written Report on the Study conducted for presentation to the Department Final Seminar, as oral Presentation before a departmental committee | Ap,An |
| 5 | Work on innovative projects and future work | Ap,An,E |

CL: Cognitive Levels (R-Remember; U- Understand; Ap- Apply; An- Analyze; E- Evaluate; C- Create)

**COs-POs/PSOs Mapping for the course:**

| POs / COs | POs | | | | | | | | | | | | PSOs | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 |
| CO-1 | 3 | 3 | 2 | 1 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 |
| CO-2 | 3 | 2 | 2 | 2 | 3 | 1 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |
| CO-3 | 3 | 3 | 2 | 1 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 2 |
| CO-4 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

"3"- Strong; "2"- Moderate; "1"- Low; "-" No correlation

**Detailed Syllabus:**

| **Project work and Seminar** |
|---|
| • The students are expected to take up a Project under the guidance of a faculty from the institute.<br>• The topic of the project should be justified for the degree of M.Sc. Electronics.<br>• The project selected should ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivities.<br>• Execution and documentation of a project on a specific topic with one of the following aspects:<br>1. Part of ongoing research projects in the department<br>2. Developmental work related to industry requirements<br>3. State of the art new technological studies |



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4. Theoretical and experimental studies
5. Development of prototypes in the finished product form
6. Technical Writing and Project Documentation
7. Presentation and Appreciation.

- Contents:
  1. Identification of research problem
  2. Survey of literature
  3. Formulation of hypothesis, design and methodology
  4. Analysis of data and interpretation of results
  5. Discussion and conclusion
  6. Writing a project report
- The students may be asked to work individually or in a group having not more than THREE students.
- The students/group of students shall collect all necessary information from literature on selected topic/project.
- It should include the scope of project, identification of necessary data, source of data, development of design method and identification, methodology, software analysis.
- The students are expected to submit the report in standard format approved by university.
- Students should deliver a **Seminar** on selected project/topic.
- There will be an external viva-voce at the end of the semester and the students are demonstrate the project at the time of viva-voce.

**Note:** Project work will involve investigative work and the student will have to do this in the time after their regular theory and practical classes. The final evaluation of the project work will be through a committee involving internal and external examiners. Guidelines provided by University for executing and evaluation of project work will be final.

**Activities with direct bearing on Employability/ Entrepreneurship/ Skill development:**
It helps to development of skill of presentation and project planning



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## Guidelines for preparing the Project Report

### I. General Guidelines

- The report must be written in English and be word processed on single side of paper. The numbers of pages should not exceed 100.
- Every chapter must begin on new page.
- Page numbers are mandatory and should be in Arabic numerals put at the bottom (center) with all preliminary pages numbered in lower case Roman script.
- Spell checks should be carried out.
- Equations, figures and tables should be numbered as per the chapter number (E.g. Fig. 3.1 for first figure in chapter 3) and they should be cited in the text in proper and suitable manner.
- Appropriate Caption to each figure and Heading to each table should be provided.
- Maintain uniformity in writing the report.
- Reports are to be bound in sky blue colored hard cover with written materials in black script on the cover page of the report.

### II. Report Format

- Report Title Page (Outer Cover) as per the format given to students by department
- Report Title Page (Inner Cover) as per the format given to students by department
- Declaration by the students
- Certificate from Supervisor/s
- Certificate from Examiners
- Acknowledgements
- Abstract
- Table of Contents
- List of Tables
- List of Figures
- Chapters
- Appendix
- References



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## III. Components of the Report

- **Preliminary Pages**
  The preliminary pages must include the title page, the certificates, acknowledgements, abstract, Table of Contents, List of Tables and List of Figures.

- **Abstract**
  The Abstract should be a comprehensive restatement of the document's purpose, scope, methods, results, conclusions, findings, and recommendations. The length should not exceed one page.

- **Introduction**
  The introduction provides the students with background information for the project work. Its purpose is to establish a framework, so that the students can understand how it is related to other area. The Introduction has multiple purposes, namely to create student interest in the topic or the motivation, objectives of the problem that leads to the study, and the contribution made by the students.

- **Literature Review and Theory**
  This should deal with review of the associated theory or the related background of their work. It shares with the students the results of other studies that are closely related to the study being reported and provides a framework for establishing the importance of the study. It can serve as a benchmark for comparing the results of the study with other findings.

- **Methodology**
  This section specifies the design utilized in the proposed work. It should detail the context of their work, indicating how the design was selected, discuss techniques for data collection, and explain the underlying rationale for these decisions. It may be useful to discuss the strengths and weaknesses of the chosen design.

- **Results Analysis and Discussions**
  The analysis compares the findings of the study. It may point out similarities and differences, agreements and contradictions, and explanations for these relationships.

- **Conclusions, Future Scope and Reference**
  Although this section does not need to be long, the students have an opportunity to tie up loose ends, summarize findings, and draw inferences. Specific recommendations are a good way of concluding the report. The students should recommend possible changes in current practices, suggest new methods or analysis, or propose changes. Students should be include their references.

## IV. Typing of the Project Report

- Type of paper: Executive bond (white)



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- Paper size: A4 size
- Font: Times new roman
- Font size ( chapter title): 22 bold
- Font size ( heading): 16 bold
- Font size( sub heading): 14 bold
- Font size ( body of the text): 12 normal
- Font size (footnote): 10 normal
- Margins: Normal
- Line spacing: 1.5, with space after paragraph
- Text alignment: Justified
- Equation: Right aligned



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**Generic Elective Courses**

**CBCS II Semester**

**ELT501 Basics of Electronics**

**Learning Objectives (LOs):**

| LO No. | Learning Objective |
|---|---|
| 01. | This course introduces students to the basic components of electronics: diodes, transistors, op amps and Optoelectronics devices. It covers the basic operation and some common applications. |

**Course Outcomes (COs):**

| CO No. | Expected Course Outcome<br>At the end of the course, the students will be able to: | CL |
|---|---|---|
| 1 | Student will able to develop a basic understanding in the area of electronics. | U,Ap |
| 2 | Student will become aware about the electronics components and devices used in the daily life. | U,An |

CL: Cognitive Levels (R-Remember; U- Understand; Ap- Apply; An- Analyze; E- Evaluate; C-Create)

**COs-POs/PSOs Mapping for the course:**

| POs / COs | POs | | | | | | | | | | | | PSOs | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 |
| CO-1 | 3 | 2 | 3 | 2 | - | - | 1 | 2 | 1 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO-2 | 3 | 3 | 3 | 2 | - | - | 2 | 2 | 1 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 2 |

"3"- Strong; "2"- Moderate; "1"- Low; "-" No correlation



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**Detailed Syllabus:**

| Unit | Topics | No. of Lectures |
|---|---|---|
| 1 | **Basic Electronics:** Introduction, Applications, Concepts of charge, potential, voltage, current, power and their units, Active and passive components | 12 |
| 2 | **Basic concepts and resistor circuits:** Resistor and its color codes, AC signals<br><br>**AC circuits:** Introduction, Capacitors, Inductors RC circuits, Response to a sine wave | 12 |
| 3 | **Overview of Analog circuitry:** Introduction to semiconductors, Conductors, Insulators, Diode and its type, Transistor and its types- NPN & PNP, Transistor as an amplifier and switch. Introduction to MOSFETS, Operational Amplifiers and Integrated Circuits | 12 |
| 4 | **Optoelectronic Devices:** LED, Solar cell, Photo diode: definition, working principle, structure, characteristics and responces | 12 |
| 5 | **Digital Electronics-** Analog vs digital signals, Concept of amplitude and frequency, Number system and their conversions, Boolean arithmetic, De – Morgan laws, basic logic gates: their realization, Universal gates, Exclusive – OR and Exclusive NOR-gates, half adder, full adder, half subtractor | 12 |

**Suggested Study material:**


1. Basic Electronics for Scientists and Engineers, Dennis L. Eggleston, Cambridge University Press.
2. Basic Electronics and Linear Circuit by N. N. Bhargava, DC Kulshreshtha and S. C. Gupta,Tata McGraw-Hill
3. Electronic Devices and Circuit Theory, 9th ed. Boylestad&Nashelsky, PHI
4. Digital Principal and Application - Malvino Leach, Tata Macgraw Hill
5. Modern Digital Electronics - R.P. Jain, Tata Mcgraw
6. Basic Electronics Solid State by B. L. Thereja, S Chand
7. Electronic Devices & Circuit Analysis – K Lal Kishore, BS Publications




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**CBCS III Semester**

**ELT502 Fundamentals of Biomedical Equipments**

**Learning Objective (LO):**

| LO No. | Learning Objective |
|---|---|
| 01. | This course constructs the foundation of concept to introduce the biomedical instruments. It will also familiarize the students with some biomedical diagnostic and treatment instruments. |

**Course Outcomes (COs):**

| CO No. | Expected Course Outcome<br>At the end of the course, the students will be able to: | CL |
|---|---|---|
| 1 | Student will able to develop a basic understanding of biomedical equipment. | U,Ap |
| 2 | Student will become aware about the working of some human organs as well as devices used in the diagnostic and treatment. | U,An,Ap |
| 3 | It helps to understand the Fundamentals of Biomedical Equipments | U,Ap |

CL: Cognitive Levels (R-Remember; U- Understand; Ap- Apply; An- Analyze; E- Evaluate; C-Create)

**COs-POs/PSOs Mapping for the course:**

| POs / COs | POs | | | | | | | | | | | | PSOs | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 |
| CO-1 | 3 | 2 | 3 | 2 | - | - | 1 | 2 | 1 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO-2 | 3 | 3 | 3 | 2 | - | - | 2 | 2 | 1 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 2 |
| CO-3 | 3 | 2 | 3 | 2 | - | - | 1 | 2 | 1 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |

"3"- Strong; "2"- Moderate; "1"- Low; "-" No correlation



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**Detailed Syllabus:**

| Unit | Topics | No. of Lectures |
|---|---|---|
| 1 | **Basics of measuring instruments of electronics:** Overview of electricity, Circuit basics, Concept of various measuring parameters- voltage, current, power, ohm's law, Kirchhoff's law. | 12 |
| 2 | **Network Theorems**: Thevenin's theorem, Norton's theorem, maximum power transfer | 12 |
| 3 | **Biomedical equipment overview:** Electronics and Medicine, medical electronics, Importance of measuring instruments in Biomedical, Overview of Electrocardiograph- operation, origin of the ECG waveform | 12 |
| 4 | **Electroencephalography (EEG) -** Signal sources, Recording modes, Applications of the EEG | 12 |
| 5 | **Techniques to Aid observation-** X-ray and Radiography, Diagnostic Ultrasound | 12 |

**Suggested Study material:**


1. Principles of Medical Electronics and Biomedical Instrumentation- C. Raja Rao, S. K. Guha, Universities Press (India Limited)
2. Introduction to Biomedical Instrumentation- Mandeep Singh, PHI Learning Pvt. Ltd.
3. Biomedical instrumentation and measurements – Leslie Cromwell, Fred J. Weibell,Erich A. Pfeiffer
4. Measurements And Instrumentation- A.V.BakshiU.A.Bakshi, Technical publication, Pune
5. Biomedical Instrumentation and Measurment- R. Anandanatarajan, PHI
6. Handbook of Biomedical Instrumentation, 3rd Edition by R. S. Khandpur, McGrow Hill Publication




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**Skill Enhancement Course- IV Semester**

**ELT601 Basics of Machine Learning Programming**

**Learning Objectives (LOs):**

| LO No. | Learning Objectives |
|---|---|
| 1 | Understand the fundamental concepts of machine learning, including supervised, unsupervised, and reinforcement learning. |
| 2 | Recognize common machine learning algorithms and their applications in real-world scenarios. |
| 3 | Evaluate and select appropriate machine learning models based on dataset characteristics and problem requirements. |

**Course Outcome (COs):**

| CO No. | Expected Course Outcome<br>At the end of the course, the students will be able to: | CL |
|---|---|---|
| 1 | Students will develop a comprehensive understanding of the principles and theories underlying machine learning algorithms and their applications. | U,Ap |
| 2 | Students will learn how to preprocess, clean, and manipulate data to make it suitable for machine learning tasks, including feature engineering and dimensionality reduction techniques. | U,Ap,An |
| 3 | Students will be able to critically analyze the results of machine learning experiments, identify potential issues or biases, and propose improvements or alternative approaches. | An,Ap |

CL: Cognitive Levels (R-Remember; U- Understand; Ap- Apply; An- Analyze; E- Evaluate; C-Create)



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**COs-POs/PSOs Mapping for the course:**

| POs / COs | POs | | | | | | | | | | | | PSOs | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 |
| CO-1 | 3 | 2 | 3 | 2 | - | - | 1 | 3 | 1 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO-2 | 2 | 3 | 3 | 2 | - | - | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 2 |
| CO-3 | 3 | 2 | 3 | 2 | - | - | 1 | 3 | 1 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |

"3"- Strong; "2"- Moderate; "1"- Low; "-" No correlation

**Detailed Syllabus:**

| Unit | List of Experiment |
|---|---|
| **1.** | Applications of Regression analysis in Data Analytics. |
| **2.** | Applications of Decision Tree and SVM in Data Analytics. |
| **3.** | Applications of Non-linear Regression analysis in Data Analytics. |
| **4.** | Problem related to Logistics Regression in Data Analytics. |
| **5.** | Applications of Statistical Learning in Data Analytics. |
| **6.** | Applications of Neural Network and Deep learning in Data Analytics |
| **7.** | Applications of PCA in Data Analytics. |
| **8.** | Applications of ICA and LDA in Data Analytics. |
| **9.** | Applications of Clustering Techniques in Data Analytics. |

**Note: Student have to perform at least 08 program. Any other experiment of the same standard can be added.**



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## Indian knowledge System (IKS) - I Semester

## ELT701 Indian Knowledge System: It's Relevance to Electronics & Photonics

**Learning Objectives (LOs):**

| LO No. | Learning Objectives |
|---|---|
| 1 | Learn about Indian Knowledge System |
| 2 | Learn the basics of Ancient Indian Science, Mathematics and Technology |
| 3 | Study about the Ancient Indian Astronomy |
| 4 | Learn and understand the importance of Yoga for health and wellness of ones mind and body |

**Course Outcomes (COs):**

| CO No. | Expected Course Outcome<br>At the end of the course, the students will be able to: | CL |
|---|---|---|
| 1 | Gain knowledge about Vedic Philosophy, Vedic Vidyapeeth and Non-Vedic Philosophical Systems. | R,U,Ap |
| 2 | Learn the IKS foundation concept for Science & Technology | R,U,An |
| 3 | Learn about ancient Indian Mathematics, Great Mathematicians and their contributions, Arithmetic Operations, Geometry | U,Ap |
| 4 | Learn about contribution of Astronomy in Indian Knowledge System | U,Ap |
| 5 | Learn Importance of Yoga & Psychology for human beings | U,An,Ap |

CL: Cognitive Levels (R-Remember; U- Understand; Ap- Apply; An- Analyze; E- Evaluate; C-Create)



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**COs-POs/PSOs Mapping for the course:**

| POs / COs | POs | | | | | | | | | | | | PSOs | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 |
| CO-1 | 3 | 3 | 2 | 3 | 1 | 3 | 3 | 2 | 1 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 2 | - |
| CO-2 | 3 | 1 | 1 | 3 | 2 | 3 | 2 | 3 | 1 | 3 | 3 | 3 | 2 | 1 | 2 | 1 | 2 | 3 |
| CO-3 | 3 | 3 | 2 | 3 | 1 | 3 | 3 | 2 | 1 | 3 | 3 | 3 | 2 | 2 | 3 | 1 | 2 | - |
| CO-4 | 3 | 3 | 2 | 3 | 1 | 3 | 3 | 2 | 1 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 2 | - |
| CO-5 | 3 | 2 | 1 | 3 | 2 | 3 | 2 | 3 | 1 | 3 | 3 | 3 | - | - | 1 | - | 1 | - |

"3":- Strong, "2":- Moderate, "1":-Low, "-":- No Correlation

**Detailed Syllabus:**

| Unit | Topics | No. of Lectures |
|---|---|---|
| 01 | Introduction to Indian Knowledge System (IKS)<br>Introduction to Vedic Philosophy, Vedic Vidyapeeth, 64 Kalas, Shilpa Shastra, Four Vedas, Vedanga, Indian Philosophical Systems, Vedic Philosophy ( Samkhya and Yoga, Nyaya and Vaisesika, Purva-Mimaṃsa and Vedanta), Non-Vedic Philosophical Systems (Carvaka, Buddhist, Jain), Puranas (Maha-puranas, Upa-Puranas and Sthala-Puranas), Itihasa (Ramayana, Mahabharata), Niti Sastras, Subhasitas | 12 |
| 02 | Foundation concept for Science & Technology<br>Linguistics & Phonetics in Sanskrit Grammar, Role of Sanskrit in Natural Language Processing, Number System and Units of Measurement, concept of zero and its importance, Large numbers & their representation, Place Value of Numerals, Decimal System, Measurements for time, distance and weight, Unique approaches to represent numbers (Bhuta Saṃkhya System, Kaṭapayadi System), Pingala and the Binary system, Knowledge Pyramid, Prameya – A Vaisesikan approach to physical reality, constituents of the physical reality, Pramaṇa, Saṃsaya | 12 |
| 03 | Indian Mathematics in IKS Indian Mathematics, Great Mathematicians and their contributions, Arithmetic Operations, Geometry (Sulba Sutras, Aryabhatiya-bhasya), value of $\pi$, Trigonometry, Algebra, Chandah Sastra of Pingala | 12 |



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| | | |
|---|---|---|
| **04** | Indian Astronomy in IKS Indian Astronomy, celestial coordinate system, Elements of the Indian Calendar Aryabhatiya and the Siddhantic Tradition Panchanga – The Indian Calendar System Astronomical Instruments (Yantras) Jantar Mantar or Raja Jai Singh Sawal | **12** |
| **05** | Yoga & Social Sciences in IKS<br>Health, Wellness & Psychology, Ayurveda Sleep and Food, Role of water in wellbeing, Indian approach to Psychology, the Triguṇa System Body-Mind-Intellect-Consciousnes, Yoga , health and hygiene, Introduction to 7 main Chakras and energy centers in human body. | **12** |

**Suggested Study material:**

1. Textbook on IKS by Prof. B Mahadevan, IIM Bengaluru.
2. Kapur K and Singh A. K (Eds) 2005). Indian Knowledge Systems, Vol. 1. Indian Institute of Advanced Study, Shimla. Tatvabodh of sankaracharya, Central chinmay mission trust, Bombay, 1995.
3. Nair, Shantha N. Echoes of Ancient Indian Wisdom. New Delhi: Hindology Books, 2008.
4. SK Das, The education system of Ancient hindus, Gyan publication house, India

**Reference Book:**

1. BL Gupta,Value and distribution system in india, Gyan publication house, India
2. Gambirananda, Swami, Tr. *Upanishads with the Commentary of Sankarachrya.* Kolkata: Advaita Ashrama publication Department, 2002.
3. Ranganathananda, Swami. *The Massage of the Upanishads.* Bombay: Bharathya Vidya Bhaven, 1985.
4. Om Prakash, Religion and Society in Ancient India, Bhariya Vidhya Prakashan, 1985
5. DK Chakkrabarty, Makkhan Lal, History of Ancient India (Set of 5 Volumes), Aryan book Internation publication, 2014
6. Dr. Girish Nath Jha, Dr. Umesh Kumar Singh and Diwakar Mishra, Science and Technology in Ancient Indian Texts, DK Print World limited,
7. Swami BB Vishnu, Vedic Science and History - Ancient Indian's Contribution to the Modern World, gosai publication, 2015
8. Chatterjee, S.C. The Nyaya Theory of Knowledge. Calcutta: University of Calcutta Press, 1950.
9. Dasgupta, Surendra. A History of Indian Philosophy. Delhi: Motilal Banarsidass, 1991.Vols. III & IV.



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