22ECXX

# DEPARTMENT OF

# ELECTRONICS AND COMMUNICATION ENGINEERING

## B.E. III to VI SEMESTER

## CURRICULUM FOR THE ACADEMIC YEAR

## 2024-2025


**H. K. E. SOCIETY'S**

**POOJYA DODDAPPA APPA COLLEGE OF ENGINEERING,**

**KALABURAGI-585102**

***(An Autonomous Institution, Affiliated to VTU, Belagavi)***

## *About the Institution*

The Hyderabad Karnataka Education (HKE) society founded by Late Shri Mahadevappa Rampure, a great visionary and educationist. The HKE Society runs 46 educational institutions. Poojya Doddappa Appa College of Engineering, Gulbarga is the first institution established by the society in 1958.The college is celebrating its golden jubilee year, setting new standards in the field of education and achieving greater heights.

## *About the department*

Department of Electronics & Communication Engineering was established in 1967 & is the pride of Karnataka. With an initial intake of 30 students the department has grown steadily and the present intake is 120 students for the UG programme. The graduates from this Department are playing a vital role in the IT revolution and are instrumental in placing Karnataka on the Global IT Landscape. These professionals have found placement in major industries and multinational corporations. Many of them are successful entrepreneurs.

The department also offers Post Graduate programs in 'Communication Systems' with an intake of 18. Active engagement of faculty in research has led to recognition of department as a Research center by the VTU.

The faculty strength of the department is 30, including 3 Professors, 4 Associate Professors, 23 Assistant Professors. The faculty always strives for imparting better knowledge to the students and works as a team in all departmental activities.

Students graduated from the department are well placed in India and abroad. Quite a few of them have pursued higher studies both in India and abroad. Some of them have qualified for Indian Engineering and Defence Services. Students of the department have bagged university ranks including the First rank on several occasions.

The department has state-of-the-art laboratories in the areas of Communication, DSP, Microwave, Microcontroller, Embedded system, VLSI design etc.

## *Vision of the Institute*

To be an institute of excellence in technical education and research to serve the needs of industry and society at local and global levels.

## *Mission of the Institute*

- To provide a high-quality educational experience for students with values and ethics that enables them to become leaders in their chosen profession.
- To explore, create and develop innovations in engineering and science through research and developmental activities.
- To provide beneficial service to national and multinational industries and communities through educational, technical and professional activities.

## *Department of Electronics and Communication Engineering*

## *Vision of the Department*

To be a premier department in Electronics and Communication Engineering field by providing quality education through teaching, learning, research and innovations to serve the industry and society.

## *Mission of the Department*

**M1**: Develop an environment for better teaching and learning in collaboration with industry, premier institutes and alumni.

**M2**: Produce competent engineers to meet the requirements of the industry and the society.

**M3:** Encourage students to pursue higher education, research work and to take up administrative responsibilities through leadership.

## *Program Educational Objectives*

1. The graduates possess emergent technical skills to perform design and developmental activities in various areas of Electronics and Communication Engineering like Signal Processing, VLSI, Embedded Systems, Communication Systems and other engineering specializations.
2. The graduates indulge into entrepreneurial, higher learning/research activities to be in pace with the continuous developing environment.
3. The graduates exhibit effective communication skills, leadership and team work qualities in industry, research and development organizations maintaining ethical standards.

## ***Program Outcomes***

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

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

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

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

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

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

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

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

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

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

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

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

## ***PSO-Program Specific Outcomes***

1. Apply the concepts of Electronics & Communication Engineering in various areas like Signal processing, VLSI, Embedded systems, Communication Systems, Digital & Analog Devices and other engineering specializations.

2. Solve complex Electronics and Communication Engineering problems with modern hardware and software tools, along with analytical skills to arrive at cost effective and appropriate solutions.

3. Possess social and environmental awareness along with ethical responsibility to adapt with the emerging technologies in Electronics and Communication Engineering for sustainable real-world applications to have a successful career.

**H. K. E. SOCIETY'S**

**POOJYA DODDAPPA APPA COLLEGE OF ENGINEERING, KALABURAGI**

**B.E in Respective Branch Name Scheme of Teaching and Examination 2022**

**Outcome Based Education (OBE) and Choice Based Credit System (CBCS)**

(Effective from the academic year 2023-24)

**III Semester**

| Sl. No. | Course and Course Code | | Course Title | Teaching Department | Teaching Hours/Weeks | | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Lecture | Tutorial | Practical/ Drawing | Self Study | Duration in Hours | CIE Marks | SEE Marks | Total Marks | |
| | | | | | L | T | P | S | | | | | |
| 1 | PCC | 22MATE31 | Engineering Mathematics-III | Mathematics | 3 | 0 | 0 | - | 03 | 50 | 50 | 100 | 3 |
| 2 | IPCC | 22EC32 | Electronics Circuits | E & CE | 3 | 0 | 2 | - | 03 | 50 | 50 | 100 | 4 |
| 3 | IPCC | 22EC33 | Networks and Control Systems | E & CE | 3 | 0 | 2 | - | 03 | 50 | 50 | 100 | 4 |
| 4 | PCC | 22EC34 | Digital Electronics | E & CE | 3 | 0 | 0 | - | 03 | 50 | 50 | 100 | 3 |
| 5 | PCCL | 22ECL35 | Digital Electronics Lab | E & CE | 0 | 0 | 2 | - | 03 | 50 | 50 | 100 | 1 |
| 6 | ESC | 22EC36A | Signals and Systems | E & CE | 3 | 0 | 0 | - | 03 | 50 | 50 | 100 | 3 |
| 7 | UHV | 22UHV37 | Social Connect and Responsibility | E & CE | 0 | 0 | 2 | - | 02 | 50 | - | 50 | 1 |
| 8 | AEC | 22ECAE381 | Fundamentals of Computer System and Office | | If the Course is a Theory | | | | 02 | 50 | 50 | 100 | 1 |
| | | | | | 0 | 2 | 0 | - | | | | | |
| | | | | | If the course is a Laboratory | | | | 03 | | | | |
| | | | | | 0 | 0 | 2 | - | | | | | |
| 9 | NCMC | 22NS39 | Mandatory Course | NSS Coordinator | 0 | 0 | 2 | - | - | 50 | - | 50 | 0 |
| | | 22PE39 | Mandatory Course | Physical Education Director | | | | | | | | | |
| | | 22YO39 | Mandatory Course | Yoga Teacher | | | | | | | | | |
| | | | | | | | | | **Total** | **450** | **350** | **800** | **20** |

**PCC**: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. K: This letter in the course code indicates common to all the stream of engineering. ESC: Engineering Science Course, ETC: Emerging Technology Course, PLC: Programming Language Course

| **Engineering Science Course (ESC/ ETC/ PLC) [L-T-P:3-0-0]** | |
|---|---|
| 22EC36A | Signals and Systems |
| **Ability Enhancement Course –III** | |
| 22ECAE381 | Fundamentals of Computer System and Office |

**Professional Core Course (IPCC):** Refers to Professional Core Course Theory Integrated with practicals of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L: T: P) can be considered as (3: 0: 2) or (2: 2: 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. Form the regulation governing the Degree of Bachelor of Engineering/ Technology (B.E. / B. Tech.) 2022-23 may please be referred.

**National Service Scheme /Physical Education/ Yoga:** All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE) (Sports and Athletics), and Yoga (YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semesters to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall Not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

**H. K. E. SOCIETY'S**

**POOJYA DODDAPPA APPA COLLEGE OF ENGINEERING, KALABURAGI**

**B.E in Respective Branch Name Scheme of Teaching and Examination 2022**

**Outcome Based Education (OBE) and Choice Based Credit System (CBCS)**

(Effective from the academic year 2023-24)

**IV Semester**

| Sl. No. | Course and Course Code | | Course Title | Teaching Department | Teaching Hours/Weeks | | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Lecture | Tutorial | Practical/ Drawing | Self Study | Duration in Hours | CE Marks | SEE Marks | Total Marks | |
| | | | | | L | T | P | S | | | | | |
| 1 | PCC | 22EC41 | Analog and Digital Communication | E & CE | 3 | 0 | 0 | - | 03 | 50 | 50 | 100 | 3 |
| 2 | IPCC | 22EC42 | Embedded Microcontrollers | E & CE | 3 | 0 | 2 | - | 03 | 50 | 50 | 100 | 4 |
| 3 | IPCC | 22EC43 | Digital Design using Verilog HDL | E & CE | 3 | 0 | 2 | - | 03 | 50 | 50 | 100 | 4 |
| 4 | PCCL | 22ECL44 | Analog and Digital Communication lab | E & CE | 0 | 0 | 2 | - | 03 | 50 | 50 | 100 | 1 |
| 5 | ESC | 22EC45A | Principles of Electromagnetics | E & CE | 3 | 0 | 0 | - | 03 | 50 | 50 | 100 | 3 |
| 6 | BSC | 22BSC46 | Biology for engineers | E & CE | 3 | 0 | 0 | - | 02 | 50 | 50 | 100 | 3 |
| 7 | UHV | 22UHV47 | Universal Human Values | E & CE | 2 | 0 | 0 | - | 02 | 50 | 50 | 100 | 1 |
| 8 | AEC | 22ECAE481 | MATLAB for Engineers | E & CE | If the Course in Theory<br>0 | 2 | 0 | - | 03 | 50 | 50 | 100 | 1 |
| | | | | | If the Course in Laboratory<br>0 | 0 | 2 | - | | | | | |
| 9 | NCMC | 22NS49 | Mandatory Course | NSS Coordinator | 0 | 2 | 2 | - | - | 50 | - | 50 | 0 |
| | | 22PE49 | Mandatory Course | Physical Education Director | | | | | | | | | |
| | | 22YO49 | Mandatory Course | Yoga Teacher | | | | | | | | | |
| | | | | | | | | | **Total** | **450** | **400** | **850** | **20** |

**22ECXX**

**PCC**: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S=SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. K: This letter in the course code indicates common to all the stream of engineering.

**Engineering Science Course:** The course is not common to all the departments and it is relevant to the respective departments.

| **Engineering Science Course(ESC/ETC/PLC)[L-T-P::3-0-0]** | |
|---|---|
| 22EC45A | Principles of Electromagnetics |
| **Ability Enhancement Course /Skill Enhancement Course IV** | |
| 22ECAE481 | MATLAB for Engineers |

**Professional Core Course (IPCC):** Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L: T: P) can be considered as (3: 0: 2) or (2: 2: 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering/ Technology (B.E/ B. Tech.) 2022-23

**National Service Scheme /Physical Education/Yoga:** All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE) (Sports and Athletics), and Yoga (YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semesters to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses is mandatory for the award of degree.

| **Engineering Mathematics-III( Electrical & Electronics Engineering Stream)** | | | |
|---|---|---|---|
| Course Code | 22MATE31 | Credits | 3 |
| Course Type | Theory | CIE Marks | 50 |
| Lecture Hours(L:T:P) | 3:0:0 | SEE Marks | 50 |
| Total Hours | 42 | SEE Hours | 03 |

**Course Objectives:**

- Z-transforms, Fourier Series, Fourier transforms and and its application in engineering fields
- Probability distribution of discrete and continuous random variables
- Joint probability distributions and discrete and continuous random variables

| **Modules-1** | **Teaching Hours** |
|---|---|
| **Difference equations and Z-Transforms :** Difference equations –Basic definitions, Z Transform-Definitions, standard Z-transform, linearity property, damping rule, shifting rule , initial value theorem ,final value theorem. Inverse Z-Transform and applications. | **09** |
| **Modules-2** | |
| **Fourier series:** Periodic functions, Fourier series with periods $(0, 2\pi)$, $(-\pi, \pi)$, $(0, 2l)$ and $(-l, l)$. Half range Fourier series, Practical harmonic analysis and problems. | **08** |
| **Modules-3** | |
| **Fourier Transform:** Finite and Infinite Fourier transforms, Fourier sine and cosine transforms, properties, Inverse Fourier transforms and problems | **09** |
| **Modules-4** | |
| **Probability distributions:** Random variable (Discrete and continuous) p.d.f., c.d.f., Binomial distribution, Poisson distributions, Normal distribution and problems | **08** |
| **Modules-5** | |
| **Joint probability distributions:** Concept of joint probability distribution, discrete and continuous random variables independent random variables .problems on expectation and variance | **08** |

**Question paper pattern:**

- The question paper shall have five modules for 100 marks;
- Each full question carries 20 marks.
- Two questions to be set in each module (total ten questions).
- The candidate will have to answer one full question from each module.

Note: There can be a maximum of 4 subsections in each Question.

**Text boo**ks:

1 Higher Engineering Mathematics by B.S.Grewal, Khanna publishers; 40th Edition.2007

2 Engineering Mathematics by N. P. Bali and Manish Goyal. Laxmi publications, latest edition

**Reference books:**

1.Advanced Engineering Mathematics by E. Kreyszig, John Willey & sons 8th Edn.

2.A short course in differential equations – Rainvile E.D.9th Edition.

3.Advanced Engineering Mathematics by R.K.Jain & S.R.K Iyengar; Narosa publishing House.

4.Introductory methods of numerical analysis by S.S.Sastry

4. Statistical Methods Authored By Gupta S.P. Publisher: Sultan Chand & Sons. Publishing Year: 2021

5. Fundamentals of Mathematical Statistics Authored By Gupta S.C.& Kapoor V.K.Publisher: Sultan Chand & Sons. Publishing Year: 2020

**E books and online course materials:**

**Course outcomes: On completion of the course, the student will have the ability to,**

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| 22MATE31 | CO1 | Understanding the characteristics and properties of the Z-transform |
| | CO2 | Construction of Fourier series for periodic signals and Fourier series to analyze circuits. |
| | CO3 | Determine Fourier transformation for continuous time signals and systems |
| | CO4 | Solve problems using theoretical probability distributions |
| | CO5 | Apply the concepts of joint probability, to find covariance, correlation, independent variables |

| ELECTRONIC CIRCUITS | | | |
|---|---|---|---|
| Course Code | 22EC32 | Credits | 4 |
| Course Type | Integrated | CIE Marks | 50 |
| Lecture Hours(L:T:P) | 3:0:2 | SEE Marks | 50 |
| Total Hours | 42 (Theory)+13 (Lab Slots) | SEE Hours | 03 |

**Course Objectives**:

- Various Applications of diode circuits
- Biasing of BJTs and FETs
- Design and analysis of BJT and FET
- Design and analysis of oscillators.
- Analysis of power devices

| Modules-1 | Teaching Hours |
|---|---|
| **Diode characteristics:** Introduction, load line analysis, diode approximations, series diode configurationwith DC inputs, parallel and series configurations,<br>**Diodes applications**: AND / OR gates, rectifiers with filter, clippers, clampers, zener diodes as regulators and voltage multiplier circuits. | 8 |
| **Modules-2** | |
| **Bipolar Junction transistor:** Introduction, transistor construction, configurations and input outputcharacteristics,<br>**Transistor biasing:** operating point, fixed bias circuit, emitter stabilized bias circuits and voltage dividerbias analysis.<br>**Small signal analysis:** BJT transistor modeling and hybrid equivalent model of small signal amplifier configuration and deriving voltage gain, input impedance and output impedance. | 9 |
| **Modules-3** | |
| **Power Amplifiers:** Class A large signal amplifiers, second harmonic distortion Higher order harmonic generation; the transformer coupled audio power amplifier, efficiency, push pull amplifiers, class B and class C amplifiers.<br>**FET biasing:** fixed bias configurations, self -bias configurations, voltage divider biasing.<br>**Small signal analysis:** small signal model of JFET, FET amplifier design and analysis. | 9 |
| **Modules-4** | |
| **Linear operational amplifier Applications**: V to I & I to V converters, op–amp feedback limiters using diodes, log and antilog amplifiers, analog multipliers, peak detectors, precision rectifiers, instrumentation amplifier<br>**Non linear operational amplifier Applications:** Monostable and astable multi vibrators, comparators,Schmitt trigger using operational-amplifier. | 8 |
| **Modules-5** | |
| **Timers:** Basic timer circuit, 555 timer used as monostable and astable multivibrators,<br>**Data converters:** Performance parameters, D/A converters, weighted binary type, ladder R–2R converters, **A/D converters:** Performance parameters, types of A/D converters: V/t, V/f, counter ramp, flash type,successive approximation, dual slope. | 8 |

**Question paper pattern:**

- The question paper shall have five modules for 100 marks;
- Each full question carries 20 marks.
- Two questions to be set in each module (total ten questions).
- The candidate will have to answer one full question from each module.
- Note: There can be a maximum of 4 subsections in each Question..

**Text Books:**

1. Robert L Boylestad, "Electronic Devices and Circuit Theory", 6 th edition 1999. PHI.
2. Miliman Halkias, "Electronic Devices and circuits", TMH
3. Muhammad H Rashid,"Power Electronics", 2 nd edition 2004, PHI

**Reference Books:**

1. Adel .S. Sedra, Kenneth C. Smith, "Micro Electronic Circuits", 6 th Edition, Oxford University Press, 2010.
2. David A.Bell, "Electronic Devices and Circuits", 5 th editon 2010, Oxford Higher Education Press.

**E books and online course materials:**

**Course outcomes: On completion of the course, the student will have the ability to,**

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| **22EC32** | CO1 | Analyze and apply diode circuits for various applications. |
| | CO2 | Design and analyze transistor biasing circuits and amplifiers. |
| | CO3 | Analyze FET biasing circuits and amplifiers |
| | CO4 | Analyze feedback amplifiers and design oscillators. |
| | CO5 | Analyze and apply power devices for various applications. |

**LIST OF EXPERIMENTS:**

1. Full-wave rectifier with/without capacitor filter.
2. Clipping and Clamping circuits
3. Zener voltage regulator
4. DesignandconstructBJTCEamplifierusingvoltagedividerbiaswithandwithoutbypassemitterresistor.
5. Darlington amplifier
6. RC Phase shift oscillator using BJT.
7. Hartley and Colpitt's oscillator
8. Design of a single stage voltage series feedback amplifier and draw frequency response.
9. Precision rectifiers.
10. Design and implement Monostable and astable multi vibrator using IC 741.
11. Design and implement Monostable and astable multi vibrator using 555 timer.
12. R-2R Ladder Digital to analog converter.

**22EC32: Electronic Circuits**

| CO# | CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | Analyze and apply diode circuits for various applications. | 3 | 3 | 1 | | | | | 2 | 3 | 1 | 3 | 1 | 3 | 2 | 2 |
| CO2 | Design and analyze transistor biasing circuits and amplifiers. | 3 | 3 | 2 | | | | | 2 | 3 | 1 | 3 | 1 | 3 | 2 | 2 |
| CO3 | Analyze FET biasing circuits and amplifiers | 3 | 3 | 2 | | | | | 2 | 3 | 1 | 3 | 1 | 3 | 2 | 2 |
| CO4 | Analyze feedback amplifiers and design oscillators. | 3 | 3 | 3 | | | | | 2 | 3 | 1 | 3 | 1 | 3 | 2 | 2 |
| CO5 | Analyze and apply power devices for various applications. | 3 | 3 | 2 | | | | | 2 | 3 | 1 | 3 | 1 | 3 | 2 | 2 |
| Average | | 3 | 3 | 2 | | | | | 2 | 3 | 1 | 3 | 1 | 3 | 2 | 2 |

| NETWORK ANALYSIS AND CONTROL SYSTEMS | | | |
|---|---|---|---|
| Course Code | 22EC33 | Credits | 4 |
| Course Type | Integrated | CIE Marks | 50 |
| Lecture Hours(L:T:P) | 3:0:2 | SEE Marks | 50 |
| Total Hours | 42 (Theory)+13 (Lab Slots) | SEE Hours | 03 |

**Course Objectives:**

- To apply and analyze various network theorems in solving the problems related to electrical circuits.
- To describe various network parameters and resonant circuits..
- To teach the fundamental concepts of Control systems and mathematical modeling of the system.
- To study the concept of time response and frequency response of the system.
- To teach the basics of stability analysis of the system

| Modules-1 | Teaching Hours |
|---|---|
| **Network fundamentals and Theorems:** Mesh Loop and Node analysis with linear dependent and independent sources for DC and AC networks. Network Theorems: Superposition, Reciprocity, Thevenin's, Norton's, Maximum Power transfer and Millman's theorems.. | 9 |
| **Modules-2** | |
| **Filter, Resonance and Two port network parameters**: Definition of Q, the factor of merit, series resonance, bandwidth of the series resonant circuit, parallel resonance, conditions for maximum impedance. Filters, constant k low pass and high pass filter, Two port Networks: Z, Y, ABCD and Hybrid parameters, their inter-relationships | 8 |
| **Modules-3** | |
| **Basic Ideas of Control Systems, Mathematical Models of Physical Systems**: Classification of Control Systems, Open Loop and Closed Loop (in detail), Differential equations of Physical Systems and Transfer Function (and electrical systems) Block Diagram Reduction, Signal Flow Graphs (simple examples). | 8 |
| **Modules-4** | |
| **Time Response of Feedback Control Systems:** Standard Test Signals, Step Response for First and Second Order, Impulse Response for First and Second Order, Distinction between Type and Order of the System. Time Domain Specifications for Second Order System. tr, td, ts tp, Mp, Steady State Error Analysis, Error Constants, Kp, Kv, Ka. | 8 |
| **Modules-5** | |
| **Stability Analysis:** R-H criteria of Stability, Root Locus criteria and stability analysis, Stability Analysis using Bode Plot. | 9 |

**Question paper pattern:**

- The question paper shall have five modules for 100 marks;
- Each full question carries 20 marks.
- Two questions to be set in each module (total ten questions).
- The candidate will have to answer one full question from each module.
- Note: There can be a maximum of 4 subsections in each Question..

**Text Books:**

1. M. E. Van Valkanberg, "Network Analysis", PHI Third edition,2005

2. I J Nagrath and M Gopal, Control systems and Engineering, New Age Publishers 6 th Edition-2017.
3. K Ogata, Modern Control Engineering, PHI 3 rd Edition-2001

**Reference Books:**

1. William D Stanley, "Network Analysis with Applications", Pearson Education Fourth edition, 2002.
2. Roy Choudhary D, "Network and systems", New age Publications First edition,
3. Kuo B C, Control Engineering

**E books and online course materials: NPTEL**

**Course outcomes:**
**On completion of the course, the student will have the ability to:**

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| 22EC33 | CO1 | Analysis of circuits by using different theorems. |
| | CO2 | Analysis of resonance circuits, constant k-filters and different two port network. |
| | CO3 | Analyze physical systems using differential equations, block diagrams and signal flow graphs. |
| | CO4 | Analyze time response of first and second order systems. |
| | CO5 | Construct the root locus, bode plot and analyze the stability of the system in time domain. |

List of Experiments

**1.** Study of KCL, KVL
**2.** Network theorems:
i) Thevenin's Theorem and Norton's Theorem
ii) Superposition
iii) Maximum power theorem
**3.** Resonance and tuned circuits
i) Series resonance ii. Parallel resonance
**4.** Measurement of impedance and Admittance parameters of a Two port network.
**5.** Measurement of Hybrid parameters of a Two port network.
**6.** Attenuators.
**7.** Steady state response of RC,RL circuits for sinusoidal inputs.
**8.** Filters
i. Low pass filter
ii. High pass filter
**9.** Frequency response analysis of
i. LAG compensating network
ii. LEAD compensating network
iii. LAG-LEAD compensating network
**10.** Step and Frequency response analysis first order system.
**11.** Time domain analysis of second order system.
**12.** To study basic open loop and closed loop control systems.

**22ECXX**

## 22EC33 (IPCC): NETWORK ANALYSIS AND CONTROL SYSTEMS

| CO# | CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | Analysis of circuits by using different theorems. | 3 | 2 | 1 | | | 1 | 1 | 2 | 3 | 2 | | | 3 | 2 | 2 |
| CO2 | Analysis of resonance circuits, constant k-filters and different two port network. | 3 | 2 | 1 | | | 1 | 1 | 2 | 3 | 2 | | | 3 | 2 | 2 |
| CO3 | Analyze physical systems using differential equations, block diagrams and signal flow graphs. | 3 | 3 | 2 | | | | | 1 | | 1 | | 1 | 3 | 2 | 2 |
| CO4 | Analyze time response of first and second order systems. | 3 | 3 | 2 | | | | | 1 | | 1 | | 1 | 3 | 2 | 2 |
| CO5 | Construct the root locus, bode plot and analyze the stability of the system in time domain. | 3 | 3 | 2 | | 2 | | | 1 | | 1 | | 1 | 3 | 2 | 2 |
| Average | | **3** | **2.6** | **1.6** | | **2** | **1** | **1** | **1.4** | **3** | **1.4** | | **1** | **3** | **2** | **2** |

| DIGITAL ELECTRONICS | | | |
|---|---|---|---|
| Course Code | 22EC34 | Credits | 3 |
| Course Type | Theory | CIE Marks | 50 |
| Lecture Hours(L:T:P) | 3:0:0 | SEE Marks | 50 |
| Total Hours | 42 | SEE Hours | 03 |

**Course objectives:**

- Learn simplification of Boolean expressions, Combinational logic Design
- Learn design of Combinational circuits using MSI ICs.
- Learn design of Sequential circuits.
- Gain understanding of Analysis of Sequential circuits
- Learn fundamentals of Microprocessors.

| **Module-1** | **Teaching Hours** |
|---|---|
| Combinational Logic Design: Introduction, Review of Boolean Algebra and Logic gates, Standard Representations for Logical Functions, Minimization of Logical Functions and realisation using gates - K-maps (upto 5 variables), Quine-McCluskey technique, VEM technique. Design examples(with gate realisation)-Arithmetic circuits, Adder with Look-Ahead Carry, BCD-to-7-segment Decoder. | 10 |
| **Module-2** | |
| Combinational Logic Design using MSI circuits: Multiplexers-Design examples, Applications, Mux Tree, Demultiplexers/Decoders-Design, Applications, BCD Adder, Digital Comparator, Code Converters-Bin-to-Gray and Gray-to-Binary, Priority Encoders: Decimal-to-BCD, Decoder/Driver for Display: BCD-to-7-segment Decoder/Driver. | 8 |
| **Module-3** | |
| Sequential Circuits : Introduction, A 1-bit memory Cell, Clocked S-R Flip-Flop, J-K FF, D-FF, T-FF. Excitation Table of FFs, Clocked FF Design, Edge-triggered FFs. Registers, Applications of Shift Registers-Ring Counter, Twisted-Ring Counter, Sequence Generator. | 8 |
| **Module-4** | |
| Sequential Circuits: Ripple/Asynchronous Counters-Design examples using T-FFs, JK-FFs, examples using MSI ICs-7493, 7490. Synchronous Counters-Design examples using FFs, Clocked Sequential Circuit Design, Analysis of Synchronous sequential circuits. | 8 |
| **Module-5** | |
| Fundamentals of Microprocessors: Introduction, An ideal MP, D-Bus, A-Bus, C-Bus, MP based System-Basic operation, MP operation, MP Architecture, Instruction Set, The 8085A MP, The 8086MP, Programming Languages. | 8 |

**Question paper pattern:**

- The question paper shall have five modules for 100 marks;
- Each full question carries 20 marks.

- Two questions to be set in each module (total ten questions).
- The candidate will have to answer one full question from each module.

Note: There can be a maximum of 4 subsections in each Question..

**Text Books:**

1. R.P.Jain, " Modern Digital Electronics" 3th Edition, Tata McGraw-Hill Publ. Co. Ltd.
2. John. M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2006.

**Reference Books:**

1. M.Morris Mano,"Digital Design",4thEdn, PHI Pvt. Ltd,2008
2. Morris and Miller."Designing with TTL integrated circuits", McGrawHill
3. Fletcher, "An Engineering approach to Digital Design", PHI
4. Kohavi, "Switching and Finite Automata Theory",TMH

**Course Outcomes: On completion of the course, the student will have the ability to,**

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| 22EC34 | CO1 | Apply different methods for simplification of Boolean expressions and realize using gates. |
| | CO2 | Design and realize Combinational circuits using MSI ICs. |
| | CO3 | Design and realize sequential circuits. |
| | CO4 | Analyse Asynchronous sequential circuits. |
| | CO5 | Analyse Microprocessor based systems |

**22EC34 : Digital Electronics**

| CO# | CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | Apply different methods for simplification of Boolean expressions and realize using gates. | 3 | 2 | 3 | | | | | 1 | | 1 | | 1 | 3 | 3 | 2 |
| CO2 | Design and realize Combinational circuits using MSI ICs. | 3 | 3 | 3 | | | | | 1 | | 1 | | 1 | 3 | 3 | 2 |
| CO3 | Design and realize sequential circuits. | 3 | 3 | 3 | | | | | 1 | | 1 | | 1 | 3 | 3 | 2 |
| CO4 | Analyse Asynchronous sequential circuits. | 3 | 3 | 3 | | | | | 1 | | 1 | | 1 | 3 | 3 | 2 |
| CO5 | Analyse Microprocessor based systems | 1 | 1 | 2 | | | | | 1 | | 1 | | 1 | 3 | 3 | 2 |
| Average | | 2.6 | 2.4 | 2.8 | | | | | 1 | | 1 | | 1 | 3 | 3 | 2 |

| DIGITAL ELECTRONICS LABORATORY | | | |
|---|---|---|---|
| Course Code | 22ECL35 | Credits | 1 |
| Course Type | Practical | CIE Marks | 50 |
| Lecture Hours(L:T:P) | 0:0:2 | SEE Marks | 50 |
| Total Hours | 13 Lab Slots | SEE Hours | 03 |

**Course objectives:**

- Learn design, realize and practically implement Combinational logic circuits
- Learn design, realize and practically implement Combinational logic circuits-MSI ICs
- Learn design, realize and practically implement Sequential logic circuits-Counters
- Learn design, realize and practically implement Sequential logic circuits-Registers

1. Design and implementation of Adder and Subtractor using logic gates.
2. Design and implementation of code converters using logic gates
3. Design and implementation of 4 bit binary Adder/ subtractor and BCD adder using IC 7483
4. Design and implementation of 2 bit Magnitude Comparator using logic gates and 8 Bit Magnitude Comparator using IC 7485
5. Design and implementation of 16 bit odd/even parity checker generator using IC74180.
6. Design and implementation of Multiplexer and De-multiplexer using logic gates and realization Boolean functions using MSI MUX/DEMUX
7. Design and implementation of encoder and decoder using logic gates and realization Boolean functions using MSI Encoders/Decoder.
8. Design and realization of 2-bit, 3-bit and 4-bit ripple counters.
9. Design and implementation of synchronous counters.
10. Implementation of SISO, SIPO, PISO and PIPO shift registers using flip-flops.
11. Realization of ring counters using 7495 ICs.

**Conduct of Practical Examination:**

- All laboratory experiments are to be included for practical examination
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and will be evaluated for 85% of the total marks.

**Course outcomes: On completion of the course, the student will have the ability to,**

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| 22ECL35 | CO1 | Simplification of Boolean expressions and realization using gates. |
| | CO2 | Design and realize Combinational circuits using MSI ICs. |
| | CO3 | Design and realize Ripple/Asynchronous Counters. |
| | CO4 | Design and realize Synchronous Counters. |
| | CO5 | Design and realize Sequential circuits using Shift Registers. |

**22ECL35 : Digital Electronics Lab**

| CO# | CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | Simplification of Boolean expressions and realization using gates. | 2 | 2 | 1 | | | 1 | 1 | 2 | 3 | 2 | | 1 | 3 | 2 | 2 |
| CO2 | Design and realize Combinational circuits using MSI ICs. | 3 | 3 | 1 | | | 1 | 1 | 2 | 3 | 2 | | 1 | 3 | 2 | 2 |
| CO3 | Design and realize Ripple/Asynchronous Counters. | 3 | 3 | 1 | | | 1 | 1 | 2 | 3 | 2 | | 1 | 3 | 2 | 2 |
| CO4 | Design and realize Synchronous Counters. | 3 | 3 | 1 | | | 1 | 1 | 2 | 3 | 2 | | 1 | 3 | 2 | 2 |
| CO5 | Design and realize Sequential circuits using Shift Registers. | 3 | 3 | 1 | | | 1 | 1 | 2 | 3 | 2 | | 1 | 3 | 2 | 2 |
| Average | | 2.6 | 2.8 | 2.8 | 1 | | | 1 | 1 | 2 | 3 | 2 | | 1 | 3 | 2 |

| SIGNALS AND SYSTEMS | | | |
|---|---|---|---|
| Course Code | 22EC36A | Credits | 3 |
| Course Type | Theory | CIE Marks | 50 |
| Lecture Hours(L:T:P) | 3:0:0 | SEE Marks | 50 |
| Total Hours | 42 Hours | SEE Hours | 03 |

**Course Objectives:**

- To understand basics of signals and systems, sampling theorem.
- To learn Linear Time Invariant systems and properties of LTI systems.
- To understand Fourier representation of Continuous Time signals.
- To understand Fourier representation of Discrete Time signals.
- To learn Transform and its applications.

| Modules-1 | Teaching Hours |
|---|---|
| **Introduction:** Continuous-Time and Discrete-Time signals, Transformation of the independent variable, exponential and sinusoidal signals, the unit impulse and unit-step functions, Continuous-Time and Discrete-Time systems, basic system properties. | **8** |
| **Modules-2** | |
| **Linear Time-Invariant Systems:** Discrete-time LTI systems, the convolution sum, continuous-time LTI systems, convolution integral, properties of LTI systems, causal LTI systems described by differential and difference equations, singularity functions. | **8** |
| **Modules-3** | |
| **Fourier series representation of periodic signals:** The response of LTI systems to complex exponentials, Fourier series representation of Continuous-Time periodic signals, convergence of the Fourier series, properties of Continuous-Time Fourier series, Fourier series representation of Discrete-Time periodic signals, properties of Discrete-Time Fourier series. | **9** |
| **Modules-4** | |
| **Representation of aperiodic signals:** Continuous-Time Fourier transform, the Fourier transform of periodic signals, properties Continuous-Time Fourier transform, the convolution and multiplication property, duality, the Discrete-Time Fourier transform, the Fourier transform of periodic signals, properties of Discrete-Time Fourier transform, the convolution and multiplication property, duality. | **9** |
| **Modules-5** | |
| **Sampling:** Representation Continuous-Time signals by its samples, the sampling theorem, Reconstruction of a signal from its samples using interpolation, aliasing.<br>**Z-Transform:**The Z-Transform, region of convergence (ROC) and its properties, inverse Z-transform, properties of Z-transform, analysis and characterization of LTI systems using Z-Transforms, unilateral Z-transform. | **8** |

**Question paper pattern:**

- The question paper shall have five modules for 100 marks;
- Each full question carries 20 marks.
- Two questions to be set in each module (total ten questions).
- The candidate will have to answer one full question from each module.

Note: There can be a maximum of 4 subsections in each Question.

**Text Books:**

1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, "Signals and Systems", Pearson Education, 2007.

**Reference Books:**

1. Simon Haykin and Barry Van Veen "Signals and Systems", John Wiley & Sons, 2001
2. Miichael J Roberts, Govind Sharma, "Fundamentals of Signals and Systems", 2nd Edition, McGrawHill 2010
3. B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2005

**E books and online course materials:** NPTEL

**Course outcomes: On completion of the course, the student will have the ability to,**

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| 22EC36A | **CO1** | Analyze different signals and operations on signals. |
| | **CO2** | Analyze LTI systems and determine properties of LTI systems. |
| | **CO3** | Analyze Continuous-Time signals in Fourier Domain |
| | **CO4** | Analyze Discrete-Time signals in Fourier domain. |
| | **CO5** | Analyze Discrete-Time signals using Z-Transform. |

**22EC36A : Signals and Systems**

| CO# | CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | Analyze different signals and operations on signals. | 3 | 3 | 2 | | | | | | | | | | 3 | 3 | 2 |
| CO2 | Analyze LTI systems and determine properties of LTI systems. | 3 | 3 | 2 | | | | | | | | | | 3 | 3 | 2 |
| CO3 | Analyze Continuous-Time signals in Fourier Domain | 3 | 3 | 2 | | | | | | | | | | 3 | 3 | 2 |
| CO4 | Analyze Discrete-Time signals in Fourier domain. | 3 | 3 | 2 | | | | | | | | | | 3 | 3 | 2 |
| CO5 | Analyze Discrete-Time signals using Z-Transform. | 3 | 3 | 2 | | | | | | | | | | 3 | 3 | 2 |
| Average | | 3 | 3 | 2 | | | | | | | | | | 3 | 3 | 2 |

| SOCIAL CONNECT AND RESPONSIBILITY | | | |
|---|---|---|---|
| Course Code | 22UHV37 | Credits | 1 |
| Course Type | Theory | CIE Marks | 50 |
| Lecture Hours(L:T:P) | 0:0:2 | SEE Marks | - |
| Total Hours | 28 Hours | SEE Hours | - |

**Course Objectives:**

- To familiarize the students with the basic biological concepts and their engineering applications.
- To enable the students with an understanding of bio design principles to create novel devices and structures.
- To provide the students an appreciation of how biological systems can be re- designed as substitute products for natural systems.
- To motivate the students to develop interdisciplinary vision of biological engineering.

| **Modules-1** | **Teaching Hours** |
|---|---|
| **Plantation and adoption of a tree**: Plantation of a tree that will be adopted for four years by a group of B.Tech. students. They will also make an excerpt either as documentary or a photoblog describing the origin its usage in daily life, and its appearance in folklore and literature. origin, its usage in daily life, and its appearance in folklore and literature Objectives, Visit, case study, report,outcomes. | **6** |
| **Modules-2** | |
| **Heritage walk and crafts corner:** Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photo blog and documentary on evolution and practice of various craft forms. Objectives, Visit, case study, report,outcomes. | **6** |
| **Modules-3** | |
| **Organic farming and waste management:** usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus. Objectives, Visit, case study, report, outcomes**.** | **6** |
| **Modules-4** | |
| **Water Conservation**: knowing the present practices in the surrounding villages and implementation in the campus, documentary or photo blog presenting the current practices. Objectives, Visit, case study, report, outcomes. | **5** |
| **Modules-5** | |
| Food walk city's culinary practices, food lore and indigenous materials of the region used in cooking Objectives, Visit, case study, report, outcomes | **5** |

Activities: Jamming session, open mic, and poetry: Platform to connect to others. Share the stories with others. Share the experience of Social Connect. Exhibit the talent like playing instruments, singing, one-act play, art-painting, and fine art.

PEDAGOGY: The pedagogy will include interactive lectures, inspiring guest talks, field visits, social immersion, and a course project. Applying and synthesizing information from these sources to define the social problem to address and take up the solution as the course project, with your group. Social immersion with NGOs/social sections will be a key part of the course. Will all lead to the course project that will address the needs of the social sector?

COURSE TOPICS: The course will introduce social context and various players in the social space, and present approaches to discovering and understanding social needs. Social immersion and inspiring conversional will culminate in developing an actual, idea for problem-based intervention, based on an in-depth understanding of a key social problem.

Duration : A total of 40 - 50 hrs engagement per semester is required for the 3rd semester of the B.E.

/B.Tech. program. The students will be divided into groups. Each group will be handled by faculty mentor. Faculty mentor will design the activities (particularly Jamming sessions open mic ,and poetry) Faculty mentors has to design the evaluation system as per VTU guidelines of scheme & syllabus.

Guideline for Assessment Process:
Continuous Internal Evaluation (CIE): After completion of the course, the student shall prepare, with daily diary as reference, a comprehensive report in consultation with the mentor/s to indicate what he has observed and learned in the social connect period. The report should be signed by the mentor. The report shall be evaluated on the basis of the following criteria and/or other relevant criteria pertaining to the activity completed. Marks allotted for the diary are out of 50. Planning and scheduling the social connect Information/Data collected during the social connect Analysis of the information/data and report writing Considering all above points allotting the marks as mentioned below
Excellent: 80 to 100
Good: 60 to 79
Satisfactory: 40 to 59 Unsatisfactory and fail : <39

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| 22UHV37 | **CO1** | Communicate and connect to the surrounding. CO2: Create a responsible connection with the society |
| | **CO2** | Involve in the community in general in which they work. |
| | **CO3** | Notice the needs and problems of the community and involve them in problem solving. |
| | **CO4** | Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems. |
| | **CO5** | Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes. |

Teaching-Learning Process(General Instructions)
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.
1. Explanation via real life problem, situation modeling, and deliberation of solutions, hands- on sessions, reflective and questioning /inquiry-based teaching.
2. Instructions with interactions in classroom lectures (physical/hybrid).
3. Use of ICT tools, including YouTube videos, related MOOCs, AR/VR/MR tools.
4. Flipped classroom sessions (~10% of the classes).
5. Industrial visits, Guests talks and competitions for learning beyond the syllabus. -video based content creation for the syllabus (asassignments).
7. Use of gamification tools (in both physical/hybrid classes) for creative learning outcomes.

Pedagogy-Guidelines
It may differ depending on local resources available for study as well as environment and climatic differences, location and time of execution.

| s.no | Topic | Group Size | Location | Activity Execution | Reporting | Evaluation of the topic | |
|---|---|---|---|---|---|---|---|
| 1. | Plantation | May be | Farmers land, | Site selection/proper | Report | Evaluatio | |
| | and | individua | parks,villages,road | consultation/continuo | should be | n as per | |
| | adoption of | l or team | side, community | us monitoring | submitte | the | |
| | a tree | | area/college campus | information board | d by the | rubrics of | |
| | | | etc | | individua | the | |
| | | | | | l to the | scheme | |
| | | | | | concerne | and | |
| | | | | | d | syllabus | |
| | | | | | evaluatio | by | |
| | | | | | n | Faculty | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | authority | | |
| 2 | Heritage | May be | Temples / monumental | Site selection /proper | Report | Evaluatio | |
| | Walk and | individua | places / Villages/ City | consultation/Contin | should be | n as per | |
| | crafts corner | l or team | Areas / Grama | uous monitoring/ | submitte | the | |
| | | | panchayat/ public | Information board | d by | rubrics | |
| | | | associations/Governme | | individua | Of | |
| | | | nt Schemes officers/ | | l to the | scheme | |
| | | | campus etc…., | | concerne | and | |
| | | | | | d | syllabus | |
| | | | | | evaluatio | by | |
| | | | | | n | Faculty | |
| | | | | | authority | | |
| 3 | Organic | May be | Farmers land / parks / | Group selection / | Report | Evaluatio | |
| | farming and | individua | Villages visits / | proper consultation / | should be | n as per | |
| | waste | l or team | roadside/ community | Continuous | submitte | the | |
| | managemen | | area / College campus | monitoring / | d by | rubrics | |
| | t: | | etc…., | Information board | individua | Of | |
| | | | | | l to the | scheme | |
| | | | | | concerne | and | |
| | | | | | d | syllabus | |
| | | | | | evaluatio | by | |
| | | | | | n | Faculty | |
| | | | | | authority | | |
| 4 | Water | May be | Villages/ City Areas / | site selection / proper | Report | Evaluatio | |
| | conservatio | individua | Grama panchayat/ | consultation/Contin | should be | n as per | |
| | n: & | l or team | public | uous monitoring/ | submitte | the | |
| | conservatio | | associations/Governme | Information board | d by | rubrics | |
| | n techniques | | nt Schemes officers / | | individua | Of | |
| | | | campus etc… | | l to the | scheme | |
| | | | | | concerne | and | |
| | | | | | d | syllabus | |
| | | | | | evaluatio | by | |
| | | | | | n authority | Faculty | |
| 5 | Food walk: | May be | Villages/ City Areas / | Group selection / | Report | Evaluatio | |
| | Practices in | individua | Grama panchayat/ | proper consultation / | should be | n as per | |
| | society | l or team | public | Continuous | submitte | the | |
| | | | associations/Governme | monitoring / | d by | rubrics | |
| | | | nt Schemes officers/ | Information board | individua | Of | |
| | | | campus etc…., | | l to the | scheme | |
| | | | | | concerne | and | |
| | | | | | d | syllabus | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | evaluatio | by | |
| | | | | | n | Faculty | |
| | | | | | authority | | |

Plan Of Action(Execution of Activities)

| S.No | Practice Session Description |
|---|---|
| 1 | Lecture session in field to start activities |
| 2 | Students Presentation on Ideas |
| 3 | Commencement of activity and its progress |
| 4 | Execution of Activity |
| 5 | Execution of Activity |
| 6 | Execution of Activity |
| 7 | Execution of Activity |
| 8 | Case study based Assessment, Individual performance |
| 9 | Sector/ Team wise study and its consolidation |
| 10 | Video based seminar for 10 minutes by each student At the end of semester with Report |

Each student should do activities according to the scheme and syllabus.
At the end of semester student performance has to be evaluated by the faculty for the assigned activity progress and its completion.
At last consolidated report of all activities from 1 st to 5 th, compiled report should be submitted as per the instructions and scheme.

Assessment Details for CIE

| Weightage | CIE – 100% |
|---|---|
| Field Visit, Plan, Discussion | 10 Marks |
| Commencement of activities and its progress | 20 marks |
| Case study based Assessment Individual performance with report | 20 marks |
| Sector wise study & its consolidation 5*5 = 25 | 25 marks |
| Video based seminar for 10 minutes by each student At the | 25 marks |
| end of semester with Report. Activities 1 to 5, 5*5 = 25 | |
| Total marks for the course in each semester | 100 marks |

- Implementation strategies of the project ( NSS work). The last report should be signed by NSS Officer, the
- HOD and principal. At last report should be evaluated by the NSS officer of the institute.

Finally the consolidated marks sheet should be sent to the university and also to be made available at LIC visit

For each activity, 20 marks CIE will be evaluated for IA marks at the end of semester, Report and assessment copy should be made available in the department.

Students should present the progress of the activities as per the schedule in the prescribed practical session in the field. There should be positive progress in the vertical order for the benefit of society in general through activities.

| Fundamentals of Computer System and Office | | | |
|---|---|---|---|
| Course Code | 22ECAE381 | Credits | 1 |
| Course Type | Practical | CIE Marks | 50 |
| Lecture Hours(L:T:P) | 0:0:2 | SEE Marks | 50 |
| Total Hours | 13 Lab Slots | SEE Hours | 03 |

**Course objectives:**

- To acquire basic knowledge about computer hardware and software.
- To be able to create documents for printing and sharing using MS-Word.
- To be able to create and share presentations using MS-PowerPoint.
- To be able to manage and store data in a spreadsheet using Ms-Excel.
- To familiarize the use of Internet and E-mail & computer communication and networks.

| Modules-1 | Teaching Hours |
|---|---|
| Introduction to computer and Basic data types Introduction to computer- Characteristics and Basic Applications of Computer, Components of Computer System, Central Processing Unit (CPU), VDU, Keyboard and Mouse, Other input/output Devices, Memory, concepts of Hardware and Software, Classifications of computers; Representation of data/Information concepts of data processing, Basic data types, Storage of data/Information as files, operating system and The User Interface (windows, Linux), Windows Setting- Control Panels, Accessories (windows) | **5** |
| **Modules-2** | |
| Basic Word Processing Introduction to Word Processing, Opening Word Processing Package, Opening and closing documents, Using a Document/Help Wizard, Text Creation and Manipulation, Formatting the Text, Handling Multiple Documents, Table Manipulation, Printing, saving documents in different formats. | **6** |
| **Modules-3** | |
| Basic Presentations Basics- Difference between presentation and document, Using Power Point, Creation of Presentation, Preparation of Slides, Selection of type of Slides, Importing text from word documents, Providing aesthetics- Slide Designs, Slide Manipulation and Slide Show, Presentation of the Slides | **6** |
| **Modules-4** | |
| Spreadsheets and Basic Data Analysis Spread Sheet, Elements of Electronics Spread Sheet, Application/usage of Electronic Spread Sheet, Manipulation of cells, Formulas and functions; Spread sheets for Small accountings maintaining invoices/budgets, basic practical data analysis works (Maintaining daily and monthly sales reports) | **6** |
| **Modules-5** | |
| Basic Computer Communication and Internet Basic of Computer networks- LAN and WAN, Internet, Service on Internet; WWW and Web Browsers, Web Browsing software, Surfing the Internet, Chatting on Internet, Email-Basic of electronic mail, Using Emails, Document handling in Email | **5** |

**Question paper pattern:**

- The question paper will have ten questions.
- Each full question consists of 20marks.

- There will be 2 full questions (with a maximum of four sub questions) from each module, there will be five modules.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**Text books:**

1. C.S. French "Data Processing and Information Technology", BPB Publications 1998
2. P.K Sinha, Computer Fundamentals, BPB Publications, 1992

**Reference Books:**

1. Guy Hart-Davis "The ABCs of Microsoft Office 97 Professional edition", BPB Publications, 1998
2. Karl Schwartz, "Microsoft Windows 98 Training Guide", 1998

**E books and online course materials:**

1. Word : https://support.office.com/en-US/article/Word-2013-training-courses-videos-andtutorials-14807f76-d2b5-44d6-af11-9c880c44e551?ui=en-US&rs=en-US&ad=US
2. Excel: https://support.office.com/en-US/article/Excel-2013-training-courses-videos-andtutorials-aaae974d-3f47-41d9-895e-97a71c2e8a4a

**Course outcomes: On completion of the course, the student will have the ability to,**

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| 22ECAE381 | CO1 | Describe and work with computer system |
| | CO2 | Work in MS Word for project report drafting & Creating a Newsletter. |
| | CO3 | Develop presentation in MS Power Point for seminar/project interactive presentation |
| | CO4 | Apply formulas in MS Excel, creating charts and graphs to simplify complex information or data. |
| | CO5 | Describe Internet Applications, E-mail Account & its Functions, utility of Search Engine and Surfing Web Pages |

**22ECAE381 : Fundamentals of Computer System and Office**

| CO# | CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | Describe and work with computer system | 3 | 3 | 3 | | | | | 1 | | | | 1 | 3 | 2 | 2 |
| CO2 | Work in MS Word for project report drafting & Creating a Newsletter. | 3 | 3 | 3 | | | | | 1 | | | | 1 | 3 | 2 | 2 |
| CO3 | Develop presentation in MS Power Point for seminar/project interactive presentation | 3 | 3 | 2 | | | | | 1 | | | | 1 | 3 | 2 | 2 |
| CO4 | Apply formulas in MS Excel, creating charts and graphs to simplify complex information or data. | 3 | 3 | 2 | | | | | 1 | | | | 1 | 3 | 2 | 2 |
| CO5 | Describe Internet Applications, E-mail Account & its Functions, utility of Search Engine and Surfing Web Pages | 3 | 3 | 2 | | | | | 1 | | | | 1 | 3 | 2 | 2 |
| Average | | | | | | | | | | | | | | | | |

# Syllabus IV Semester

| Analog and Digital Communication | | | |
|---|---|---|---|
| Course Code | 22EC41 | Credits | 3 |
| Course Type | Theory | CIE Marks | 50 |
| Lecture Hours(L:T:P) | 3:0:0 | SEE Marks | 50 |
| Total Hours | 42 | SEE Hours | 03 |

**Course Objectives:**

- To introduce the concepts of analogue communication systems.
- To equip students with various issues related to analogue communication such as modulation, demodulation.
- Understand different PCM techniques and its analysis in terms of SNR.
- Understand different carrier modulation techniques and its BER performance.
- To study and understand properties of orthogonal codes and its use in spread spectrum communication

| Module-1 | Teaching Hours |
|---|---|
| **Amplitude Modulation:** Amplitude modulation, double sideband, double sideband suppressed carrier modulation, SSB modulation, vestigial sideband modulation, costas receiver, quardrature-amplitude modulation. | 8 |
| **Module-2** | |
| **Angle Modulation:** Basic definitions, properties of angle-modulated waves, relationship between PM and FM waves, narrow-band frequency modulation, wide-band Frequency Modulation, transmission bandwidth of FM waves, generation of FM waves, demodulation of FM signals<br>**Radio Receivers**: Tuned radio frequency receiver, super heterodyne receiver- RF section, frequency mixers, tracking, intermediate frequency, AGC. | 9 |
| **Module-3** | |
| **Pulse Modulation systems:** Pulse amplitude modulation (PAM), Pulse width modulation(PWM) and Pulse position modulation(PPM). Bandwidth requirements, generation and reconstruction methods, Analog to digital conversion, quantization and encoding techniques, quantization noise in PCM, Companding in PCM systems, Time division multiplexing (TDM), The delta modulator and its operation, quantization noise and slope overload in delta modulators. Comparison of delta modulation and PCM. | 9 |
| **Module-4** | |
| **Digital Modulation:** PSK, DPSK and FSK. M-array data communication systems, QAM systems, four phase PSK effects of noise in modulated digital communication Systems, Probability of error expression for binary communications, probability of error in QAM systems, comparison of digital modulation systems. | 8 |
| **Module-5** | |
| **Spread Spectrum Systems**: PN sequence, PN sequence generation, Properties of PN sequence, Direct sequence Spread spectrum, Slow and fast Frequency hopping, Time hopping, Signal space dimensionality and processing gain, antijam characteristics, CDMA Applications, comparison of spread spectrum communication. | 8 |

**Question paper pattern:**

- The question paper shall have five modules for 100 marks;
- Each full question carries 20 marks.
- Two questions to be set in each module (total ten questions).
- The candidate will have to answer one full question from each module.

Note: There can be a maximum of 4 subsections in each Question.

**Text Books:**

1. Simon Haykin, 'Introduction to Analog and Digital Communications', Second Edition.
2. Herbert Taub, Donald L.Schiling, 'Principles of Communication Systems', Second Edition.

**Reference Books:**

1. Simon Haykin, Digital Communications, John Wiley and Sons.
2. H.P.Hsu , Analog and Digital Communications, Schuam's outline series.
3. J G Proakis, Digital communications, MH.
4. B P Lathi, Modern Digital and Analog Communication, 3rd Edition.

**E books and online course materials:**

**Course outcomes: On completion of the course, the student will have the ability to,**

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| 22EC41 | CO1 | Analyze different amplitude modulation and demodulation techniques. |
| | CO2 | Analyze different angle modulation and demodulation techniques. |
| | CO3 | Analyze different PCM techniques and its analysis in terms of SNR |
| | CO4 | Analyze different carrier modulation techniques and its BER performance |
| | CO5 | Analyze properties of orthogonal codes and its use in spread spectrum communication. |

**22EC41 : Analog and Digital Communication**

| CO# | CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | Analyze different amplitude modulation and demodulation techniques. | 3 | 2 | 2 | 2 | | | | 1 | | 1 | | 1 | 3 | 2 | 2 |
| CO2 | Analyze different angle modulation and demodulation techniques. | 3 | 3 | 2 | 2 | | | | 1 | | 1 | | 1 | 3 | 2 | 2 |
| CO3 | Analyze different PCM techniques and its analysis in terms of SNR | 3 | 3 | 2 | 2 | | | | 1 | | 1 | | 1 | 3 | 2 | 2 |
| CO4 | Analyze different carrier modulation techniques and its BER performance | 3 | 3 | 2 | 2 | | | | 1 | | 1 | | 1 | 3 | 2 | 2 |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO5 | Analyze properties of orthogonal codes and its use in spread spectrum communication. | 3 | 2 | 2 | 2 | | | | 1 | | 1 | | 1 | 3 | 2 | 2 |
| Average | | **3** | **2.6** | **2** | **2** | | | | **1** | | **1** | | **1** | **3** | **2** | **2** |

| EMBEDDED MICROCONTROLLERS | | | |
|---|---|---|---|
| Course Code | 22EC42 | Credits | 4 |
| Course Type | Integrated | CIE Marks | 50 |
| Lecture Hours(L:T:P) | 3:0:2 | SEE Marks | 50 |
| Total Hours | 42 (Theory)+13 (Lab Slots) | SEE Hours | 03 |

**Course Objectives:**

- Study the architecture of 8051 microcontrollers
- Study addressing modes instruction sets, timers and counters to program with 8051
- Understand interrupt programming and real world interfacing with 8051
- Study architecture of ARM Cortex M series and TM4C
- Study ARM fundamentals for basic programming

| Module-1 | Teaching Hours |
|---|---|
| The 8051 Microcontrollers: Micro-controllers and Embedded Processors, Overview of the 8051 Family, Inside the 8051<br>8051 Programming: Pin diagram, Introduction to 8051 Assembly Programming, Assembling and Running an 8051 Program. The Program Counter and ROM Space in the 8051, Data Types and Directives. 8051 PSW Register, RAM organization, Stack. | 8 |
| **Module-2** | |
| Addressing Modes, Instruction Sets: Data transfer, Arithmetic, Logical, Bit, Branch instructions.<br>8051 Timer and Counter Programming: TMOD and TCON register, Programming 8051 Timers, Counter Programming. | 8 |
| **Module-3** | |
| Interrupt Programming: 8051 Interrupts, Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupt, Interrupt Priority in the 8051.<br>Real World Interfacing: 8051 Interfacing to LCD, Keyboard, ADC/DAC, stepper motor. | 9 |
| **Module-4** | |
| Introduction to Embedded system: Introduction to ARM architecture and Cortex – M4F processor, Cortex M4F architecture, Features.TM4C123GH6PM Block diagram, Features, Applications, TM4C123GH6PM launch pad I/O ports, Address space, On-chip peripherals (analog and digital), Register sets, Addressing modes and Instruction set basics. | 7 |
| **Module-5** | |
| Microcontroller fundamentals for basic programming: I/O pin multiplexing, pull up/down registers, GPIO control, Programming System registers, Watchdog Timer, QEI.<br>Applications Based on TIVA: LED Blinking, Interrupt programming through GPIO, PWM generation, Interfacing potentiometer (ADC) with TIVA GPIO. | 8 |

**Text Books:**

1. The 8051 Microcontrollers and Embedded Systems, MAZIDI and MAZIDI, Second edition, Pearson Education,1999
2. Embedded Systems: Real-Time Interfacing to ARM Cortex-M Microcontrollers, 2014, Create space publications ISBN: 978-1463590154.
3. Embedded Systems: Introduction to ARM Cortex - M Microcontrollers, 5th edition Jonathan W Valvano, Create space publications ISBN-13: 978-1477508992

**Reference Books:**

1. The 8051 Microcontroller, Kenneth Ayala, Second Edition, Thomson,2006
2. The Definitive Guide to ARM® Cortex®-M3, Second Edition, 2017 November, Joseph Yui.
3. CC3100/CC3200 Simple Link™ Wi-Fi® Internet-on-a-Chip User Guide Texas Instruments Literature Number: SWRU368A April 2014–Revised August 2015.

**Question paper pattern:**

- The question paper shall have five modules for 100 marks;
- Each full question carries 20 marks.
- Two questions to be set in each module (total ten questions).
- The candidate will have to answer one full question from each module.

Note: There can be a maximum of 4 subsections in each Question..

**List of Experiments/ Programs**

Programming 8051 using Keil µVision

1. Develop programs using data movement instructions and arithmetic instructions
2. Develop programs on logical, bit manipulation instructions
3. Develop programs on branch and loop instructions
4. Programs 8051 timers and counters to perform specific functions
5. Develop programs to perform code conversions
6. Program 8051 to execute subroutine call and interrupts

Programming Tiva C series TM4Cxx module with CC Studio.

7. Interfacing and Programming GPIO ports in 'C' using Tiva(LED Blinking and Push Button)
8. Interrupt programming through GPIO
9. PWM generation using PWM module on Tiva
10. Interfacing Potentiometer with Tiva GPIO

**Course outcomes: On completion of the course, the student will have the ability to,**

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| 22EC42 | CO1 | Describe the 8051 microcontroller architecture, PSW and memory |
| | CO2 | Analyze the working of 8051 timers and counters and program using 8051. |
| | CO3 | Perform interrupt programming and Interface 8051 with real world I/O devices |
| | CO4 | Describe the architecture of ARM and TM4C microcontroller and program for basic operations |
| | CO5 | Analyze the TM4C modules and Program TM4C to interface real world modules |

**22EC42: Embedded Microcontrollers**

| CO# | CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | Describe the 8051 microcontroller architecture, PSW and memory | 3 | 3 | 3 | | 3 | | | | 3 | | | 2 | 3 | 2 | 2 |
| CO2 | Analyze the working of 8051 timers and counters and program using 8051. | 3 | 3 | 3 | | 3 | | | | 3 | | | 2 | 3 | 2 | 2 |
| CO3 | Perform interrupt programming and Interface 8051 with real world I/O devices | 3 | 3 | 3 | | 3 | | | | 3 | | | 2 | 3 | 2 | 2 |
| CO4 | Describe the architecture of ARM and TM4C microcontroller and program for basic operations | 3 | 3 | 3 | | 3 | | | | 3 | | | 2 | 3 | 2 | 2 |
| CO5 | Analyze the TM4C modules and Program TM4C to interface real world modules | 3 | 3 | 3 | | 3 | | | | 3 | | | 2 | 3 | 2 | 2 |
| Average | | 3 | 3 | 3 | | 3 | | | | 3 | | | 2 | 3 | 2 | 2 |

| **DIGITAL DESIGN USING VERILOG HDL** | | | |
|---|---|---|---|
| Course Code | 22EC43 | Credits | 4 |
| Course Type | Integrated | CIE Marks | 50 |
| Lecture Hours(L:T:P) | 3:0:2 | SEE Marks | 50 |
| Total Hours | 42 (Theory)+13 (Lab Slots) | SEE Hours | 03 |

**Course Objectives:**

- Learn different Verilog HDL constructs.
- Familiarize the different levels of abstraction in Verilog.
- Understand Verilog Tasks and Directives.
- Understand timing and delay Simulation.
- Understand logic synthesis using Verilog.

| **Module-1** | **Teaching Hours** |
|---|---|
| Overview of Digital Design with Verilog HDL: Evolution of CAD, Emergence of HDLs, Typical HDL-flow, Why Verilog HDL?, Trends in HDLs.<br>Top-down and bottom-up design methodology, Lexical conventions, Structure of Verilog HDL module, Levels of abstraction. | 7 |
| **Modules-2** | |
| Operators and Data types, Dataflow Modelling: Continuous assignments, delay specification, expressions, Structure of Dataflow description, Examples. | 8 |
| **Modules-3** | |
| Behavioural Modelling**:** Structured procedures, initial and always, blocking and non blocking statements, delay control, event control, conditional statements, Multiway branching, loops, sequential and parallel blocks. | 9 |
| **Modules-4** | |
| Gate-Level Modelling: Modelling using basic Verilog gate primitives, description of and/or and buf/not type gates, rise, fall and turn-off delays, min, max, and typical delays.<br>Tasks and Functions: Differences between tasks and functions, declaration, invocation, automatic tasks and functions. | 7 |
| **Modules-5** | |
| Useful Modeling Techniques**:** Procedural continuous assignments, overriding parameters, conditional compilation and execution, useful system tasks.<br>Logic Synthesis with Verilog: Logic Synthesis, Impact of logic synthesis, Verilog HDL Synthesis, Synthesis design flow, Synthesis information from Entity and Module, Mapping Process and Always in the Hardware Domain | 9 |

**Text Books:**

1. Samir Palnitkar, “Verilog HDL: A Guide to Digital Design and Synthesis”, Pearson Education, Second Edition.
2. Nazieh M Botros, “HDL Programming – VHDL and Verilog”, Dreamtech Press, 2006 Edition.

**Reference Books:**

1. Donald E. Thomas, Philip R Moorby, 'The Verilog Hardware Description Language", Springer Science+ Business Media, LLC, Fifth edition.
2. Michael D. Ciletti, "Advanced Digital Design with the Verilog HDL", Pearson (Prentice Hall), Second edition.
3. Padmanabhan, Tripura Sundari, "Design through Verilog HDL", Wiley, 2016 or earlier.

**Question paper pattern:**

- The question paper shall have five modules for 100 marks;
- Each full question carries 20 marks.
- Two questions to be set in each module (total ten questions).
- The candidate will have to answer one full question from each module.

Note: There can be a maximum of 4 subsections in each Question..

**List of Laboratory Experiments**

1. Develop a Verilog code for all basic gates in all the modelling styles.
2. Develop a Verilog code for different combinational circuits (half adder, half subtractor, 2:1 multiplexer, 1:2 demultiplexer, 4:2 encoder and 2:4 decoder).
3. Develop a Verilog code for 1-bit full adder and full subtractor in all the modelling styles.
4. Develop a Verilog code for 4-bit full adder and full subtractor.
5. Develop a Verilog code for code conversion (binary to gray, gray to binary, binary to BCD, BCD to binary).
6. Develop a Verilog code for 8-bit, 16-bit and 32-bit ALU.
7. Develop a Verilog code for clock generation.
8. Develop a Verilog code for flip flops (SR, JK, D, T and Master Slave).
9. Develop a Verilog code for 4-bit counters (binary, BCD, Ring, Johnson).
10. Develop a Verilog code for 4-bit Bidirectional Shift Register.
11. Develop a Verilog code for calculation of a factorial of a number using task and function.

**Course outcomes: On completion of the course, the student will have the ability to,**

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| 22EC43 | CO1 | Understand the basics of Verilog HDL Programming |
| | CO2 | Develop programs in Data flow modelling using various data types and operators |
| | CO3 | Develop programs to demonstrate behavioural modelling using conditional statements and loops. |
| | CO4 | Develop programs in gate-level modelling using delays and using tasks and functions |
| | CO5 | Perform timing and delay simulation and interpret the various constructs in logic synthesis. |

**22EC43: Digital Design Using Verilog HDL**

| CO# | CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | Describe the design flow and structure of Verilog HDL Programming | 3 | 2 | 2 | 2 | | | 2 | | 2 | | 2 | 3 | 2 | 2 | 3 |
| CO2 | Develop programs with Data flow modelling by applying different data types and operators | 3 | 3 | 3 | 3 | | | 2 | | 2 | | 2 | 3 | 3 | 2 | 3 |
| CO3 | Develop programs to demonstrate behavioural modelling using conditional statements and loops. | 3 | 3 | 3 | 3 | | | 2 | | 2 | | 3 | 3 | 3 | 3 | 3 |
| CO4 | Develop programs in gate-level modelling using delays and using tasks and functions | 3 | 3 | 3 | 3 | | | 3 | | 2 | | 3 | 3 | 3 | 3 | 3 |
| CO5 | Perform timing and delay simulation and interpret the various constructs in logic synthesis. | 3 | 3 | 3 | 3 | | | 2 | | 3 | | 3 | 3 | 2 | 2 | 3 |
| Average | | 3 | 2.8 | 2.8 | 2.8 | | | 2.2 | | 2.2 | | 2.6 | 3 | 2.6 | 2.4 | 3 |

| ANALOG AND DIGITAL COMMUNICATION LAB | | | |
|---|---|---|---|
| Course Code | 22ECL44 | Credits | 1 |
| Course Type | Practical | CIE Marks | 50 |
| Lecture Hours(L:T:P) | 0:0:2 | SEE Marks | 50 |
| Total Hours | 13 Lab Slots | SEE Hours | 03 |

**Course objectives:**

- To design and Demonstrate Second Order active low pass, high pass and band pass filters.
- To design and Demonstrate analog and angle Modulation
- To design and Demonstrate pulse modulation and demodulation.
- To design and Demonstrate digital modulation and demodulation such as ASK, PSK, DPSK and FSK
- To Verify and demonstrate PN sequence generation

- Second order active low pass and high pass filter
- Second order active band pass and band elimination filter
- Amplitude modulation and demodulation using envelop detector
- Frequency modulation and demodulation using PLL
- Pre-emphasis and De-emphasis circuits.
- PAM modulation and demodulation
- PPM Modulation and demodulation
- PWM Modulation and demodulation
- Signal sampling and its reconstruction
- Time division multiplexing of signals
- Amplitude shift keying
- Frequency shift keying
- Phase shift keying
- PN sequence generator.

**Conduct of Practical Examination:**

- All laboratory experiments are to be included for practical examination
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and will be evaluated for 85% of the total marks.

**Course outcomes: On completion of the course, the student will be able to:**

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| 22ECL44 | CO1 | Design various second order active filters. |
| | CO2 | Design AM, FM and its demodulation. |
| | CO3 | Design and implement Pulse modulation schemes such as AM, PWM and PPM |
| | CO4 | Design and implement ASK, FSK and PSK modulation and demodulation. |
| | CO5 | Design and implement PN sequence generator. |

**22ECL44: ANALOG AND DIGITAL COMMUNICATION LAB**

| CO# | CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | Design various second order active filters. | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 3 | 2 | | 1 | 3 | 3 | 2 |
| CO2 | Design AM, FM and its demodulation. | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 3 | 2 | | 1 | 3 | 3 | 2 |
| CO3 | Design and implement Pulse modulation schemes such as AM, PWM and PPM | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 3 | 2 | | 1 | 3 | 3 | 2 |
| CO4 | Design and implement ASK, FSK and PSK modulation and demodulation. | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 3 | 2 | | 1 | 3 | 3 | 2 |
| CO5 | Design various second order active filters. | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 3 | 2 | | 1 | 3 | 3 | 2 |
| Average | | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 3 | 2 | | 1 | 3 | 3 | 2 |

| PRINCIPLES OF ELECTROMAGNETICS | | | |
|---|---|---|---|
| Course Code | 22EC45A | Credits | 3 |
| Course Type | Theory | CIE Marks | 50 |
| Lecture Hours(L:T:P) | 3:0:0 | SEE Marks | 50 |
| Total Hours | 42 | SEE Hours | 03 |

**Course objectives:**

- To appreciate the theory of vector analysis
- To understand the concepts of electrostatics, electrical potential, energy density and their applications
- To analyze the concepts of magnetostatics, magnetic flux density, scalar and vector potential and its applications
- To explore Biot-Savart'sLaw, Ampere's Law, Faraday's Laws, and Maxwell's equations

| Modules-1 | Teaching Hours |
|---|---|
| **Preliminaries**: Vector analysis and coordinate transformation: vector algebra, coordinate systems, vector components, unit vector, dot &cross products. Cylindrical and spherical, coordinate system, coordinate transformations.<br>**Coulomb's law electric field intensity**: Experimental coulombs law, electric field intensity, electric field due to continuous volume charge, line charge, sheet charge. Electric flux density, Gauss law and Divergence: electric flux density, Gauss law and its applications, divergence theorem | 9 |
| **Module-2** | |
| **Energy and potential:** Energy and potential in a moving point charge in an electric field, line integral, potential difference and potential, potential field of a point charge, The potential field of a system of charges- conservative property, potential gradient, the dipole, energy density in electric field.<br>**Conductors, dielectric and capacitance**: Current and current density, continuity of current, Metallic conductors, conductor properties and boundary conditions, Capacitance, several capacitance examples. Capacitance of a two- wire line | 8 |
| **Module-3** | |
| **Poisson's and Laplace's equation**: Poisson's and Laplace's equations, Uniqueness theorem, solution of Laplace's equation, examples of solutions of Poisson's equations.<br>**Magnetic Fields:** Steady Magnetic fields: Biot savart's law, Ampere's circuital law, Curl. Stokes theorem, magnetic flux and flux density, Magnetic forces, material and inductances: Scalar and vector magnetic potentials, magnetic force between differential current elements, force and torque on a closed circuit, magnetic boundary conditions , magnetic circuit, inductance. | 8 |
| **Module-4** | |
| **Time varying fields and Maxwell's equations**: Faraday's law, displacement current, Maxwell's equations in point form and integral form, the retarded potentials.<br>**Uniform plane wave**: Wave propagation in free space, wave propagation in dielectrics, The Poynting vector& power considerations, propagation in good conductors-skin effect, wave polarization, the distortion less line. | 9 |
| **Module-5** | |
| **Plane waves at boundaries & in dispersive media**: Reflection of uniform plane waves at normal incidence, standing wave ratio, wave reflection from multiple interfaces, plane wave propagation in general directions, plane wave reflection at oblique incidence angles, | 8 |

| | |
|---|---|
| plane wave propagation in dispersive media. | |

**Question paper pattern:**

- The question paper shall have five modules for 100 marks;
- Each full question carries 20 marks.
- Two questions to be set in each module (total ten questions).
- The candidate will have to answer one full question from each module.

Note: There can be a maximum of 4 subsections in each Question..

**Text books:**

1. William H Hayt Jr and John A Buck., Engineering electromagnetic,TMH7$^{th}$ed.

**Reference Books:**

1. Kraus J D and Carver K R., electromagnetic.,(TMH)
2. JA r. Edminister, electromagnetic, TMH 2$^{nd}$ ed.
3. P.N.O Sadiku,"Elementsofelectromagnetic"4$^{th}$ ed. Oxford University press.
4. E C Jordon & K G . Balmain., electromagnetic waves and radiation system., PHI2$^{nd}$ ed.Hayt. W. H. & J. E. Kemmerly, "Engineering Circuit Analysis", TMH Eighth edition JA r. Edminister, electromagnetic, TMH 2$^{nd}$ ed.

**E books and online course materials:**

**Course outcomes: On completion of the course, the student will have the ability to,**

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| 22EC45A | CO1 | Compute electric field intensity & potential using Coulomb's law & Gauss's law. |
| | CO2 | Analysis of EM field using boundary conditions |
| | CO3 | Analysis of steady magnetic fields. |
| | CO4 | Analysis of time varying fields using Maxwell's equations and wave propagation in different media. |
| | CO5 | Analysis of wave reflection in different media |

**22EC45A: Principles of Electromagnetics**

| CO# | CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | Compute electric field intensity & potential using Coulomb's law & Gauss's law. | 3 | 3 | 2 | | | | | 1 | | 1 | | 1 | 3 | 2 | 2 |
| CO2 | Analysis of EM field using boundary conditions | 3 | 3 | 2 | | | | | 1 | | 1 | | 1 | 3 | 2 | 2 |
| CO3 | Analysis of steady magnetic fields. | 3 | 3 | 2 | | | | | 1 | | 1 | | 1 | 3 | 2 | 2 |
| CO4 | Analysis of time varying fields using Maxwell’s equations and wave propagation in different media. | 3 | 3 | 2 | | | | | 1 | | 1 | | 1 | 3 | 2 | 2 |
| CO5 | Analysis of wave reflection in different media | 3 | 3 | 2 | | | | | 1 | | 1 | | 1 | 3 | 2 | 2 |
| Average | | 3 | 3 | 2 | | | | | 1 | | 1 | | 1 | 3 | 2 | 2 |

| BIOLOGY FOR ENGINEERS | | | |
|---|---|---|---|
| Course Code | 22BSC46 | Credits | 3 |
| Course Type | Theory | CIE Marks | 50 |
| Lecture Hours(L:T:P) | 3:0:0 | SEE Marks | 50 |
| Total Hours | 42 | SEE Hours | 03 |

**Course Objectives:**

- To familiarize the students with the basic biological concepts and their engineering applications.
- To enable the students with an understanding of bio design principles to create novel devices and structures.
- To provide the students an appreciation of how biological systems can be re-designed as substitute products for natural systems.
- To motivate the students to develop interdisciplinary vision of biological engineering.

| Module-1 | Teaching Hours |
|---|---|
| **INTRODUCTION TO BIOLOGY:** The cell: the basic unit of life, Structure and functions of a cell. The Plant Cell and animal cell, Prokaryotic and Eukaryotic cell, Stem cell s and their application. Biomolecules: Properties and functions of Carbohydrates, Nucleic acids, proteins, lipids. Importance of special biomolecules; Enzymes (Classification (with one example each), Properties and functions),vitamins and hormones | 8 |
| **Module-2** | |
| **BIOMOLECULES ANDTHEIR APPLICATIONS(QUALITATIVE):** Carbohydrates(cellulose- based water filters, PHA and PLA as bioplastics), Nucleicacids(DNA Vaccine for Rabies and RNA vaccines for Covid19, Forensics– DNA finger printing), Proteins(Proteins as food– whey protein and meat analogs, Plant based proteins), lipids(biodiesel, cleaning agents/detergents), Enzymes (glucose-oxidase in biosensors, lignolytic enzyme in bio-bleaching). | 8 |
| **Module-3** | |
| **HUMAN ORGAN SYSTEMS AND BIODESIGNS(QUALITATIVE):** Brain as a CPU system (architecture, CNS and Peripheral Nervous System, signal transmission, EEG, Robotic arms for prosthetics. Engineering solutions for Parkinson's disease). Eye as a Camera system(architecture of rod and cone cells, optical corrections, cataract, lens materials, bionic eye). Heart as a pump system (architecture, electrical signaling -ECG monitoring and heart related issues, reasons for blockages of blood vessels, design of stents, pacemakers, defibrillators). Lungs as purification system(architecture, gas exchange mechanisms ,spirometry, abnormal lung physiology-COPD, Ventilators, Heart-lung machine). Kidney as a filtration system(architecture, mechanism of filtration, CKD, dialysis systems). | 9 |
| **Module-4** | |
| **NATURE-BIO INSPIRED MATERIALS AND MECHANISMS(QUALITATIVE):** Echolocation (ultra sonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf). Bird flying(GPS and aircrafts), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs(Velcro), Shark skin(Friction reducing swim suits), Kingfisher beak(Bullet train). Human Blood substitutes-hemoglobin- based oxygen carriers(HBOCs) and per flouro carbons(PFCs). | 8 |

| Module-5 | |
|---|---|
| **TRENDS IN BIO ENGINEERING(QUALITATIVE):**<br>Muscular and Skeletal Systems as scaffolds (architecture, mechanisms, bio engineering solutions for muscular dystrophy and osteoporosis), scaffolds and tissue engineering, Bio printing techniques and materials, 3D printing of ear, bone and skin. 3D printed foods. Electrical tongue and electrical nose in food science, DNA origami and Bio computing, Bio imaging and Artificial Intelligence for disease diagnosis. Self-healing Bio concrete(based on bacillus spores, calcium lactate nutrients and bio mineralization processes) and Bioremediation and Bio mining via microbial surface adsorption (removal of heavy metals like Lead,<br>Cadmium, Mercury, Arsenic). | 9 |

**Suggested Learning Resources: Books**

- Biology for Engineers, Rajendra Singh C and Rathnakar Rao N, Rajendra Singh C and Rathnakar Rao N Publishing, Bengaluru, 2023.
- Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022
- Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W.,Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.
- Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
- Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011.
- Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.
- Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press.
- Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C. Mattiussi, MIT Press, 2008.
-

**Web links and Video Lectures(e-Resources):**

- https://nptel.ac.in/courses/121106008
- https://freevideolectures.com/course/4877/nptel-biology-engineers-other-non-biologists
- https://ocw.mit.edu/courses/20-020-introduction-to-biological-engineering-design-spring-2009
- https://ocw.mit.edu/courses/20-010j-introduction-to-bioengineering-be-010j-spring-2006
- https://www.coursera.org/courses?query=biology
- https://onlinecourses.nptel.ac.in/noc19_ge31/preview
- https://www.classcentral.com/subject/biology
- https://www.futurelearn.com/courses/biology-basic-concepts

**Activity Based Learning(Suggested Activities in Class)/Practical Based learning**

- Group Discussion of Case studies
- Model Making and seminar/poster presentations
- Design of novel device/equipment like Cellulose-based water filters, Filtration system

**Course outcomes: On completion of the course, the student will have the ability to,**

| Course Code | | Course Outcome (CO) |
|---|---|---|
| 22BSC46 | | Elucidate the basic biological concepts via relevant industrial applications and case studies. |
| | | Evaluate the principles of design and development, for exploring novel bioengineering projects. |
| | | Corroborate the concepts of bio mimetics for specific requirements. |
| | | Think critically towards exploring innovative bio based solutions for socially relevant problems |

**22BSC46: BIOLOGY FOR ENGINEERS**

| CO# | CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | Elucidate the basic biological concepts via relevant industrial applications and case studies. | | | | | | | | | | | | | | | |
| CO2 | Evaluate the principles of design and development, for exploring novel bioengineering projects. | | | | | | | | | | | | | | | |
| CO3 | Corroborate the concepts of bio mimetics for specific requirements. | | | | | | | | | | | | | | | |
| CO4 | Think critically towards exploring innovative bio based solutions for socially relevant problems | | | | | | | | | | | | | | | |
| Average | | | | | | | | | | | | | | | | |

| MATLAB FOR ENGINEERS | | | |
|---|---|---|---|
| Course Code | 22ECAE481 | Credits | 1 |
| Course Type | Practical | CIE Marks | 50 |
| Lecture Hours(L:T:P) | 0:0:2 | SEE Marks | 50 |
| Total Hours | 13 Lab Slots | SEE Hours | 03 |

**Course Objectives:**

- The objectives of the course is to enable students to:
- Write MATLAB programs using built in functions.
- Write code to sketch plots.

| **Modules-1** | **Teaching Hours** |
|---|---|
| Introduction, basic features, a minimum MATLAB session, getting started | 5 |
| **Modules-2** | |
| Mathematical functions, basic plotting, matrix generation | 5 |
| **Modules-3** | |
| Array operations, solving linear equations, matrix functions | 6 |
| **Modules-4** | |
| Introduction to programming in Matlab, M-file scripts, M-file functions, input to a script file, output commands. | 6 |
| **Modules-5** | |
| Control flow and operators, saving output to a file, debugging M-files | 6 |

**Question paper pattern:**

- The question paper shall have five modules for 100 marks;
- Each full question carries 20 marks.
- Two questions to be set in each module (total ten questions).
- The candidate will have to answer one full question from each module.

Note: There can be a maximum of 4 subsections in each Question..

**Text Books:**

1. David Houcque, " Introduction To Matlab For Engineering Students"

**Reference Books:**

1. Brian H Hahn, Daniel T Valentine, "Essential MATLAB for Engineers and scientists"

**Course outcomes:**

**On completion of the course, the student will have the ability to:**

| **Course Code** | **CO #** | **Course Outcome (CO)** |
|---|---|---|
| **21ECAE481** | CO1 | Start using MATLAB |
| | CO2 | Use mathematical functions and plot |
| | CO3 | Use array functions and matrix functions |
| | CO4 | Do programming using MATLAB |
| | CO5 | Use flow control functions and know how debug. |

**22ECAE481: MATLAB For Engineers**

| CO# | CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | Start using MATLAB | 2 | 2 | 1 | | | 1 | 1 | 2 | 3 | 2 | | 1 | 3 | 2 | 2 |
| CO2 | Use mathematical functions and plot | 3 | 3 | 1 | | | 1 | 1 | 2 | 3 | 2 | | 1 | 3 | 2 | 2 |
| CO3 | Use array functions and matrix functions | 3 | 3 | 1 | | | 1 | 1 | 2 | 3 | 2 | | 1 | 3 | 2 | 2 |
| CO4 | Do programming using MATLAB | 3 | 3 | 1 | | | 1 | 1 | 2 | 3 | 2 | | 1 | 3 | 2 | 2 |
| CO5 | Use flow control functions and know how debug. | 3 | 3 | 1 | | | 1 | 1 | 2 | 3 | 2 | | 1 | 3 | 2 | 2 |
| Average | | 2.6 | 2.8 | 2.8 | 1 | | | 1 | 1 | 2 | 3 | 2 | | 1 | 3 | 2 |

**H. K. E. SOCIETY'S**

**POOJYA DODDAPPA APPA COLLEGE OF ENGINEERING, KALABURAGI**

**B.E in Electronics & Communication Engineering 2022**

**Outcome Based Education (OBE) and Choice Based Credit System (CBCS)**

**Scheme of Teaching and Examination 2022-23 to 2025-26**

(Effective from the academic year 2023-24)

**V Semester**

| Sl. No. | Course and Course Code | | Course Title | Teaching Department | Teaching Hours/Weeks | | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Lecture | Tutorial | Practical/ Drawing | Self Study | Duration in Hours | CIE Marks | SEE Marks | Total Marks | |
| | | | | | L | T | P | S | | | | | |
| 1 | PCC | 22EC51 | Antenna and Microwave Engineering | E & CE | 4 | 0 | 0 | - | 04 | 50 | 50 | 100 | 4 |
| 2 | IPCC | 22EC52 | Digital Signal Processing | E & CE | 3 | 0 | 2 | - | 03 | 50 | 50 | 100 | 4 |
| 3 | IPCC | 22EC53 | Data Structure and Algorithm | E & CE | 3 | 0 | 2 | - | 03 | 50 | 50 | 100 | 4 |
| 4 | PCCL | 22ECL54 | Antenna and Microwave Lab | E & CE | 0 | 0 | 2 | - | 03 | 50 | 50 | 100 | 1 |
| 5 | PEC | 22EC55X | PEC-I | E & CE | 3 | 0 | 0 | - | 03 | 50 | 50 | 100 | 3 |
| 6 | PROJ | 22ECMP56 | Mini-Project | E & CE | 0 | 0 | 2 | - | 03 | 50 | - | 50 | 2 |
| 7 | RMI | 22RMI57 | Research Methodology and IPR | E & CE | 3 | 0 | 0 | - | 03 | 50 | 50 | 100 | 3 |
| 8 | ESC | 22ES58 | Environmental Studies | E & CE | 3 | 0 | 0 | | 03 | 50 | 50 | 100 | 2 |
| 9 | NCMC | 22NS59 | Mandatory Course | NSS Coordinator | 0 | 0 | 2 | - | - | 50 | - | 50 | 0 |
| | | 22PH59 | Mandatory Course | Physical Education Director | | | | | | | | | |
| | | 22YO59 | Mandatory Course | Yoga Teacher | | | | | | | | | |
| | | | | | | | | | **Total** | **450** | **350** | **800** | **23** |

**Professional Elective Course(PEC-I)**

| | |
|---|---|
| PEC-22EC551 | IOT and its application |
| PEC-22EC552 | Analog CMOS VLSI Design |

**PCC:** Profession core Course, **PCCL:** Professional Core Course Laboratory, **UHV:** Universal Human Value Course, **MC:** Mandatory Course(Non-Credit), **AEC:** Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **K:** The letter in the course code indicates common to all the stream of engineering. **PROJ**: Project/Mini Project. **PEC**: Professional Elective Course. IPCC: Integrated Professional Core Course

| Antenna and Microwave Engineering | | | |
|---|---|---|---|
| Course Code | 22EC51 | Credits | 4 |
| Course Type | PCC | CIE Marks | 50 |
| Lecture Hours (L:T:P) | 4:0:0 | SEE Marks | 50 |
| Total Hours | 52 | SEE Hours | 03 |

**Course Objectives:**

- To impart knowledge of basic concepts of antenna theory.
- To impart knowledge of Identify antenna types for specific applications.
- To impart knowledge of basic concepts of Active& Passive Devices.

| Modules | Teaching Hours |
|---|---|
| **Module-1** | |
| **Introduction to Antenna**: Principle of radiation, isotropic radiator, radiation resistance, radiation pattern, beam width, bandwidth, directivity, gain, effective length of an antenna, relationship between gain and radiating efficiency, power gain, Frii's transmission formula. | 10 |
| **Module-2** | |
| **Antenna arrays:** Point sources, two element arrays of equal amplitude and same phase, equal amplitude and opposite phase and unequal amplitude and any phase, broad side and end fire arrays, multiplication of patterns, Binomial arrays, Effect of earth on vertical pattern | 10 |
| **Module-3** | |
| **Antenna Measurement:** Methods of measuring impedance, field pattern, gain and directivity.<br>**Antenna Types**: Yagi-Uda antenna, folded dipole antenna, parabolic reflectors, loop antenna, Helical antenna, horn antenna, patch antenna, slot antenna | 11 |
| **Module-4** | |
| **Microwave waveguides and components**: Introduction, hybrid circuits, directional couplers, circulators, magic tee and isolators, phase shifters, attenuators, s-matrix representation of multiport networks. | 10 |
| **Module-5** | |
| **Microwave diodes**: Transfer electron devices: Introduction: Avalanche transit time devices: READ diode, IMPATT diode, BARITT diode, parametric amplifiers and other diodes: PIN diodes, Schottky diodes. GUNN effect diodes – GaAs diodes, RWH theory, Modes of operation. | 11 |

**Text Books:**


1. Antennas and wave propagation – John D Krauss,Ronald J Marhefka, Ahmed Khan, 4th Edition.Mcgraw Hill Education 2013.
2. Antenna and wave propagation – K. D. Prasad, Satyaprakashan Publishers,2012
3. Microwave Engineering –AnnapurnaDas, Sisir K Das, TMH publication, 2nd edition 2010.
4. Microwave Devices and Circuits – Samuel Y Liano, Pearson education.


**Reference Books:**


1. Antenna and wave propagation- Harish and Sachidananda, oxford university press 2007.
2. Antenna theory analysis and design,C A Balanis, Third Edition, Wiley
3. Microwave Engineering- David M Pozar, John Wiley India Pvt Ltd, 3rd edition.
4. Microwave Engineering- Sushrut Das, Oxford Higher Education 2nd edition 2015.


**Question paper pattern:**

• The question paper will have ten questions.

• Each full question consists of 20 marks.

• There will be 2 full questions (with a maximum of four sub questions) from each module.

• Each full question will have sub questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

| Course Code | CO | Course Outcome (CO) |
|---|---|---|
| 22EC51 | CO1 | Analyze various Antenna parameters and their significance. |
| | CO2 | Analyze and understand the concepts of Antenna Arrays. |
| | CO3 | Identify various Antenna Configurations for suitable applications. |
| | CO4 | Understand the basic concepts & functional characteristics of passive devices . |
| | CO5 | Understand the basic concepts & functional characteristics of Active devices. |

**CO-PO-PSO Matrix:**

| CO# | CO Statement | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | Analyze various Antenna parameters and their significance | 3 | 2 | | | | | | 1 | | | | 1 | 3 | | |
| CO2 | Analyze and understand the concepts of Antenna Arrays | 3 | 3 | 2 | 2 | | | | 1 | | 1 | | 1 | 3 | 2 | 2 |
| CO3 | Identify various Antenna Configurations for suitable applications | 3 | 2 | 2 | 2 | | | | 1 | | 1 | | 1 | 3 | 2 | 2 |
| CO4 | Understand the basic concepts & functional characteristics of passive devices | 2 | 1 | 1 | 1 | | | | 1 | | | | 2 | 3 | 1 | 1 |
| CO5 | Understand the basic concepts & functional characteristics of Active devices. | 2 | 1 | 1 | 1 | | | | 1 | | | | 2 | 3 | 1 | 1 |
| Average | | 2.6 | 1.8 | 1.2 | 1.2 | | | | 1 | | 0.4 | | 1.4 | 2 | 3 | 1.2 |

| Digital Signal Processing | | | |
|---|---|---|---|
| Course Code | 22EC52 | Credits | 4 |
| Course Type | IPCC | CIE Marks | 50 |
| Lecture Hours(L:T:P) | 3:0:2 | SEE Marks | 50 |
| Total Hours | 42 | SEE Hours | 03 |

**Course objectives:**

- To study the basic concepts of digital signal processing.
- To study analysis and processing of signals for different kind of applications and retrieval of information from signals.
- To study designing of digital filters and its realization.
- To study analysis of signals using the discrete Fourier transform (DFT) and Z-Transform.

| Modules | Teaching Hours |
|---|---|
| **Module -1** | |
| **Discrete Fourier Transform:** Representation of periodic sequences – The Discrete Fourier Series, Properties of DFS, Sampling the Z-transform, Fourier Representation of finite duration sequences – The Discrete Fourier Transform, Properties of DFT, Examples on DFT properties. | 9 |
| **Module -2** | |
| **DFT Continued**: Linear filtering using DFT, Filtering of long data sequences, and Frequency analysis of signals using DFT. **Computation of the Discrete Fourier Transform:** Goertzel algorithm, Decimation in Time algorithms, Decimation in Frequency algorithms, FFT algorithms for N a composite number. Chirp Z-Transform algorithm. | 8 |
| **Module -3** | |
| **IIR Filters:** Design of IIR digital filters from Analog filters – Impulse Invariance, Design based on numerical solution of the differential equation, Bilinear transformation, Characteristics of commonly used Analog filters, Design examples – Analog to digital Transformation. Frequency transformations. Comparison of Digital IIR and FIR filters | 9 |
| **Module -4** | |
| **FIR Filters:** Properties of FIR digital filters, Design of Linear phase FIR filters using windows and frequency sampling method, Design of FIR differentiators, Design of Hilbert Transformers. | 8 |
| **Module -5** | |
| **Digital Filter Structures:** Basic Network structures for IIR filters – Direct forms, Cascade form, Parallel form, transposed form, Lattice structures, Basic network structures for FIR Systems – Direct forms Cascade form, Networks for Linear phase FIR systems, Frequency sampling structure, Lattice structure. | 8 |

**Question paper pattern:**

• The question paper will have ten questions.

• Each full question consists of 20 marks.

• There will be 2 full questions (with a maximum of four sub questions) from each module.

• Each full question will have sub questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

**List of Laboratory Experiments (2 Hours/Week/Batch) Batch Strength: 15**

1. Introduction to MATLAB
2. Verification of sampling theorem
3. Generation of signals (Sinusoidal signals, Exponential signals etc.)
4. Operations on signals (Time shifting, time scaling and amplitude scaling)

5. Determine Z-transform and inverse Z-transform of discrete-time signals
6. Linear convolution, circular convolution.
7. Fourier representation of Discrete-time signals(DTFT, DFS), Properties of DTFT and DFS.
8. Discrete Fourier Transform(DFT), Properties of DFT
9. Linear filtering using DFT
10. DFT and IDFT using radix-2 FFT algorithm.
11. Design and implement digital IIR filters
12. Design and implement digital FIR filters

**Reference Books:**

1. A.V.Oppenheim and R.W.Schafer, Digital Signal Processing, PHI.
2.J.G.Proakis and D.G.Manolakis, Digital Signal Processing- Principals,Algorithms and Applications, PHI.
3. Rabiner and Gold, Theory and Applications of Digital Signal Processing, PHI
4. SanjitK.Mitra, Digital Signal- A computer- Based Approach, TMH.

**Course outcomes:**

**On completion of the course, the student will have the ability to:**

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| 22EC52 | CO1 | Compute the Discrete Fourier Transform (DFT) of a sequence. |
| | CO2 | Analyze the efficient computation of DFT using Fast Fourier Transform. |
| | CO3 | Design FIR filters using Windows and frequency sampling Technique. |
| | CO4 | Design digital IIR filters from Analog filters. |
| | CO5 | Realize digital filters using network structures. |

**CO-PO-PSO Matrix:**

| CO# | CO Statement | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | Compute the Discrete Fourier Transform (DFT) of a sequence. | 3 | 2 | 2 | 2 | 2 | | | 1 | | 1 | | 1 | 3 | 3 | 2 |
| CO2 | Analyze the efficient computation of DFT using Fast Fourier Transform. | 3 | 2 | 2 | 2 | 2 | | | 1 | | 1 | | 1 | 3 | 3 | 2 |
| CO3 | Design FIR filters using Windows and frequency sampling Technique. | 3 | 2 | 3 | 2 | 2 | | | 1 | | 1 | | 1 | 3 | 3 | 2 |
| CO4 | Design digital IIR filters from Analog filters | 3 | 2 | 3 | 2 | 2 | | | 1 | | 1 | | 1 | 3 | 3 | 2 |
| CO5 | Realize digital filters using network structures. | 3 | 2 | 2 | 2 | 2 | | | 1 | | 1 | | 1 | 3 | 3 | 2 |
| Average | | 3 | 2 | 2.4 | 2.4 | 2 | | | 1 | | 1 | | 1 | 3 | 3 | 2 |

| Data Structures and Algorithms Using Python | | | |
|---|---|---|---|
| Course Code | 22EC53 | Credits | 4 |
| Course Type | IPCC | CIE Marks | 50 |
| Lecture Hours(L:T:P) | 3-0-2 | SEE Marks | 50 |
| Total Hours | 40 Hours (Theory) + 12 Hours (Practical) | SEE Hours | 03 |

**Course Objectives:**

- Understand the basic of python programming
- Introduce the fundamentals of Data Structures
- Understand the algorithms
- Gain knowledge of linear and nonlinear data structures
- Understand the searching and sorting techniques.

| Modules | Teaching Hours |
|---|---|
| **Module-1** | |
| Introduction: The Python environment, Variables and expressions,Variable scope, operators, expressions, Membership, identity and logical operations, **Built-in data types**Flow immutable sets, control and iteration Sequences, Strings, Lists, Tuples, Functions, Recursive functions, Sets, Arrays.<br>Introduction to object orientated programming paradigm, Classes and object programming, Special methods, Inheritance, Data encapsulation and properties, Namespaces. | 9 |
| **Module-2** | |
| **Introduction to Data Structures:** Types of Data Structure, Primitive Data Types Algorithms: Time and Space Complexity of Algorithms<br>**Arrays:** Array Initialization, Definition of Array, Characteristic of Array, One-dimensional Array, Two-dimensional Array **Linked Lists:**Singly linked lists, Singly linked list class, operations on list, list traversal, Deleting nodes, List search Clearing a list , Doubly linked lists, operations on doubly linked lists, Circular lists, Appending elements, Deleting an element, Iterating through a circular list. | 9 |
| **Module-3** | |
| **Stacks,** Stack implementation, Stack operations, Application of stack,<br>**Queues**, List-based queue, Queueoperations, Stack-based queue, Application of queues. | 8 |
| **Module-4** | |
| **Trees, Terminology, Tree nodes**, **Binary trees,** Binary search trees, Binary search tree implementation,Binary search tree operations, Finding the minimum and maximum nodes, Inserting nodes, Deleting nodes, Searching the tree, tree Traversal, Heaps. | 8 |
| **Module-5** | |
| **Searching & Sorting Techniques:** Introduction, Objectives and search techniques, linear and binary search. Sorting techniques: Introduction, Bubble Sort, Insertion Sort, Radix Sort, Selection Sort, Quick Sort<br>**Hashing Techniques:** Hash function, Address calculation techniques, Common hashing functions Collision resolution, Linear probing, Quadratic, Double hashing, Bucket hashing, Deletion and rehashing. | 8 |

**Text Books:**

1. Benjamin Baka, "Python Data Structures and Algorithms", Packt Publishing, 2017
2. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser , "Data Structures and Algorithms in Python"

**Reference Books:**

1. Rance D. Necaise , "Data Structures and Algorithms Using Python"
2. David L. Ranum and Bradley N. Miller , "Problem-Solving with Data Structures and Algorithms"

**Question paper pattern:**

• The question paper will have ten questions.

• Each full question consists of 20 marks.

• There will be 2 full questions (with a maximum of four sub questions) from each module.

• Each full question will have sub questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

**List of Laboratory Experiments (2 Hours/Week/Batch) Batch Strength: 15**

| | |
|---|---|
| 1 | Python program to show how to create a Python List and some of its operations |
| 2 | Python program to show how to create a Python Tuple and to access its elements |
| 3 | Creating a bytearray |
| 4 | Python program to show the implementation of the linked list<br>Creating a node class<br>Creating a linked list class<br>Printing the linked list |
| 5 | Python programs to show linked list operations<br>Creating a node class<br>Creating a linked list class<br>Inserting a node at the beginning of the list<br>Inserting a node after a particular node<br>Inserting the node at the end of the list<br>Deleting a particular node<br>Searching an element in the list<br>Sorting the linked list<br>Printing the linked list |
| 6 | Python program to show how to create a stack and implement the operations<br>Creating a stack<br>To check if it is an empty stack<br>Adding new elements to the stack<br>Eliminating an item from the stack |
| 7 | Python program to create a queue and implement operations of a queue<br>Creating a class for queue<br>Adding an element to the queue<br>Removing an element to the queue |
| 8 | Python program to implement a heap data structure in Python<br>Defining a method to create a heap |
| 9 | Python program to show how to create a binary tree and traverse it in Python<br>Creating a class for a Node of the tree<br>Method to transverse in a pre-order manner<br>Method to transverse in an in-order manner<br>Method to transverse in an post-order manner |
| 10 | Python program to implement Bubble Sort Algorithm |
| 11 | Python program to implement Selection Sort |
| 12 | Python program to perform Quick Sort Algorithm and Binar sort |

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| | CO1 | Develop Python programs to implement various data structures applications |
| | CO2 | Design and analyze basic algorithms and prove their correctness using the appropriate data structure |
| | CO3 | Implementing data structures like Linked Lists, and basic Trees operations. |

| | | |
|---|---|---|
| 22EC53 | CO4 | Implementing data structures like Stacks, Queues |
| | CO5 | Implement searching & sorting techniques |

**CO-PO-PSO Matrix:**

| CO# | CO Statement | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | Develop Python programs to implement various data structures applications | 3 | 3 | 3 | | 3 | 2 | 2 | 2 | | | | | 3 | | |
| CO2 | Design and analyze basic algorithms and prove their correctness using the appropriate data structure | 3 | 3 | 3 | | 2 | 2 | 2 | 2 | | | | | 3 | | |
| CO3 | Implementing data structures like Linked Lists and basic Trees operations. | 3 | 3 | 3 | | 2 | 2 | 2 | 2 | | | | | 3 | 2 | 2 |
| CO4 | Implementing data structures like Stacks, Queues | 3 | 3 | 3 | | 2 | 2 | 2 | 2 | | | | | 3 | 2 | 2 |
| CO5 | Implement searching & sorting techniques | 3 | 3 | 3 | | 3 | 2 | 2 | 2 | | | | | 3 | 2 | 2 |
| **Average** | | **3** | **3** | **3** | | **2.4** | **2** | **2** | **2** | | | | | **3** | **1.2** | **1.2** |

| Antenna & Microwave Lab | | | |
|---|---|---|---|
| Course Code | 22ECL54 | Credits | 1 |
| Course Type | PCCL | CIE Marks | 50 |
| Lecture Hours(L:T:P) | 0-0-2 | SEE Marks | 50 |
| Total Hours | 28 | SEE Hours | 03 |

**Course Objectives:**

To enable the students to obtain the knowledge of Antenna and MicrowaveLab:

- Study & understand the basic characteristics of Gunn diode and Reflex Klystron.
- Study &Analyze functional characteristics of Passive Devices.
- Learn & understand to draw the radiation pattern of Horn Antenna.
- Learn & understand the design of microstrip patch antennas for wireless applications.

**List of experiments of the laboratory to be conducted**

1. V-I Characteristics of Gun diode
2. Repeller mode characteristics of reflex klystron.
3. Calibration of attenuator and Measurement of attenuation.
4. Characteristics of directional coupler
5. Characteristics of Isolator.
6. Characteristics of Circulator.
7. Characteristics of magic tree.
8. Radiation pattern of horn antenna.
9. Design and simulation of rectangular microstrip patch antenna with a particular operating frequency, dielectric constant and substrate thickness
10. Design of microstrip patch antenna using microstrip line feeding technique
11. Design of microstrip patch antenna using a coaxial feeding technique
12. Design and simulation of wide band patch antenna

**Conduct of Practical Examination:**

- All laboratory experiments are to be included for practical examination
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer

script for breakup of marks.

Change of experiment is allowed only once and will be evaluated for 85% of the total marks.

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| 22ECL54 | CO1 | Characterize different modes of operation of active microwave devices like reflex klystron & Gunn diode. |
| | CO2 | Analyze the functional characteristics of passive microwave devices |
| | CO3 | Determine the radiation pattern of Horn antenna |
| | CO4 | Design and simulate rectangular patch antenna using Antenna Design Tool in MATLAB software |
| | CO5 | Design and simulation of patch antenna for different applications antenna using Antenna Design Tool in MATLAB software |

**CO-PO-PSO Matrix:**

| CO# | CO Statement | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | Characterize different modes of operation of active microwave devices like reflex klystron & Gunn diode. | 3 | 2 | | 2 | | | | | 3 | | | 1 | 3 | 2 | |
| CO2 | Analyze the functional characteristics of passive microwave passive devices | 1 | 2 | | 2 | | | | | 3 | | | 1 | 3 | 2 | |
| CO3 | Determine the radiation pattern of Horn antenna | 1 | 2 | 2 | 2 | | | | | 3 | | | 1 | 3 | 2 | |
| CO4 | Design and simulate rectangular patch antenna | 1 | 2 | 2 | 2 | | | | | 3 | | | 1 | 3 | 2 | 1 |
| CO5 | Analyze functional characteristics of devices like directional coupler, power divider using microstrip | 1 | 2 | 2 | 1 | | | | | 3 | | | 1 | 3 | 2 | 1 |
| Average | | 1.4 | 2 | 2 | 1.8 | | | | | 3 | | | 1 | 3 | 2 | 1 |

| Internet of Things & its Application | | | |
|---|---|---|---|
| Course Code | 22EC551 | Credits | 3 |
| Course Type | PEC | CIE Marks | 50 |
| Lecture Hours(L:T:P) | 3:0:0 | SEE Marks | 50 |
| Total Hours | 42 Hours | SEE Hours | 03 |

**Course Objectives:**

- To study the fundamentals about IoT
- To study about IoT connectivity Technologies
- To study the IoT communication Technologies
- To study theParadigms ,challenges ,Future andHardware platforms
- To study the applications of IoT in industry

| Modules | Teaching Hours |
|---|---|
| **Module-1** | |
| **FUNDAMENTALS OF IoT**- Evolution of Internet of Things, Enabling Technologies, M2M Communication, IoT World Forum (IoTWF) standardized architecture, Simplified IoT Architecture, Core IoT Functional Stack, Fog, Edge and Cloud in IoT, Functional blocks of an IoT ecosystem, Sensors, Actuators, Smart Objects and Connecting Smart Objects. | 8 |
| **Modules-2** | |
| **IoTconnectivity Technologies**-Introduction, IEEE 802.15.4,Zigbee,Thread,ISA100.11A,Wireless HART,RFID,NFC,DASH7, Z-WAVE ,Weightless, Sigfox, LORa, NB-IOT ,Wi-Fi, Bluetooth | 9 |
| **Modules-3** | |
| **IoT communication Technologies**-Introduction, constrained nodes, networks, types of constrained Devices, low power and lossy networks.<br>**Infrastructure protocols:**Internet protocol Version 6(IPv6), LOADng, RPL, 6LoWPAN, QUIC, Micro internet protocol, Nano internet protocol, Content –centric networking.<br>**Discovery Protocols:** Physical web, multicast DNS, Universal Plug and play.<br>**Data protocols:**MQTT, MQTTSN, CoAP, AMQP, XMPP, SOAP, REST, web socket. Identification protocol ,Device management, semantic protocols | 8 |
| **Modules-4** | |
| **Paradigms,challenges and Future**-Introduction ,Evolution of New IoT paradigms, challenges Associated with IoT, Emerging pillars of IoT<br><br>**Beginning IoT Hardware Project:** Introduction to Arduino Boards, writing an Arduino Sketch, introduction to Raspberry Pi boards, | 8 |
| **Modules-5** | |
| **Industrial Applications**:-IoT applications in home, infrastructures, buildings, security, Industries &other IoT electronic equipment, Industry 4.0 concepts. | 9 |

**Text Books:**

1. Introduction To IoT –SudipMisra, Anandarup Mukherjee, Arijit Roy-Cambridge University Press,2021
2. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017

**Reference Books:**

1. Internet of Things – A hands-on approach, ArshdeepBahga, Vijay Madisetti, Universities Press, 2015

2. https://onlinecourses.nptel.ac.in/noc22_cs53/preview

**Question paper pattern:**

• The question paper will have ten questions.
• Each full question consists of 20 marks.
• There will be 2 full questions (with a maximum of four sub questions) from each module.
• Each full question will have sub questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

**Assessment Details (both CIE and SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 40% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

| Course Code | CO # | Course Outcome (CO)<br>At the end of this course, students will be able to |
|---|---|---|
| 22EC551 | CO1 | Describe the basics of IoT. |
| | CO2 | Analyze different IoT protocols. |
| | CO3 | Analyze the design methodology and hardware platforms involved in IoT. |
| | CO4 | Describe techniques to organize the data. |
| | CO5 | Demonstrate IOT Applications in Industrial & real world. |

**CO-PO-PSO Matrix:**

| CO# | CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | Describe the basics of IoT. | 3 | 2 | 2 | 2 | | | 2 | | | | 1 | 3 | 2 | 2 | 3 |
| CO2 | Analyze different IoT protocols. | 3 | 2 | 2 | 2 | | | 2 | | | | 1 | 3 | 3 | 2 | 3 |
| CO3 | Analyze the design methodology and hardware platforms involved in IoT. | 3 | 2 | 2 | 2 | | | 2 | | | | 1 | 3 | 3 | 3 | 3 |
| CO4 | Describe techniques to organize the data. | 3 | 2 | 2 | 2 | | | 2 | | | | 1 | 3 | 3 | 3 | 3 |
| CO5 | Demonstrate IOT Applications in Industrial & real world. | 3 | 2 | 2 | 2 | | | 2 | | | | 1 | 3 | 2 | 2 | 3 |
| Average | | 3 | 2 | 2 | 2 | | | 2 | | | | 1 | 3 | 2.6 | 2.4 | 3 |

## Analog CMOS VLSI Design

| | | | |
|---|---|---|---|
| Course Code | 22EC552 | Credits | 3 |
| Course Type | PEC-I | CIE Marks | 50 |
| Lecture Hours(L:T:P) | 3:0:0 | SEE Marks | 50 |
| Total Hours | 42 Hours(Theory) | SEE Hours | 03 |

**Course Objectives:**

- Describe the basic MOS device physics and models.
- Describe method of the small signal and large signal analysis of amplifiers.
- Understanding the working of single stage MOS amplifiers with analysis.
- Describe the operation of different types of Current mirrors and their applications.
- Analysis and Design of the Operational amplifiers.
- Analysis and design of CMOS oscillators with mathematical model of VCOs

| Modules | Teaching Hours |
|---|---|
| **Module-1** | |
| Single– Stage Amplifiers: MOS Device Models, Basic Concepts, Common–Source Stage, Source Follower, Common–Gate Stage, Cascade Stage | 8 |
| **Modules-2** | |
| Differential Amplifiers: Single– Ended and Differential Operation. Basic Differential Pair, Common–Mode Response, Differential Pair with MOS Loads, Gilbert Cell. | 8 |
| **Modules-3** | |
| Passive and Active Current Mirrors: Basic Current Mirrors Cascode Current Mirrors, Active Current Mirrors.<br>Frequency Response of Amplifiers: General Considerations: Explore and analyze the Wilson Current mirror. Miller Effect, Association of Poles with Nodes Common source stage Source Followers. | 9 |
| **Modules-4** | |
| Frequency Response of Amplifiers: Common Gate stage, Cascode Stage and Differential Pair.<br>Operational Amplifiers: General considerations, One stage op-amp, Two stage op-amp, Gain Boosting, Comparison, Common Mode feedback, | 9 |
| **Modules-5** | |
| Operational Amplifiers: Input Range limitations, Slew rate, Power supply rejection, Noise in Op-amps.<br>Oscillators: General Considerations, Ring Oscillators, LC Oscillators, Voltage–Controlled Oscillators, Mathematical Model of VCOs. | 8 |

**Text Books: Text Book(s):**

**1**. Design of Analog CMOS Integrated Circuits", Behzad Razavi, Tata McGraw Hill, Indian Edition, 2008, ISBN:0-07-238032-2.

**Reference Books: Reference Book(s):**

1."CMOS Analog Circuit Design", Phillip E. Allen, Douglas R. Holberg, Oxford University Press, 3rd edition 2011, ISBN:9780199765072.

2."CMOS Circuit Design, Layout and Simulation", R. Jacob Baker, Harry W. Li, David E. Boyce, Prentice Hall of India, 1st edition 2005, ISBN-13:978-0780334168 ISBN- 10:0780334167.

**Question paper pattern:**

• The question paper will have ten questions.
• Each full question consists of 20 marks.
• There will be 2 full questions (with a maximum of four sub questions) from each module.
• Each full question will have sub questions covering all the topics under a module. The students

will have to answer 5 full questions, selecting one full question from each module.

**Assessment Details (both CIE and SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 40% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

| Course Code | CO # | Course Outcome (CO)<br>At the end of this course, students will be able to |
|---|---|---|
| 22EC552 | CO1 | Analyze MOS transistor theory and fabrication process |
| | CO2 | Design MOS circuits using stick and layout diagrams. |
| | CO3 | Analyze CMOS fabrication flow and technology scaling |
| | CO4 | Analyze CMOS subsystems and architectural issue with the design constraints |
| | CO5 | Analyze Memory elements and testability issues in VLSI Design |

| CO# | CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | Analyze MOS transistor theory and fabrication process | 3 | 2 | 2 | 2 | | | 2 | | | | 1 | 3 | 2 | 2 | 3 |
| CO2 | Design MOS circuits using stick and layout diagrams. | 3 | 2 | 2 | 2 | | | 2 | | | | 1 | 3 | 3 | 2 | 3 |
| CO3 | Analyze CMOS fabrication flow and technology scaling | 3 | 2 | 2 | 2 | | | 2 | | | | 1 | 3 | 3 | 3 | 3 |
| CO4 | Analyze CMOS subsystems and architectural issue with the design constraints | 3 | 2 | 2 | 2 | | | 2 | | | | 1 | 3 | 3 | 3 | 3 |
| CO5 | Analyze Memory elements and testability issues in VLSI Design | 3 | 2 | 2 | 2 | | | 2 | | | | 1 | 3 | 2 | 2 | 3 |
| Average | | 3 | 2 | 2 | 2 | | | 2 | | | | 1 | 3 | 2.6 | 2.4 | 3 |

| Mini-Project | | | |
|---|---|---|---|
| Course Code | 22ECMP56 | Credits | 1 |
| Course Type | PROJ | CIE Marks | 50 |
| Lecture Hours(L:T:P) | 0-0-2 | SEE Marks | - |
| Total Hours | 28 | SEE Hours | 03 |

**Course objectives:**

- To impart knowledge for Improve the practical skills
- To impart knowledge to Collect the information of project
- To impart knowledge to select appropriate method
- To impart knowledge of Plan and implement project
- To impart knowledge of Document and present the project

Each batch comprising of two to four students shall identify mini project related to the curriculum of study. Students are supposed to carry out the following during the semester

1. Selecting the project which is having some functionality.
2. Collect the information about project
3. Develop, test and implement project
4. Document the work.

Each group shall submit a project report at the end of fifth semester. The project report should contain Literature survey, Design, Engineering documentation and Test results. Innovative design concepts, Reliability considerations, Its usefulness in practice taken care of in the project shall be given due weightage.

**Guidelines for Evaluation:**

1. Attendance and regularity,
2. Understanding and involvement.
3. Level of completion, Originality and Functionality.
4. Presentation , Demo and Viva-voce
5. Project report.

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| 22ECMP56 | CO1 | Implement the layout/schematic (Design) . |
| | CO2 | Testing of the individual modules. |
| | CO3 | Record the results and analyze. |
| | CO4 | Perform the review |
| | CO5 | Demonstration of the work done (Viva Voce ) |

**CO-PO-PSO Matrix:**

| CO# | Course Outcome (CO) | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | Implement the layout/schematic (Design) | 3 | 3 | 2 | 1 | 3 | | | | 3 | | 3 | 1 | 2 | 2 | |
| CO2 | Testing of the individual modules. | 2 | 2 | | | 2 | | | | 3 | | | 1 | 2 | 2 | |
| CO3 | Record the results and analyze. | 2 | 3 | | | 2 | | 2 | | 3 | | | 1 | 2 | 2 | |
| CO4 | Perform the review | | | | | | | | | 3 | 3 | | | | | |
| CO5 | Demonstration of the work done (Viva Voce ) | 1 | 1 | | 1 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 2 | 2 | 2 |
| Average | | 2 | 2.2 | 2 | 1 | 2.2 | 3 | 2.5 | 3 | 3 | 3 | 3 | 1 | 2 | 2 | 2 |

| ESEARCH METHODOLOGY & INTELLECTUAL PROPERTY RIGHTS | | | |
|---|---|---|---|
| Course Code | 22RMI57 | Credits | 3 |
| Course Type | RMI | CIE Marks | 50 |
| Lecture Hours(L:T:P) | 3:0:0 | SEE Marks | 50 |
| Total Hours | 42 | SEE Hours | 03 |

**Course objectives:**

- To understand the knowledge on basics of research and its types.
- To learn the concept of defining research problem and Literature Review, Technical Reading.
- To learn the concept of attributions and citation and research design.
- Concepts, classification, need for protection, International regime of IPRs - WIPO, TRIPS,Patent - Meaning, Types, surrender, revocation, restoration, Infringement, Procedure for obtaining Patent and Patent Agents.
- Meaning, essential requirements, procedure for registration and Infringement of Industrial Designs, Copyright.

| Modules | Teaching Hours |
|---|---|
| **Module -1** | |
| Introduction: Meaning of Research, Objectives of Engineering Research, and Motivation in Engineering Research, Types of Engineering Research, Finding and Solving a Worthwhile Problem. Ethics in Engineering Research, Ethics in Engineering Research<br>Practice, Types of Research Misconduct, Ethical Issues Related to Authorship | 9 |
| **Module -2** | |
| . Defining the research problem - Selecting the problem. Necessity of defining the problem Techniques involved in defining the problem- Importance of literature review in defining a problem Literature Review and Technical Reading, New and Existing Knowledge, Analysis and Synthesis of Prior Art Bibliographic Databases, Web of Science, Google and Google Scholar, Effective Search: The Way Forward Introduction to Technical Reading Conceptualizing Research, Critical and Creative Reading, Taking<br>Notes While Reading, Reading Mathematics and Algorithms, Reading a Datasheet. | 8 |
| **Module -3** | |
| Research design and methods - Research design - Basic principles. Need of research design Features of good design- Important concepts relating to research design - Observation and Facts Attributions and Citations: Giving Credit Wherever Due, Citations: Functions and Attributes, Impact of Title and Keywords on Citations, Knowledge Flow through Citation, Citing Datasets, Styles for Citations, Acknowledgments and Attributions, What Should Be Acknowledged, Acknowledgments in, Books Dissertations,<br>Dedication or Acknowledgments. | 9 |
| **Module -4** | |
| Basic Concepts of Intellectual Property (IP), Classification of IP, Need for Protection of IP, International regime of IPRs - WIPO , TRIPS. Patents: Meaning of a Patent – Characteristics/ Features. Patentable and Non-Patentable Invention. Procedure for obtaining Patent. Surrender of Patent, revocation &restoration of Patents, Infringement of Patents and related remedies (penalties) . Different prescribed forms used in Patent Act. Patent agentsqualifications and disqualifications Case studies on patents - Case study of Neem petent, Curcuma(Turmeric)patent and Basmati rice patent, Apple inc.v Samsung electronics co.Ltd | 8 |
| **Module -5** | |

| | |
|---|---|
| Industrial Design: Introduction to Industrial Designs. Essential requirements of Registration. Designs which are not registrable, who is entitled to seek Registration, Procedure for Registration of Designs Copy Right Meaning of Copy Right. Characteristics of Copyright. Who is Author, various rights of owner of Copyright. Procedure for registration. Term of copyright, Infringement of Copyright and Its remedies. Software Copyright. | 8 |

**Question paper pattern:**

• The question paper will have ten questions.

• Each full question consists of 20 marks.

• There will be 2 full questions (with a maximum of four sub questions) from each module.

• Each full question will have sub questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

**Text Books:**


1. Research Methodology: Methods and Techniques C.R.Kothari, Gaurav Garg New Age International4th Edition,2018
2. Dipankar Deb•RajeebDey,ValentinaE.Balas "EngineeringResearchMethodology",ISSN1868-4394 ISSN 1868-4408 (electronic), Intelligent Systems Reference Library, ISBN 978-981-13-2946-3 ISBN 978-981-13-2947-0 (eBook), https://doi.org/10.1007/978-981-13-2947-0.3
3. Dr. M.K. Bhandari"Law relating to Intellectual property" January 2017 (Publisher By Central Law Publications). Dr. R Radha Krishna and Dr. S Balasubramanain "Text book of Intellectual Property Right". First edition, New Delhi 2008. Excel books.

P Narayan "Text book of Intellectual Property Right". 2017 ,Publisher: Eastern Law House


**Reference Books:**


1. A.V.Oppenheim and R.W.Schafer, Digital Signal Processing, PHI.
2.J.G.Proakis and D.G.Manolakis, Digital Signal Processing- Principals,Algorithms and Applications, PHI.
3. Rabiner and Gold, Theory and Applications of Digital Signal Processing, PHI
4. SanjitK.Mitra, Digital Signal- A computer- Based Approach, TMH.


**E books and online course materials:**

- NPTEL: INTELLECTUAL PROPERTY by PROF.FEROZ ALI , Department of Humanities andSocial Sciences IIT Madras https://nptel.ac.in/content/syllabus_pdf/109106137.pdf
- www.wipo.intwww.ipindia.nic.in

**Course outcomes:**

**On completion of the course, the student will have the ability to:**

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| 22RMI57 | **CO1** | To know them leaning of engineering research. |
| | **CO2** | To know the defining of research problem and procedure of LiteratureReview. |
| | **CO3** | To know the Attributions and Citations and research design. |
| | **CO4** | Highlights the basic Concepts and types of IPRs and Patents |
| | **CO5** | Analyse and verify the procedure for Registration of Industrial Designs &Copyrights |

| ENVIRONMENTAL STUDIES | | | |
|---|---|---|---|
| Course Code | 22ES58 | Credits | 2 |
| Course Type | RMI | CIE Marks | 50 |
| Lecture Hours(L:T:P) | 2:0:0 | SEE Marks | 50 |
| Total Hours | 28 | SEE Hours | 03 |

**Course objectives:**

- To creative environmental awareness among the students'
- To gain knowledge on different types of pollution in the Environment

| Modules | Teaching Hours |
|---|---|
| **Module -1** | |
| Environment-Definition, components, Ecosystem-Balanced Ecosystem, Structural and functional unit of Ecosystem,<br>Human activities – Economic and Social Security | **5** |
| **Module -2** | |
| Human activities Effects on Environment-Industries, Housing, Agriculture, mining, Transportation, Natural Resources-Water Resources, forest, mineral resources, fluoride problems in Drinking water, water Induced diseases. Deforestation, sustainable mining, | 6 |
| **Module -3** | |
| Material cycles – Nitrogen, Sulphur, carbon cycle Environmental pollution –ground water pollution, noise pollution, soil pollution, Industrial and Municipal sludge. Air pollution, B.O medical waste E-wastes, Automobile pollution | 6 |
| **Module -4** | |
| Global Environmental Concerns-Climate change and global warming effects, urbanization, ozone layer depletion, acid rain, current Environmental issues and important, population growth, Environmental toxicology, Biogas energy, solar energy. | 6 |
| **Module -5** | |
| Objects of Environmental studies, Importance of women's Education, non-government organization (NGO), Green building or water treatment plant, G.I.S and Remote sensing, EIA (Environmental Impact Assessment), Role of Government for protection of Environmental | 5 |

**Reference Books:**


1. Environmental Studies- Benny Joseph –Tata Megrawhill 2005
2. Environmental Studies-D L Manjunath, P M Dotrad, B.S.Raman
3. Environmental Studies-Geeta Naagbhushan


**Course outcomes:**
**On completion of the course, the student will have the ability to:**

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| 22ES58 | **CO1** | Understand the Environmental components balance eco systems |
| | **CO2** | Develop critical thinking and apply them to the analysis of a problems or question related to Environment |
| | **CO3** | Demonstrate Ecology knowledge of a complex relationship between biotic and a biotic components |
| | **CO4** | Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers phase when dealing with complex issue |
| | **CO5** | Understand latest developments in environmental pollution, Mitigation, Tools Concept and applications of G.I.S and Remote sensing. |

**H. K. E. SOCIETY'S**

**POOJYA DODDAPPA APPA COLLEGE OF ENGINEERING, KALABURAGI**

**B.E in Respective Branch Name Scheme of Teaching and Examination 2022**

**Outcome Based Education (OBE) and Choice Based Credit System (CBCS)**

(Effective from the academic year 2023-24)

**VI Semester**

| Sl. No. | Course and Course Code | | Course Title | Teaching Department | Teaching Hours/Weeks | | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Lecture | Tutorial | Practical /Drawing | Self Study | Duration in Hours | CIE Marks | SEE Marks | Total Marks | |
| | | | | | L | T | P | S | | | | | |
| 1 | HSMS | 22HU61 | EMF | Humanities | 3 | 0 | 0 | - | 03 | 50 | 50 | 100 | 3 |
| 2 | PCC | 22EC62 | VLSI Design | E & CE | 4 | 0 | 0 | - | 04 | 50 | 50 | 100 | 4 |
| 3 | PEC | 22EC63x | PEC-II | E & CE | 3 | 0 | 0 | - | 03 | 50 | 50 | 100 | 3 |
| 4 | OEC | 22ECOE64x | OEC-I | E & CE | 3 | 0 | 0 | - | 03 | 50 | 50 | 100 | 3 |
| 5 | PROJ | 22ECP65 | Major Project Phase-I | E & CE | 0 | 0 | 3 | - | 03 | 50 | - | 50 | 2 |
| 6 | PCCL | 22ECL66 | VLSI Design Lab | E & CE | 0 | 0 | 2 | - | 03 | 50 | 50 | 100 | 1 |
| 7 | AEC/ SDC | 22ECIKS67 | Indian Knowledge System | E & CE | If the course is offered as theory: 2 | 0 | 0 | - | 02 | 50 | - | 50 | 1 |
| | | | | | If the course is offered as practical: 0 | 0 | 2 | - | 02 | | | | |
| 8 | NCME | 22NS68 | Mandatory Course | NSS Coordinator | 0 | 0 | 2 | - | - | 50 | - | 50 | 0 |
| | | 22PE68 | Mandatory Course | Physical Education Director | | | | | | | | | |
| | | 22YO68 | Mandatory Course | Yoga Teacher | | | | | | | | | |
| | | | | | | | | | **Total** | **400** | **250** | **650** | **17** |

**Professional Elective Course(PEC-II)**

| | | | |
|---|---|---|---|
| 22EC631 | Wireless Communication | 22EC633 | Optical Fiber Communication |
| 22EC632 | Satellite Communication | | |

**Open Elective Course(OEC-I)**

| | | | |
|---|---|---|---|
| 22ECOE641 | Soft Computing | 22ECOE643 | Computer Architecture and Organization |
| 22ECOE642 | Automotive Electronics | 22ECOE644 | Robotics |

**Ability Enhancement Course/Skill Enhancement Course**

| | |
|---|---|
| 22ECIKS67 | Indian Knowledge System |

| Entrepreneurship,Management &Finance | | | |
|---|---|---|---|
| Course Code | 22HU61 | Credits | 3 |
| Course Type | HSMS | CIE Marks | 50 |
| Lecture Hours(L:T:P) | 3:0:0 | SEE Marks | 50 |
| Total Hours | 42 | SEE Hours | 3 |

**Course Objectives:**

- The Meaning, Functions, Characteristics, Types, Role and Barriers of Entrepreneurship, Government Support for Entrepreneurship
- Management – Meaning, nature, characteristics, scope , functions, role etc and Engineers social responsibility and ethics
- Preparation of Project and Source of Finance
- Fundamentals of Financial Accounting
- Personnel and Material Management, Inventory Control

| Modules | Teaching Hours |
|---|---|
| **Module-1** | |
| **Entrepreneur:** Meaning of Entrepreneur; Functions of an Entrepreneur; Characteristics of an entrepreneur , Types of Entrepreneur; Intrapreneurs – an emerging class ; Role of Entrepreneurs in economic development; Barriers to entrepreneurship, Government Support for Innovation and Entrepreneurship in India - Startup-India, Make-in-India, PMMY, AIM , STEP, BIRAC, Stand-up India, TREAD. | 9 |
| **Module-2** | |
| **Management:** Introduction – Meaning – nature and characteristics of Management, Scope and functional areas of management, Levels of Management, Henry Fayol - 14 Principles to Management , McKinsey's 7-S Model, Management by objective(MBO) – Meaning, process of MBO, benefits and drawbacks of MBO. | 9 |
| **Module-3** | |
| **Preparation of Project:** Meaning of project; Project Identification; Project Selection; Project Report; Need and Significance of Report; Contents;<br>**Source of Finance:** Long Term Sources(Equity, Preference, Debt Capital, Debentures, loan from Financial Institutions etc) and Short Term Source(Loan from commercial banks, Trade Credit, Customer Advances etc) | 8 |
| **Module-4** | |
| **Fundamentals of Financial Accounting:** Definition, Scope and Functions of Accounting , Accounting Concepts and Conventions: Golden rules of Accounting, Final Accounts - Trading and Profit and Loss Account, Balance sheet | 8 |
| **Module-5** | |
| **Personnel Management:** Functions of Personnel Management, Recruitment, Selection and Training, Wages, Salary and Incentives<br>**Material Management and Inventory Control:** Meaning, Scope and Objects of Material Management. Inventory Control- Meaning and Functions of Inventory control ; Economic Order Quantity(EOQ) and various stock level ( Re-order level, Minimum level, Maximum level, Average level and Danger level) | 8 |

**Question paperpattern:**

- The question paper shall have five Module for 100 marks;
- Each full question carries 20 marks.
- Two questions to be set in each module (total ten questions).
- The candidate will have to answer one full question from each module.

Note: There can be a maximum of 4 subsections in each Question.

**Textbooks:**

1. Financial Accounting -B S Raman- United Publishers Manglore, Maheswar S N &Maheswari S K-Vikas Publishing House. January 2018.
2. Management & Entrepreneurship- K R Phaneesh- Sudha Publications January 2018, Prof Manjunatha& Amit kumar G – laxmi Publication, January 2011. VeerbhadrappaHavina - Published by New Age International (P) Ltd., 2009.
3. Principles of Management First Edition (English, G. Murugesan), Laxmi Publications – New Delhi.
4. Management by Objectives (MbO) in Enterprises: 21 December 2018 by Dr Wazir Ali Khan

**ReferenceBooks:**

1. Industrial Organization & Engineering Economics-T R Banga& S C Sharma- Khanna Publishers, Dehli.

**Ebooksandonlinecoursematerials:**

1. https://nptel.ac.in/courses/110/106/110106141/
2. https://www.businessmanagementideas.com/notes/management-notes/notes-on-management-in-an-organisation/4669
3. https://vskub.ac.in/wp-content/uploads/2020/04/Unit-5-ppmb.pdf

Courseoutcomes:

On completion ofthecourse,thestudentwillhavetheabilityto:

| CourseCode | CO# | CourseOutcome(CO) |
|---|---|---|
| 22HU61 | CO1 | Develop Entrepreneurship skills |
| | CO2 | Apply the concepts of management and Management By Objective(MBO) |
| | CO3 | Prepare project report & choose different Source of Finance. |
| | CO4 | Apply Fundamentals of Financial Accounting and interpret the final accounts |
| | CO5 | Apply personnel management skills, Material and inventory control techniques |

**CO-PO-PSO Matrix:**

| CO# | Course Outcome (CO) | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | Develop Entrepreneurship skills | 2 | | | | | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | | |
| CO2 | Apply the concepts of management and Management By Objective(MBO) | 2 | 1 | | | | 1 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | |
| CO3 | Prepare project report & choose different Source of Finance. | 2 | | | | | 1 | 1 | 2 | 3 | 3 | 3 | 2 | 2 | | |
| CO4 | Apply Fundamentals of Financial Accounting and interpret the final accounts | 2 | | | | | 1 | 1 | 2 | 3 | 3 | 3 | 2 | 2 | | |
| CO5 | Apply personnel management skills, Material and inventory control techniques | 2 | | | | | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 2 | | |
| Average | | 2 | 1 | | | | 1.2 | 1.4 | 2.4 | 2.8 | 2.6 | 2.8 | 2.4 | 2 | 1 | |

| VLSI Design | | | |
|---|---|---|---|
| Course Code | 22EC62 | Credits | 4 |
| Course Type | PCC | CIE Marks | 50 |
| Lecture Hours(L:T:P) | 4:0:0 | SEE Marks | 50 |
| Total Hours | 52 | SEE Hours | 3 |

**Course Objectives:**

- To impart knowledge to learn the MOS transistor theory and analyze CMOS technologies
- To impart knowledge of design the combinational and sequential circuit in CMOS technology
- To impart knowledge of concepts of subsystem and illustrate the design processes.
- To impart knowledge of concepts of CMOS testing.

| Modules | Teaching Hours |
|---|---|
| **Module-1** | |
| **Introduction:** A Brief History, MOS Transistors, MOS Transistor Theory, Ideal I-V Characteristics, Non-ideal I-V Effects, DC Transfer Characteristics. MOS Device Design Equations.<br>**Fabrication:** nMOS Fabrication, CMOS Fabrication [P-well process, N-well process, Twin tub process, BiCMOS Technology. | 11 |
| **Modules-2** | |
| **Circuit Design Processes:** MOS layers. Stick Diagrams. Design rules and layout – Lambda-based design and other rules.<br>**Logic Design with MOSFET:** Basic logic gates and complex logic gates in CMOS, Transmission gates circuits, CMOS Design rules and NMOS Design rules. | 11 |
| **Modules-3** | |
| **Basic Circuit Concepts:** Sheet resistance. Area capacitances. Capacitancecalculations. The delay unit, Inverter delays. Driving capacitive loads. Propagation delays. Wiring capacitances.<br>**Scaling of MOS circuits:** Scaling models and scaling factors. Limits on scaling. | 10 |
| **Modules-4** | |
| **Subsystem Designs:** Some Architectural Issues, Switch Logic, Gate(restoring) Logic, Parity Generators, Multiplexers, The Programmable Logic Array (PLA)<br>**Subsystem Design Processes:** Some General considerations, An illustration of Design Processes. | 10 |
| **Modules-5** | |
| **Memory, Registers and Aspects of system Timing**- System Timing Considerations, some commonly used Storage/Memory elements. (Self study)**Testing and Verification:** Introduction, Logic Verification, Log | 10 |

**Text books:**

1. Basic VLSI Design – Douglas A Pucknell& Kamran Eshraghian,PHI 3rd Edition (original Edition – 1994), 2005.
2. Principles of CMOS VLSI Design: A Systems Perspective, Neil H. E. Westeand K. Eshragian,2nd edition, Pearson Education (Asia Pvt. Ltd., 2000.) McGraw-Hill Publishing Co.Ltd.
3. Introduction to VLSI circuits & systems, John P.Uymeura

**Reference Books:**

1. CMOS Digital 4Integrated Circuits: Analysis and Design, Sung-Mo Kang & Yusuf Leblebici, 3rd Edition, Tata McGraw Hill, New Delhi, 2007.
2. Analysis and Design of Digital Integrated Circuits – D.A Hodges,H.G Jackson and R.A Saleh 3rd Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2007

E books and online course materials: NPTEL

**Question paperpattern:**

- The question paper shall have five Module for 100 marks;
- Each full question carries 20 marks.
- Two questions to be set in each module (total ten questions).
- The candidate will have to answer one full question from each module.

Note: There can be a maximum of 4 subsections in each Question.

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| 22EC62 | CO1 | Analyze MOS transistor theory and fabrication process |
| | CO2 | Design MOS circuits using stick and layout diagrams. |
| | CO3 | Analyze CMOS fabrication flow and technology scaling |
| | CO4 | Analyze CMOS subsystems and architectural issue with the design constraints |
| | CO5 | Analyze Memory elements and testability issues in VLSI Design |

**CO-PO-PSO Matrix:**

| CO# | CO Statement | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | CO1 Analyze MOSand fabrication transistor theoryprocess. | 3 | 2 | 2 | | | | | | | | | 1 | 3 | | 3 |
| CO2 | Design MOS circuits using stick and layout diagrams | 2 | 3 | 3 | | 3 | | | | | | | 1 | 3 | 2 | 3 |
| CO3 | Analyze CMOS fabricationflow and technology scaling | 2 | 3 | 2 | | 3 | | | | | | | 1 | 3 | 2 | 3 |
| CO4 | Analyze CMOS subsystems and architectural issue with the design constraints | 3 | 3 | 2 | | | | | | | | | 1 | 3 | 2 | 3 |
| CO5 | Analyze Memory elements and testability issues in VLSI Design | 3 | 2 | 2 | | | | | | | | | 1 | 3 | 2 | 3 |
| Average | | 2.6 | 2.6 | 2.2 | | 3 | | | | | | | 1 | 3 | 2 | 3 |

| **Wireless Communication** | | | |
|---|---|---|---|
| Course Code | 22EC631 | Credits | 3 |
| Course Type | PEC-II | CIE Marks | 50 |
| Lecture Hours(L:T:P) | 3:0:0 | SEE Marks | 50 |
| Total Hours | 42 | SEE Hours | 3 |

**Course Objectives:**

- To impart knowledge of to introduce the conceptsof wireless communication systems.
- To impart knowledge of mobile radio propagation models for large scale path loss.
- To impart knowledge of small scale fading and multi-path propagation.
- To impart knowledge of diversity techniques and the recent trends in wireless communication.
- To impart knowledge of important Digital Modulation Techniques, Error Performance in wireless channel and basics of multiple access techniques.

| **Modules-1** | **Teaching Hours** |
|---|---|
| **Introduction to wireless communication systems**: Evolution of mobile radio communication. Examples of Wireless communication systems: Paging, Cordless and Cellular telephone systems. Comparison of common wireless communication systems.Evolution to 2.5G wireless networks.Introduction to 3G wireless networks. **Cellular concept and system design fundamentals:** Frequency reuse, ChannelAssignmentStrategies, HandoffStrategies, Interference and SystemCapacity, Trunking and Grade of service, Improving Coverage and Capacity in Cellular Systems. | 10 |
| **Modules-2** | |
| **Mobile Radio Propagation: Large Scale Path Loss:** Introduction to radio wave propagation, Free space propagation model, Relating power to electric field.<br>Basic propagation mechanism, reflection from dielectrics, Brewster angle, Reflection from perfect conductors. Diffraction, Fresnel zone geometry, Knife edge diffraction, Scattering.<br>Outdoor Propagation Models: Longley-Rice model, Okumura model. Indoor Propagation models: Log distance path loss model. | 8 |
| **Modules-3** | |
| **Mobile RadioPropagation: Small-ScaleFading and Multi-path:** Small scale multi-path propagation, Factors influencing small scale fading, Doppler shift, Impulse response model of a multi-path channel, Relationship between bandwidth and received power.<br>**Types of small scale fading:**Fading Effects Due to Multi-path Time Delay Spread: Flat & frequency selective fading. Fadingeffects due to Doppler spread: Fast & Slow fading, Rayleigh and Ricean distributions. | 8 |
| **Modules-4** | |
| **Equalization and Diversity Techniques:** Equalizers in a Communications Receiver, Survey of Equalization Techniques, Linear Equalizers, Nonlinear Equalization, Decision Feedback Equalization (DFE), Maximum Likelihood Sequence Estimation (MLSE) Equalizer, Diversity Techniques, Rake receiver.<br>**Advanced Topics in Wireless Ccommunication:** MIMO & Massive MIMO Emerging Techniques for 5G, D2D, Millimeter wave communication, Content catching. | 8 |
| **Modules-5** | |

| | |
|---|---|
| **Digital Modulation Techniques**: MPSK & MQAM schemes.<br>**Error Performance in:** AWGN & Fading Channel.<br>**Basics of Multiple Access Techniques:** FDMA,TDMA,CDMA & OFDMA | 8 |

**Question paper pattern:**

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

**Text books:**

1. Theodore S Rappaport, Wireless Communications principles and practice, New Age Publishers 2nd Edition-2002.

**Reference Books:**

1. William C Y Lee. Wireless and cellular communication McGraw-Hill Professional, 2nd edition.

**E books and online course materials:** NPTEL course material

**Course outcomes:**

On completion of the course, the student will have the ability to:

| CO # | | Course Outcome (CO) |
|---|---|---|
| 22EC631 | **CO1** | Understand and analyze the modern wireless communication systems and cellular concepts |
| | **CO2** | Illustrate the effects of atmosphere on radio wave propagation during large scale. |
| | **CO3** | Illustrate the effects of atmosphere on radio wave propagation during small scale fading and multi path. |
| | **CO4** | Analyze the various equalization and diversity techniques, Understand the recent topics in wireless communication. |
| | **CO5** | Understand important Digital Modulation Techniques, Error Performance in wireless channel and basics of multiple access techniques. |

**CO-PO-PSO Matrix:**

| CO# | CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | Understand and analyze the modern wireless communication systems and cellular concepts. | 3 | 2 | 1 | | | | | | | | | 2 | 3 | 2 | |
| CO2 | Illustrate the effects of atmosphere on radio wave propagation during large scale. | 3 | 3 | 2 | | | | | | | | | 2 | 3 | 2 | 2 |
| CO3 | Illustrate the effects of atmosphere on radio wave propagation during small scale fading and multi-path. | 3 | 3 | 2 | | | | | | | | | 2 | 3 | 2 | 2 |
| CO4 | Analyze the various equalization and diversity techniques and also understand the recent topics in wireless communication.. | 3 | 3 | 2 | | | | | | | | | 2 | 3 | 2 | 2 |
| CO5 | Understand important Digital Modulation Techniques, Error Performance in wireless channel and basics of multiple access techniques. | 3 | 3 | 2 | | | | | | | | | 2 | 3 | 2 | 2 |
| | | 3 | 2.9 | 1.9 | | | | | | | | | 2 | 3 | 2 | 2 |

| Satellite Communication | | | |
|---|---|---|---|
| Course Code | 22EC632 | Credits | 3 |
| Course Type | PEC-II | CIE Marks | 50 |
| Lecture Hours(L:T:P) | 3:0:0 | SEE Marks | 50 |
| Total Hours | 42 | SEE Hours | 3 |

**Course Objectives:**

- To impart knowledge of Fundamental issues and concepts of satellite Communication.
- To impart knowledge of Look angles and geostationary orbits.
- To impart knowledge of Space Segment & Earth Segment.
- To impart knowledge of Satellite Link design and Budget Calculations.
- To impart knowledge of Propagation Effects and their Impact on Satellite-Earth Links

| Modules | Teaching Hours |
|---|---|
| **Modules-1** | |
| **Overview of satellite systems:** Introduction, Basic concepts of satellite communication, Elements of satellite communication, Frequency allocation and band spectrum, active and passive satellites advantages and disadvantages of satellites, applications.<br>**Orbital aspects of satellite communication :** satelliteorbits, orbit fundamentals, orbit mechanics, equations of the orbit, locating the satellite with respect to earth, orbital parameters ,orbital elements, Kepler's three laws of planetary motion, apogee and perigee heights. | 9 |
| **Modules-2** | |
| **Look angle determination:** The sub-satellite point, elevation calculation, Azimuth calculation, orbit perturbations.<br>**The Geostationary orbit:** Introduction, polar mount antenna, limits of visibility. near geostationary orbits, earth eclipse of satellite, sun transit outage, launching orbits. | 8 |
| **Modules-3** | |
| **Space Segment & Earth Segment:**<br>**The Space segment:** Introduction, power supply, attitude control, station keeping, thermal control, TT&C subsystem, transponders, antenna subsystem.<br>**The Earth segment:** Introduction, receive-only home TV systems, master antenna TV system, Community antenna TV system, transmit-receive earth station | 8 |
| **Modules-4** | |
| **Satellite link design and Satellite access:** Basic transmission theory, system noise temperature and G/T ratio; noise temperature, calculation of system noise temperature, noise figure and noise temperature G/T ratio for earth stations, Downlink design-link budget; Uplink design; design for specified C/N, uplink and downlink attenuation in rain, uplink and downlink attenuation and C/N, satellite communication link design procedure system design examples.Ku band uplink and downlink design. Rain effects at Ku band. | 8 |
| **Modules-5** | |
| **Propagation Effects and their Impact on Satellite-Earth Links:** Introduction**.** Quantifying attenuation and Depolarization, Propagation effect that are not associated with hydrometeors. Atmospheric Absorption, Tropospheric scintillation and low angle fading, Faraday rotation in the atmosphere, Ionospheric scintillation. Rain and Ice effects, Characterizing Rain, Rain drop distribution. Prediction of Rain attenuations. Prediction of XPD, rain effects on Antenna noise. Propagation impairment counter measures, | 9 |

| | |
|---|---|
| Attenuation, Diversity, Depolarization. | |

**Question paper pattern:**

- The question paper shall have five Module for 100 marks;
- Each full question carries 20 marks.
- Two questions to be set in each module (total ten questions).
- The candidate will have to answer one full question from each module.

Note: There can be a maximum of 4 subsections in each Question.

**Text Books:**

1. Dennis Roddy, "Satellite Communications", McGraw-Hill international, 4th Edition, 2006.
2. Timothy Pratt, Charles Bostian, Jeremy Allnutt. "Satellite Communications", John Wiley Pvt Ltd & Sons, 2nd Edition, 2008

**Reference Books:**

1. W. L. Pitchand, H. L. Suyderhoud, R.A. Nelson., "Satellite Communication system Engineering", Pearson Education, 2ndEdition 2007.
2. Raja Rao: Fundamentals of Satellite communications, PHI Learning.
3. MonojitMitra: Satellite Communication: PHI Learning..

E books and online course materials: NPTEL

Course outcomes:
On completion of the course, the student will have the ability to:

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| 22EC632 | CO1 | Understand the overview of Satellite system, and orbital aspects. |
| | CO2 | Understand the look angles and geostationary orbit. |
| | CO3 | Understand the principle, working and operation of various subsystems of satellite as well as earth station. |
| | CO4 | Analyze and Design satellite communication link |
| | CO5 | Learn the Propagation Effects and their Impact on Satellite-Earth Links |

**CO-PO-PSO Matrix:**

| CO# | Course Outcome (CO) | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | Understand the overview of Satellite system, and orbital aspects. | 1 | 1 | | | | | | | | 1 | | | 2 | 1 | |
| CO2 | Understand the look angles and geostationary orbit. | 2 | 1 | 2 | 2 | | 1 | 1 | | 3 | 2 | 2 | 1 | 2 | 1 | |
| CO3 | Understand the principle, working and operation of various subsystems of satellite as well as earth station. | 1 | | 1 | | | | 2 | | | 1 | | 1 | 2 | 1 | |
| CO4 | Analyze and Design satellite communication link | 1 | 2 | 2 | 2 | | 1 | 1 | | 2 | 2 | 3 | 1 | 1 | 2 | 1 |
| CO5 | Learn the Propagation Effects and their Impact on Satellite-Earth Links | 1 | 1 | 1 | 1 | | 1 | 1 | | 2 | 2 | 2 | 1 | 1 | 2 | 1 |
| Average | | 1.2 | 1.2 | 1.2 | 1.6 | | 1 | 1.3 | | 2.3 | 1.6 | 2.3 | 1 | 1.6 | 1.4 | 1 |

| Optical Fiber Communication | | | |
|---|---|---|---|
| Course Code | 22EC633 | Credits | 3 |
| Course Type | PEC-II | CIE Marks | 50 |
| Lecture Hours(L:T:P) | 3:0:0 | SEE Marks | 50 |
| Total Hours | 42 | SEE Hours | 3 |

**Course Objective:**

- To learn the basic elements of optical fiber transmission link, structures and signal distortion
- To Learn optical sources, materials and photo detector.
- To learn the fiber optical receivers and noise performance in photo detector.
- To learn WDM and Coherent optical systems.
- To learn SONET/SDH networks and various standards.

| Modules | Teaching Hours |
|---|---|
| **Module-1** | |
| Introductions to fundamental of fiber optics, Different Generations of optical fiber communication systems, Optical fiber structure, Fiber types.<br>Modes in optical fiber signal degradation in optical fibers, fiber losses. | 9 |
| **Module-2** | |
| Optical sources, Characteristics of optical sources. LED & ILD, Light source materials. Modulation capability.<br>Photo detectors, PIN photodiode and Avalanche photodiodes, Photo detector noise. | 9 |
| **Module-3** | |
| Optical receiver performance calculations, Power lunching and coupling power coupling calculations, lensing schemes for coupling improvement.<br>Fiber joints, fiber fabrication, cables and connectors, fiber splices, link Analysis and fiber codes. | 8 |
| **Module-4** | |
| WDM, optical coupler and optical measurements.<br>Coherent optical systems. Methods of modulation, Heterodyne and Homodyne systems, Noise in coherent systems Multichannel coherent systems. | 8 |
| **Module-5** | |
| Introduction to light wave networks and different topologies.SONET/SDH, SONET/SDH Benefits, SONET and SDH Rates,SONET/SDH Frame. | 8 |

**Text Books:**

1. Optical fiber Communications. –GERD KEISER, 3 Edition, McGraw Hillinternational editions.
2. Optical fiber communications - J.M. Senior, 3rd Edition, Pearson Education ltd

**Reference Books:**

1. Optical fiber Communications. –GERD KEISER, 4thEdition, McGraw Hill internationaleditions.
2. Fiber Optic Communication , Joseph C Palais, Pearson Education, 2005
3. Optical fiber & Fiber Optical Communication Systems – DrSubirKumar
4. Sarkar, S.Chand (G/L) &Company Ltd.
5. https://onlinecourses.nptel.ac.in
6. https://nptel.ac.in/courses/117/104/117104127

**Question paper pattern:**

- The question paper shall have five Module for 100 marks;
- Each full question carries 20 marks.
- Two questions to be set in each module (total ten questions).
- The candidate will have to answer one full question from each module.

Note: There can be a maximum of 4 subsections in each Question.

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| 22EC633 | CO1 | Understand optical fiber transmission link, fiber modes, structures and fiber losses. |
| | CO2 | Analyze optical sources and detectors |
| | CO3 | Understand receiver noise and coupling. |
| | CO4 | Analyze WDM and multichannel coherent systems. |
| | CO5 | Illustrate optical networks and understand various standards. |

**CO-PO-PSO Matrix:**

| CO# | CO Statement | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | Understand optical fiber transmission link, fiber modes, structures and fiber losses. | 3 | 2 | 1 | | | | | | | | | 1 | 3 | | 1 |
| CO2 | Analyze optical sources and detectors | 3 | 2 | 1 | | | | | | | | | 1 | 3 | | 1 |
| CO3 | Understand receiver noise and coupling. | 3 | 2 | 1 | | | | | | | | | 1 | 3 | 2 | 1 |
| CO4 | Analyze WDM and multichannel coherent systems. | 3 | 2 | 1 | | | | | | | | | 1 | 3 | 2 | 1 |
| CO5 | Illustrate optical networks and understand various standards. | 3 | 2 | 1 | | | | | | | | | 1 | 3 | 2 | 1 |
| Average | | 3 | 2 | 1 | | | | | | | | | 1 | 3 | 2 | 1 |

| Soft Computing | | | |
|---|---|---|---|
| Course Code | 22ECOE641 | Credits | 3 |
| Course Type | OEC-I | CIE Marks | 50 |
| Lecture Hours(L:T:P) | 3:0:0 | SEE Marks | 50 |
| Total Hours | 42 | SEE Hours | 3 |

**Course Objectives:**

- To impart knowledge of soft computing and the need of it in modern world.
- To impart knowledge of fuzzy logic, various fuzzy systems, and related concepts.
- To impart knowledge of neuro-fuzzy systems, modeling, and data clustering algorithms.
- To impart knowledge of neural networks and their different types.
- To impart knowledge of fuzzy decision-making approaches and engineering applications of soft computing

| Modules | Teaching Hours |
|---|---|
| **Module-1** | |
| Evolution of Computing, Soft Computing constituents, From conventional AI to computational intelligence, Machine learning basics, Probabilistic reasoning and Bayesian networks. | 8 |
| **Modules-2** | |
| Fuzzy Sets, Fuzzy Logic, Operations on Fuzzy Sets, Fuzzy Relations, Fuzzy Numbers, Linguistic variables, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems. | 8 |
| **Modules-3** | |
| AdaptiveNeuro- Fuzzy Inference Systems,Coactive Neuro-Fuzzy Modeling, **Advanced Neuro-Fuzzy Modelling**:Classification and Regression Trees, Data Clustering Algorithms. | 8 |
| **Modules-4** | |
| **Adaptive Networks:** Introduction, Architecture, Backpropagation for Feedforward networks, Extended backpropagation for Recurrent networks, Hybrid learning rule. **Supervised Learning Neural Networks:** Introduction, Perceptrons, Adaline, Backpropagation Multilayer Perceptrons, RBF Networks, Modular Networks andXOR Problem. | 9 |
| **Modules-5** | |
| **Fuzzy Decision Making:** General discussion, Individual decision making, Multiperson decision making, Multicriteria decision making, Multistage decision making, Fuzzy ranking methods.<br>**Engineering Applications:** Introduction, Computer engineering, Reliability theory and Robotics.<br>**Miscellaneous Applications:** Introduction, Fuzzy systems and Genetic algorithms, Fuzzy regression and Interpersonal communication. | 9 |

**Text Books:**

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, EijiMizutani, "Neuro-Fuzzy and Soft Computing", A computational approach to learning and machine intelligence, Pearson, 2016.
2. James A. Freeman and David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques",
Addison Wesley, 2003.
3. Neural Networks, S. Haykin, Pearson Education, 2ed, 2001.

4. Soft Computing Techniques in Engineering Applications by Srikanta Patnaik, BaojiangZhong

**Reference Books:**

1. KwangH.Lee, "First course on Fuzzy Theory and Applications", Springer, 2005.
2. George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic-Theory and Applications", Pearson 2018.
3. Learning and Soft Computing, V. Kecman, MIT Press, 2001

**Question paper pattern:** The question paper will have ten questions. Each full question consists of 20marks.There will be 2 full questions (with a maximum of four sub questions) from each module. Each full question will have sub questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| 22ECOE641 | CO1 | Understand the basics of constituents of Soft Computing |
| | CO2 | Understand and analyze Fuzzy Logic systems |
| | CO3 | Recognize and understand the different Neuro-Fuzzy systems and data clustering algorithms |
| | CO4 | Understand the structure of different neural networks |
| | CO5 | Understand the fuzzy decision-making algorithms and its different applications |

**CO-PO-PSO Matrix:**

| | | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO#** | **COs** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| CO 1 | Understand the basics of constituents of Soft Computing | 3 | 3 | 1 | | | | | | | 1 | | 2 | | | |
| CO 2 | Understand and analyze Fuzzy Logic systems | 3 | 3 | 1 | | | | | | | 1 | | 2 | | | |
| CO 3 | Recognize and understand the different Neuro-Fuzzy systems and data clustering algorithms | 3 | 3 | 1 | | | | | | | 1 | | 2 | 1 | | 2 |
| CO 4 | Understand the structure of different neural networks | 3 | 2 | 2 | | | | | | | 2 | | 2 | 2 | 3 | 3 |
| CO 5 | Understand the fuzzy decision-making algorithms and its different applications | 3 | 3 | 3 | | 2 | | | | | 2 | | 3 | 2 | 3 | 3 |
| **Average** | | 3 | 3 | 2.8 | 1.6 | | 2 | | | | 1.4 | | 2.2 | 1.67 | 3 | 2.67 |

| Automotive Electronics | | | |
|---|---|---|---|
| Course Code | 22ECOE642 | Credits | 3 |
| Course Type | OEC-I | CIE Marks | 50 |
| Lecture Hours(L:T:P) | 3:0:0 | SEE Marks | 50 |
| Total Hours | 42 | SEE Hours | 3 |

**Course Objectives:**

- To impart knowledge of architecture of a vehicular system, electronic control unit (ECU), network organization.
- To impart knowledge of networking and classification of bus systems in a vehicle and various bus systems in the vehicle.
- To impart knowledge of different sensors in the vehicle.
- To impart knowledge of different electric and electro-hydraulic actuators in the vehicle.
- To impart knowledge of working of ABS, TCS and ESP in a vehicle.

| Modules | Teaching Hours |
|---|---|
| **Module-1** | |
| **Architecture:** Overview, Vehicle system architecture.<br>**Electronic control unit:** Operating conditions, Design, Data processing, Digital modules in the control unit, Control unit software, Software Development.<br>**Basic principles of networking:** Network topology, Network organization, OSI reference model, Control mechanisms. | **08** |
| **Module-2** | |
| **Automotive networking:** Cross-system functions, Requirements for bus systems, Classification of bus systems, Applications in the vehicle, Coupling of networks, Examples of networked vehicles.<br>**Bus systems:** CAN bus, LIN bus, Bluetooth, MOST bus, TTP/C, FlexRay, Diagnosis interfaces | **08** |
| **Module-3** | |
| **Automotive sensors:** Basics and overview, Automotive applications, Features of vehicle sensors, Sensor classification, Error types and tolerance requirements, Reliability, Main requirements, trends<br>**Sensor types:** Engine-speed sensors, Hall phase sensors, Speed sensors for transmission control, Wheel-speed sensors, Micromechanical pressure sensors, High-pressure sensors, Temperature sensors, Accelerator-pedal sensors, Steering-angle sensors, Position sensors for transmission control, Axle sensors, Piezoelectric acceleration sensors, iBolt™ force sensor, Torque sensor, Rain/light sensor. | **09** |
| **Module-4** | |
| **Electric Actuators:** Electromechanical actuators, Fluid-mechanical actuators, Electrical machines<br>**Electrohydraulic Actuators:** Application and Function, Requirements, Design and Operating Concept, Actuator Types. | **08** |
| **Module-5** | |
| **Antilock Braking System (ABS):** System overview, Requirements placed on ABS, Dynamics of a braked wheel, ABS control loop, and Typical control cycles.<br>**Traction Control System (TCS):** Tasks, Function description, Structure of traction control system (TCS), Typical control situations, Traction control system (TCS) for four wheel drive vehicles<br>**Electronic Stability Program (ESP):** Requirements, Tasks and method of operation, Maneuvers, Closed-loop control system and controlled variables. | **09** |

**Text Books:**

1. Automotive Electronics, Konrad Reif Ed, Bosch Professional Automotive Information, Springer Vieweg, 2015
2. Automotive Electrical and Electronics Equipment by Raj Kumar Chauhan

**Question paper pattern:** The question paper will have ten questions.Each full question consists of 20marks.There will be 2 full questions (with a maximum of four sub questions) from each module. Each full question will have sub questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

**Assessment Details (both CIE and SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 40% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| 22ECOE642 | CO1 | Understand the vehicular architecture, electronic control unit and the network organization |
| | CO2 | Recognize the requirement of bus systems and understand the working of various bus systems in a vehicle |
| | CO3 | Classify the different sensors used in an automotive and understand the different types of sensors involved in an automotive. |
| | CO4 | Understand electronic and electro-hydraulic actuators used in an automotive and classify them. |
| | CO5 | Analyze the working of Antilock Braking System, Traction Control System and Electronic Stability Program. |

**CO-PO-PSO Matrix:**

| CO # | Statements | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO 1 | Understand the vehicular architecture, electronic control unit and the network organization | 3 | 2 | | | | | | | | | | | 3 | | |
| CO 2 | Recognize the requirement of bus systems and understand the working of various bus systems in a vehicle | 3 | 2 | | | | | | | | | | | 3 | | |
| CO 3 | Classify the different sensors used in an automotive and understand the different types of sensors involved in an automotive. | 3 | 2 | 3 | 3 | | | | | | | | | 3 | 2 | 2 |
| CO 4 | Understand electronic and electro-hydraulic actuators used in an automotive and classify them. | 3 | 2 | 3 | 3 | | | | | | | | | 3 | 2 | 2 |
| CO 5 | Analyze the working of Antilock Braking System, Traction Control System and Electronic Stability Program. | 3 | 3 | 3 | 3 | 3 | | | | | | | 3 | 3 | 3 | 3 |
| **Average** | | **3** | **2.2** | **3** | **3** | **3** | | | | | | | **3** | **3** | **2.3** | **2.3** |

| Computer Architecture and Organization | | | |
|---|---|---|---|
| Course Code | 22ECOE643 | Credits | 3 |
| Course Type | OEC-I | CIE Marks | 50 |
| Lecture Hours(L:T:P) | 3:0:0 | SEE Marks | 50 |
| Total Hours | 42 | SEE Hours | 3 |

**Course Objectives:**

- To impart knowledge of Basic concepts of Computer architecture and organization.
- To impart knowledge of Design concepts of processor and control unit.
- To impart knowledge of Familiarize the basic CPU organization.
- To impart knowledge of memory types and its organization.
- To impart knowledge of Concepts of parallel computing.

| Modules | Teaching Hours |
|---|---|
| **Module-1** | |
| **Structure of Computers:** Computer types,Functional units,Basic operational concepts,Von-Neumann architecture,Bus structure ,Multiprocessor and Multicomputer, Data representation, Fixed and floating point, Computer Arithmetic: Fixed point arithmetic-Addition,Subtraction, Multiplication and Division, Basic ALU Organization | 9 |
| **Modules-2** | |
| **Basic Computer Organization and Design**: Instruction codes, Computer registers, computer instructions and instruction cycle, timing and control cycle, memory reference instructions, input-output and interrupt, Central Processing Unit: stack organization, Instruction formats, Addressing modes, Data transfer and manipulation, CISC and RISC. | 9 |
| **Modules-3** | |
| **Memory Organization:** Memory Hierarchy, Semiconductor memories, RAM, ROM types of ROM, Cache memory, performance considerations, Virtual memory, Paging, Secondary storage. | 8 |
| **Modules-4** | |
| Input Output: I/O interface, Programmed IO, Memory Mapped IO, Interrupt driven IO, DMA, IO Processors. | 8 |
| **Modules-5** | |
| Parallel Processing**:** Basic concept-types of parallel processors, performance considerations, Pipeline Processors-Basic concepts of pipelining,throughput and speedup, pipeline Hazards | 8 |

**Text Books:**

1. ComputerOrganization by Car Hamacher,ZvonksVranesic,safea Zaky.5th edition McGH
2. J P Hayes,Computer Architecture and Organization,Mcgraw-Hill,2nd edition.

**Reference Books:**

1. **William Stallings,** Computer Organization and Architecture,Pearson,7th edition.
2. Computer system Architecture, M Morris Mano 3rd edition, Person/PHI
3. Kai Hwang,Faye a Briggs, Computer Architecture and Parallel Processing,McGH

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| 22ECOE643 | CO1 | Identify various components of computer and their interconnection |
| | CO2 | Identify basic components and design of the functional units of computer. |

| | | |
|---|---|---|
| | CO3 | Compare and select various Memory devices as per requirement. |
| | CO4 | Compare various types of IO Mapping techniques. |
| | CO5 | Analyze Parallel Processor and Pipeline Processor |

**CO-PO-PSO Matrix:**

| CO# | CO Statement | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | Identify various components of computer and their interconnection | 3 | 2 | | 3 | | | | | | | | 2 | 3 | 3 | 2 |
| CO2 | Identify basic components and design of the functional units of computer. | 3 | 2 | | 3 | 3 | | | | | | | 2 | 3 | 2 | 1 |
| CO3 | Compare and select various Memory devices as per requirement. | 3 | 3 | | 2 | 2 | | | | | | | 2 | 3 | 3 | 3 |
| CO4 | Compare various types of IO Mapping techniques. | 3 | 3 | 2 | 2 | | | | | | | | 2 | 3 | 2 | 2 |
| CO5 | Analyze Parallel Processor and Pipeline Processor | 3 | 3 | 3 | 2 | 2 | | | | | | | 2 | 3 | 2 | 3 |
| | | 3 | 2.6 | 2.5 | 2.4 | 2.3 | | | | | | | 2 | 3 | 2.4 | 2.2 |

| Robotics | | | |
|---|---|---|---|
| Course Code | 22ECOE644 | Credits | 3 |
| Course Type | OEC-I | CIE Marks | 50 |
| Lecture Hours(L:T:P) | 3:0:0 | SEE Marks | 50 |
| Total Hours | 42 | SEE Hours | 3 |

**Course objectives:**

- To impart the students knowledge in various robot structures.
- To understand the motion analysis and acquire knowledge on kinematics.
- To provide some knowledge of sensors and robot programming.
- To gain skills to develop robot applications.

| Modules | Teaching Hours |
|---|---|
| **Module -1** | |
| **Fundamentals of Robotics & Automation:** Automation and robotics, history of robotics, robotics market and future prospects, robot anatomy, work volume, robot drive systems, control systems, precision of movement, end effectors, robotic sensors, robot programming and work cell control, robot applications, problems | 9 |
| **Module -2** | |
| **Robot Motion Analysis and Control:** Introduction to manipulator kinematics, homogeneous transformations and robot kinematics, manipulator path control, robot dynamics, configuration of a robot controller, types of end effecters, mechanical grippers, other types of grippers, tools as end effectors, robot/end effector interface, consideration in gripper selection and design, problems. | 8 |
| **Module -3** | |
| **Sensors in Robotics:** Transducers and sensors, sensors in robotics, tactile sensors, proximity and range sensors, uses of sensors in robotics, problems.<br>**Machine Vision:** Introduction to machine vision, sensing and digitizing function in machine vision, image processing and analysis, training the vision system, robotic applications, problems. | 8 |
| **Module -4** | |
| **Robot Programming:** Methods of robot programming, lead -through programming methods, a robot program as a path in space, motion interpolation, wait, signal and delay commands, branching, capabilities and limitations of lead-through methods, problems | 8 |
| **Module -5** | |
| **Robot Applications:** Robot cell layouts, multiple robots and machine interference, considerations in work -cell design, work-cell control, interlocks, error detection and recovery, work -cell controller, robot cycle time analysis, graphic simulation of robotic work-cells, problems. Material Transfer, Machine Loading/Unloading: General considerations in robot material handling, material transfer applications, machine loading and unloading. | 9 |

**Question paper pattern:**

- The question paper shall have five Module for 100 marks;
- Each full question carries 20 marks.
- Two questions to be set in each module (total ten questions).
- The candidate will have to answer one full question from each module.

Note: There can be a maximum of 4 subsections in each Question.

**Text Books:**

1. Mikell P. Groover, Mitchel Weiss, Roger N. Nagel, Nicholas G. Odrey and Ashish Dutta, "Industrial Robotics: Technology, Programming and Applications", 2 nd Edition, Tata McGraw Hill, 2012.
2. Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers,

Chennai, 1998Roland Siegwart, Illah R. Nourbakhsh, and DavideScaramuzza, "Introduction to Autonomous Mobile Robots", 2ndEdition, PHI, 2011.

**Reference Books:**

1. Deb.S.R- Robotics technology and flexible Automation, John Wiley, USA. 1992
2. Klafter R.D., Chimielewski T.A., Negin M Robotic Engineering – An integrated approach, Prentice Hall of India, New Delhi. 1994
3. Mc Kerrow P.J. Introduction to Robotics, Addison Wesley, USA. 1991
4. Introduction to Robotis- Syed V. Niku, PHI Pearson, 2003. Robotics, Control, Sensing , Vision and Intelligence, K. S. Fu, R. C. Gonalez, C.S.G. Lee, McGraw Hill, 1987.

**Course outcomes:**
**On completion of the course, the student will have the ability to:**

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| 22ECOE644 | CO1 | Identify basic components of robot system and its functionality |
| | CO2 | Study various control systems and end effectors. |
| | CO3 | Analyze sensors of robot and machine vision system. |
| | CO4 | Describe the robot programming methods. |
| | CO5 | Study robot cell design with robot applications. |

**CO-PO-PSO Matrix:**

| CO# | Course Outcome (CO) | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | Identify basic components of robot system and its functionality | 1 | | | | | | 2 | | | | | 2 | 2 | 2 | 2 |
| CO2 | Study various control systems and end effectors. | 1 | 2 | 2 | | | | 2 | | | | | 2 | 2 | 2 | |
| CO3 | Analyze sensors of robot and machine vision system. | 1 | 2 | 2 | | | | 2 | | | | 2 | 2 | 2 | 2 | 2 |
| CO4 | Describe the robot programming methods. | 1 | 2 | 2 | 2 | | | 2 | | | | 2 | 2 | 2 | 2 | |
| CO5 | Study robot cell design with robot applications. | 1 | 2 | 2 | 2 | | | 2 | | | | 2 | 2 | 2 | 2 | |
| Average | | 1 | 2 | 2 | 2 | | | 2 | | | | 2 | 2 | 2 | 2 | 2 |

| Project Phase-I | | | |
|---|---|---|---|
| Course Code | 22ECP65 | Credits | 2 |
| Course Type | PROJ | CIE | 50 |
| Lecture Hours (L:T:P) | 0:0:2 | SEE | - |
| Total Hours | 28 | SEE Hours | - |

**Course Objectives:**

- Design and develop individual models of the project
- Integrate the modules and test the workability
- Document the work details
- Organize and present the work

**Conduct of Project Viva Voce:**

- Students should write brief description about the project
- Students should present and demonstrate the project
- Students should clarify and clear all the doubts asked by the examiner

Course outcomes:
On completion of the course, the student will have the ability to:

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| 22ECP65 | CO1 | Implement the layout/schematic as modules |
| | CO2 | Test the individual modules, record the results and analyze |
| | CO3 | Integrate the modules, record the results and analyze |
| | CO4 | Document the work and presentation. |
| | CO5 | Demonstration of the work done (Viva Voce ) |

| CO# | CO Statement | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | Implement the layout/schematic as modules | 3 | 3 | 3 | | | | | 3 | | | | | 3 | | |
| CO2 | Test the individual modules, record the results and analyze | 2 | 3 | 3 | | 3 | | | 3 | | | | | 3 | 3 | |
| CO3 | Integrate the modules, record the results and analyze | 2 | 3 | 3 | | 3 | 3 | 3 | 3 | | | | | 3 | 3 | 3 |
| CO4 | Document the work and presentation. | 2 | | | | | | | 3 | 3 | 3 | 3 | | | | |
| CO5 | Demonstration of the work done (Viva Voce ) | | | | | | | | 3 | 3 | 3 | | | | | |
| Average | | 2.25 | 3 | 3 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | | 3 | 3 | 3 |

| VLSI Design Lab | | | |
|---|---|---|---|
| Course Code | 22ECL66 | Credits | 1 |
| Course Type | PCCL | CIE Marks | 50 |
| Lecture Hours(L:T:P) | 0:0:2 | SEE Marks | 50 |
| Total Hours | 28 | SEE Hours | 3 |

**Course Objectives:**

- To impart knowledge of the schematic & layout of basic gates.
- To impart knowledge of the schematic& layout of combinational circuits.
- To impart knowledge of schematic& layout of Sequential circuits

A. Design and develop schematic, layout and simulate the following
   1. INVERTER
   2. 2/3 Input NAND gate
   3. 2/3 Input NOR gate
   4. Transmission Gate
   5. AND/ OR gate
   6. XOR.XNOR gate7
   7. Y=A+BC

B. Design and develop schematic and layout for following and also simulate and plot the transient response and DC characteristics.
   1. Common Drain amplifier
   2. Common source amplifier
   3. Differential amplifier
   4. Operational amplifier

**Conduct of Practical Examination:**

- All laboratory experiments are to be included for practical examination
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of
- marks.
- Change of experiment is allowed only once and will be evaluated for 85% of the total mark s.

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| 22ECL66 | CO1 | Develop schematic diagram for logic gates |
| | CO2 | Develop layouts to simulate logic gates |
| | CO3 | Develop layouts to simulate CMOS TG |
| | CO4 | Design analog CMOS circuit for inverting/non inverting amplifier common drain/common source amplifier |
| | CO5 | Simulate analog CMOS circuit for Differential and operational amplifier |

**PO-PSO Matrix:**

| CO# | CO Statement | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | Develop schematic diagram for logic gates | 3 | 3 | 3 | | 3 | | | | | | | | 3 | | |
| CO2 | Develop layouts to simulate logic gates | 3 | 3 | 3 | | 3 | | | | | | | | 3 | | |
| CO3 | Develop layouts to simulate CMOS TG | 3 | 2 | 2 | | 3 | | | | | | | | 2 | | |
| CO4 | Design analog CMOS circuit for inverting/non inverting amplifier common drain/common source amplifier | 3 | 2 | 2 | | 3 | | | | | | | | 3 | 3 | 2 |
| CO5 | Simulate analog CMOS circuit for Differential and operational amplifier | 3 | 2 | 2 | | 3 | | | | | | | | 3 | 3 | 3 |
| Average | | 3 | 2.5 | 2.5 | | 3 | | | | | | | | 2.8 | 1.2 | 1 |

| Indian Knowledge Systems | | | |
|---|---|---|---|
| Course Code | 22XXIKS67 | Credits | 2 |
| Course Type | SDC | CIE Marks | 50 |
| Lecture Hours(L:T:P) | 1:0:0 | SEE Marks | 50 |
| Total Hours | 15 | SEE Hours | 2 |

**Course objectives:**

- To impart knowledge to facilitate the students with the concept of Indian Traditional Knowledge and to make them Understand the Importance of roots of Knowledge System.
- To impart knowledge to make the students understand the traditional knowledge and analyze it and apply it to their day-to-day-life.

| Modules | Teaching Hours |
|---|---|
| **Module -1** | |
| Introduction to Indian Knowledge Systems (IKS): Overview, Vedic Corpus, Philosophy Character scope and importance, traditional knowledge vis-à-vis Indigenous knowledge, traditional knowledge V/s. Western knowledge. | 5 |
| **Module -2** | |
| Traditional Knowledge in Humanities and Sciences: Linguistics, Number and measurements – Mathematics, Chemistry, Physics, Art, Astronomy, Astrology, Crafts and Trade in India and Engineering and Technology. | 5 |
| **Module -3** | |
| Traditional Knowledge in Professional Domain: Town planning and architecture-construction, Health, Wellness and Psychology-Medicine, Agriculture, Governanceand Public Administration, United Nations Sustainable development Goals | 5 |

**Text Books:**


1. Introduction to Indian Knowledge System - Concept and Applications, B. Mahadevan, VinayakRajat Bhat, NagendraPravana R. N., 2022, PHI Learning Private Ltd, ISBN-978-93-91818-21-0
2. Traditional Knowledge System in India, Amit Jha, 2009, Atlantic Publishers and Distributors (P) Ltd., ISBN: 13:978-8126912230
3. Knowledge Traditions and Practice of India: Kapil Kapoor, Avadesh Kumar Singh, Vol1, 2005, DK Print Word (P) Ltd. ISBN:81-246-0334


**Suggested Websites:**

1. https://www.youtube.com/watch?v=LZPIStpYEPM
2. http://nptel.ac.in/courses/121106003/
3. http://www.iitkgp.ac.in/department/KS;jsessionid=C5042785F727F6EB46CBF432D7683B63 (Centre of Excellence for Indian Knowledge System, IIT, Khragpur)
4. https://www.wipo.int/pressroom/en/briefs/tk_ip.html
5. https://unctad.org/system/files/official-document/ditcted10_en.pdf

**Course outcomes:**
**On completion of the course, the student will have the ability to:**

| Course Code | CO # | Course Outcome (CO) |
|---|---|---|
| 22ECIKS67 | CO1 | Provide an overview of the concept of the Indian Knowledge System and its importance. |
| | CO2 | Appreciate the need and importance of protecting traditional knowledge |
| | CO3 | Recognize the relevance of Traditional Knowledge in different domains. |
| | CO4 | Establish the significance of Indian Knowledge Systems in the contemporary world |

| ASSESSMENT AND EVALUATION PATTERN | | |
|---|---|---|
| **WEIGHTAGE** | **50%(CIE)** | **50%(SEE)** |
| **QUIZZES** | | |
| Quiz-I<br>Quiz-II | Each quiz is evaluated for 05 marks adding upto**10 Marks.** | ***** |
| **THEORY COURSE**-(Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating) | | |
| Test–I<br>Test–II | Each test will be conducted for 25 Marks adding upto 50 marks. Final test marks will be reduced To **20 Marks** | ***** |
| **EXPERIENTIALLEARNING** | **20** | ***** |
| Case Study-based Teaching-Learning | -- | ***** |
| Sector wise study & consolidation (viz., Engg. Semiconductor Design, Healthcare & Pharmaceutical, FMCG, Automobile, Aerospace and IT/ ITeS) | -- | |
| Video based seminar(4-5minutes per student) | -- | |
| **Maximum Marks for the Theory** | --- | **50Marks** |
| **Practical** | -- | -- |
| **Total Marks for the Course** | **50** | **50** |

| Reference Books | |
|---|---|
| 1 | **Introduction to Indian Knowledge System-concepts and applications**, B Mahadevan, VinayakRajatBhat,NagendraPavanaRN,2022,PHILearningPrivateLtd,ISBN-978-93-91818-21-0 |
| 2 | **Traditional Knowledge System in India**, AmitJha,2009,Atlantic Publishers and Distributors (P)Ltd.,ISBN-13:978-8126912230, |
| 3 | **Knowledge Traditions and Practices of India**, Kapil Kapoor, AvadeshKumarSingh,Vol.1, 2005,DKPrintWorld(P)Ltd.,ISBN81-246-0334, |