



Electronics and Communication Engineering (ECE) Department

B.TECH. PROGRAMME

CURRICULUM STRUCTURE

RELEASE DATE:

July, 2018: Ver1.0

May, 2019: Ver: 1.1

July, 2020: Ver : 1.2

1st Year 1st Semester Syllabus:

| A. Theory | | | | | | | | |
|---------------------|----------------------|-----------------|------------------------|--------------------|---|---|-------|---------------|
| Sl. No. | Category | Course Code | Course Title | Contact Hours/Week | | | | Credit Points |
| | | | | L | T | P | Total | |
| 1 | Basic Science course | CHEM1001 | Chemistry I | 3 | 1 | 0 | 4 | 4 |
| 2 | Basic Science course | MATH1101 | Mathematics I | 3 | 1 | 0 | 4 | 4 |
| 3 | Engg. Science course | ELEC1001 | Basic Electrical Engg. | 3 | 1 | 0 | 4 | 4 |
| Total Theory | | | | 9 | 3 | 0 | 12 | 12 |

| B. Practical | | | | | | | | |
|--------------------------|----------------------|-----------------|-----------------------------------|----|---|---|-----------|-------------|
| 1 | Basic Science course | CHEM1051 | Chemistry I Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| 2 | Engg. Science Course | ELEC1051 | Basic Electrical Engg. Laboratory | 0 | 0 | 2 | 2 | 1 |
| 3 | Engg. Science Course | MECH1052 | Engg. Graphics & Design | 1 | 0 | 4 | 5 | 3 |
| Total Practical | | | | 0 | 0 | 9 | 10 | 5.5 |
| Total of Semester | | | | 10 | 3 | 9 | 22 | 17.5 |

1st Year 2nd Semester Syllabus:

| A. Theory | | | | | | | | |
|------------------|----------------------|-----------------|---------------------------------|--------------------|---|---|-------|---------------|
| Sl. No. | Category | Course Code | Course Title | Contact Hours/Week | | | | Credit Points |
| | | | | L | T | P | Total | |
| 1 | Basic Science course | PHYS1001 | Physics I | 3 | 1 | 0 | 4 | 4 |
| 2 | Basic Science course | MATH1201 | Mathematics II | 3 | 1 | 0 | 4 | 4 |
| 3 | Engg. Science course | CSEN1001 | Programming for Problem Solving | 3 | 0 | 0 | 3 | 3 |
| 4 | Humanities | HMTS1201 | Business English | 2 | 0 | 0 | 2 | 2 |
| | | | | | | | | |
| | | | | | | | | |
| | | | TOTAL | 11 | 2 | 0 | 13 | 13 |

| B. Practical | | | | | | | | |
|--------------------------|----------------------|-----------------|--|----|---|----|----|------|
| 1 | Basic Science Course | PHYS1051 | Physics I Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| 2 | Engg. Science Course | CSEN1051 | Programming for Problem Solving Laboratory | 0 | 0 | 4 | 4 | 2 |
| 3 | Engg. Science Course | MECH1051 | Workshop/ Manufacturing Practices | 1 | 0 | 4 | 5 | 3 |
| 4 | Humanities | HMTS1251 | Language Laboratory | 0 | 0 | 2 | 2 | 1 |
| | | | | | | | | |
| Total Practical | | | | 11 | 2 | 13 | 14 | 7.5 |
| Total of Semester | | | | 12 | 2 | 13 | 27 | 20.5 |

2nd Year 1st Semester:

| A. Theory | | | | | | | | |
|--------------------------|--------------------------|-----------------|--|--------------------|----------|-----------|-----------|---------------|
| Sl. No. | Category | Course Code | Course Title | Contact Hours/Week | | | | Credit Points |
| | | | | L | T | P | Total | |
| 1 | Professional Core Course | ECEN2101 | Analog Circuits | 3 | 0 | 0 | 3 | 3 |
| 2 | Professional Core Course | ECEN2102 | Circuit and Network Theory | 3 | 0 | 0 | 3 | 3 |
| 3 | Professional Core Course | ECEN2103 | Signals and Systems | 3 | 0 | 0 | 3 | 3 |
| 4 | Basic Science course | MATH2001 | Mathematical Methods | 3 | 0 | 0 | 3 | 3 |
| 5 | Engg. Science courses | CSEN2004 | Data Structure and Basic Algorithms | 4 | 0 | 0 | 4 | 4 |
| 6 | Humanities | HMTS2001 | Human Values and Professional Ethics | 3 | 0 | 0 | 3 | 3 |
| Total Theory | | | | 19 | 0 | 0 | 19 | 19 |
| B. Practical | | | | | | | | |
| 1 | Professional Core Course | ECEN2151 | Analog Circuits Laboratory | 0 | 0 | 2 | 2 | 1 |
| 2 | Professional Core Course | ECEN2152 | Circuit and Network Theory Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| 3 | Professional Core Course | ECEN2153 | Signals and Systems Laboratory | 0 | 0 | 2 | 2 | 1 |
| 3 | Engg. Science courses | CSEN2054 | Data Structure and Basic Algorithms Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| Total Practical | | | | 0 | 0 | 10 | 10 | 5 |
| Total of Semester | | | | | | | 29 | 24 |

2nd Year 2nd Semester:

| A. Theory | | | | | | | | |
|---------------------------------|--------------------------|-------------|---|--------------------|---|---|-------|---------------|
| Sl. No. | Category | Course Code | Course Title | Contact Hours/Week | | | | Credit Points |
| | | | | L | T | P | Total | |
| 1 | Professional Core Course | ECEN2201 | Analog Communication | 3 | 0 | 0 | 3 | 3 |
| 2 | Professional Core Course | ECEN2202 | Digital Systems Design | 3 | 0 | 0 | 3 | 3 |
| 3 | Professional Core Course | ECEN2203 | EM Theory & Transmission Lines | 3 | 0 | 0 | 3 | 3 |
| 4 | Professional Core Course | ECEN2204 | Electronic Devices | 3 | 0 | 0 | 3 | 3 |
| 5 | Basic Science Course | MATH2203 | Advanced Numerical Methods | 3 | 0 | 0 | 3 | 3 |
| Total Theory | | | | 15 | 0 | 0 | 15 | 15 |
| B. Practical | | | | | | | | |
| 1 | Professional Core Course | ECEN2251 | Analog Communication Laboratory | 0 | 0 | 2 | 2 | 1 |
| 2 | Professional Core Course | ECEN2252 | Digital Systems Design Laboratory | 0 | 0 | 2 | 2 | 1 |
| 3 | Professional Core Course | ECEN2253 | EM Theory & Transmission Lines Laboratory | 0 | 0 | 2 | 2 | 1 |
| 4 | Basic Science courses | MATH2253 | Advanced Numerical Methods Laboratory | 0 | 0 | 2 | 2 | 1 |
| Total Practical | | | | 0 | 0 | 8 | 8 | 4 |
| Total of Semester | | | | | | | 23 | 19 |
| C. Mandatory Course(non-credit) | | | | | | | | |
| 1 | Mandatory | EVSC2016 | Environmental Sciences | 2 | 0 | 0 | 2 | 0 |
| Total of Semester | | | | 17 | 0 | 8 | 25 | 19 |

3rd. Year, 1st. Semester

| A. Theory | | | | | | | | |
|---------------------|--------------------------|-----------------|--------------------------------------|--------------------|---|---|-------|---------------|
| Sl. No. | Category | Course Code | Course Title | Contact Hours/Week | | | | Credit Points |
| | | | | L | T | P | Total | |
| 1 | Professional Core Course | ECEN3101 | Digital Communication | 3 | 0 | 0 | 3 | 3 |
| 2 | Professional Core Course | ECEN3102 | Digital Signal Processing | 3 | 0 | 0 | 3 | 3 |
| 3 | Professional Core Course | ECEN3103 | Microwave Engineering | 3 | 0 | 0 | 3 | 3 |
| 4 | Professional Core Course | ECEN3104 | Microprocessors and Microcontrollers | 3 | 0 | 0 | 3 | 3 |
| 5 | Professional Core Course | ECEN3105 | Information Theory and Coding | 3 | 0 | 0 | 3 | 3 |
| 6 | Professional Elective-1 | ECEN3131 | Telecommunication Systems | 3 | 0 | 0 | 3 | 3 |
| | | ECEN3132 | Computer Networks | | | | | |
| | | ECEN3133 | Speech and Audio Processing | | | | | |
| Total Theory | | | | 18 | 0 | 0 | 18 | 18 |

| B. Practical | | | | | | | | |
|--------------------------|---------------------------|-----------------|---|---|---|---|-----------|-----------|
| 1 | Professional Core Courses | ECEN3151 | Digital Communication Laboratory | 0 | 0 | 2 | 2 | 1 |
| 2 | Professional Core Courses | ECEN3152 | Digital Signal Processing Laboratory | 0 | 0 | 2 | 2 | 1 |
| 3 | Professional Core Course | ECEN3153 | Microwave Engineering Laboratory | 0 | 0 | 2 | 2 | 1 |
| 4 | Professional Core Course | ECEN3154 | Microprocessors and Microcontrollers Laboratory | 0 | 0 | 2 | 2 | 1 |
| Total Practical | | | | 0 | 0 | 8 | 8 | 4 |
| Total of Semester | | | | | | | 26 | 22 |

3rd Year 2nd Semester:

| A. Theory | | | | | | | | |
|---------------------|----------------------------|------------------|--|--------------------|----------|----------|-----------|---------------|
| Sl. No. | Category | Course Code | Course Title | Contact Hours/Week | | | | Credit Points |
| | | | | L | T | P | Total | |
| 1 | Professional Core Courses | ECEN3201 | Digital VLSI Design | 3 | 0 | 0 | 3 | 3 |
| 2 | Engineering Science Course | CSEN3208 | Object Oriented Programming Concept by using C++ | 3 | 0 | 0 | 3 | 3 |
| 3 | HU | HMTS3201 | Economics for Engineers | 3 | 0 | 0 | 3 | 3 |
| 4 | Professional Elective-2 | ECEN3231 | Digital Image Processing & Pattern recognition | 3 | 0 | 0 | 3 | 3 |
| | | ECEN3232 | IoT for Communication | | | | | |
| | | ECEN3233 | Power Electronics | | | | | |
| | | ECEN 3234 | Network Security | | | | | |
| | | ECEN 3235 | Advanced Digital Communication | | | | | |
| 5 | Open Elective - 1 | ECEN3221 | Artificial Intelligence in Radio Communication | 3 | 0 | 0 | 3 | 3 |
| | | AEIE3221 | Fundamentals Of Sensors And Transducers | | | | | |
| | | CSEN3221 | Fundamentals of RDBMS | | | | | |
| | | MATH3221 | Computational Mathematics | | | | | |
| | | MATH3222 | Advanced Probability and Information Theory | | | | | |
| | | MATH3223 | Scientific Computing | | | | | |
| Total Theory | | | | 15 | 0 | 0 | 15 | 15 |

| B. Practical | | | | | | | | |
|------------------------|----------------------------|-----------------|---|----------|----------|----------|----------|------------|
| 1 | Professional Core Course | ECEN3251 | Digital VLSI Design Laboratory | 0 | 0 | 2 | 2 | 1 |
| 2 | Engineering Science Course | CSEN3258 | Object Oriented Programming Concept by using C++ Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| Total Practical | | | | 0 | 0 | 5 | 5 | 2.5 |

| C. Sessional | | | | | | | | |
|--------------------------|---------------------------------------|-----------------|---|---|---|---|-----------|------------|
| 1 | Professional Core Courses | ECEN3252 | Mini Project/Electronic Design workshop | 0 | 0 | 3 | 3 | 1.5 |
| 2 | Project Work ,Seminar, Internship etc | ECEN3293 | Term paper with Seminar | 0 | 0 | 4 | 4 | 2 |
| Total Sessional | | | | 0 | 0 | 7 | 7 | 3.5 |
| Total of Semester | | | | | | | 27 | 21 |

| D. Mandatory Course(non-credit) | | | | | | | | |
|--|-----------|-----------------|---------------------------------------|-----------|----------|-----------|-----------|-----------|
| 1 | Mandatory | INCO3016 | Indian Constitution and Civil Society | 2 | 0 | 0 | 2 | 0 |
| Total of Semester | | | | 17 | 0 | 12 | 29 | 21 |

| | | |
|------------------|---|--|
| Open Elective -1 | i) ECEN3222 ii) ECEN3223 | i) Designing with Processors and Controllers ii) Analog and Digital Communication |
|------------------|---|--|

Open Elective -1 (to be offered by ECE Department)

4th Year 1st Semester:

| A. Theory | | | | | | | | |
|---------------------|-------------------------|--|--|--------------------|---|---|-------|---------------|
| Sl. No. | Category | Course Code | Course Title | Contact Hours/Week | | | | Credit Points |
| | | | | L | T | P | Total | |
| 1 | Professional Elective-3 | i) ECEN4131 ii)ECEN4132 iii)ECEN4133 | i) Adaptive Signal Processing ii) Fiber Optic Communication iii) EMI/EMC | 3 | 0 | 0 | 3 | 3 |
| 2 | Open Elective-2 | i) INFO4121 ii)ECEN4121 iii)AEIE4122 iv)CSEN4121 v)MATH4121 vi)MATH4122 vii)HMTS4122 | i) Fundamentals of Cloud Computing ii) Machine Learning and Regression Analysis iii)Linear Control Systems and Applications iv)Fundamentals of Operating Systems v)Methods in Optimization vi)Advanced Linear Algebra vii)German for Beginners | 3 | 0 | 0 | 3 | 3 |
| 3 | Open Elective- 3 | i) AEIE4126 ii) CSEN4126 iii)CIVL4125 iv)CHEN4122 | i) Process Instrumentation ii) Intelligent Web and Big Data iii) Remote Sensing and GIS iv)Industrial Pollution Control | 3 | 0 | 0 | 3 | 3 |
| 4 | HU | HMTS4101 | Principles of Management | 3 | 0 | 0 | 3 | 3 |
| Total Theory | | | | 12 | 0 | 0 | 12 | 12 |

| B. Sessional | | | | | | | | |
|--------------------------|---|-----------------|---------------------------------|---|---|---|-----------|-----------|
| 5 | Project Work ,Seminar, Internship etc. | ECEN4195 | Project Stage – I | 0 | 0 | 8 | 8 | 4 |
| 6 | Project Work ,Seminar, Internship etc. | ECEN4191 | Industrial Training/ Internship | - | - | - | - | 2 |
| Total Sessional | | | | 0 | 0 | 8 | 8 | 6 |
| Total of Semester | | | | | | | 20 | 18 |

| | | |
|------------------|---|--|
| Open Elective -2 | i)ECEN4122 ii)ECEN4123 | i) Software Defined Radio ii)Error Control Coding |
|------------------|---|--|

Table 2: Open Elective 2 (to be offered by ECE department)

| | | |
|------------------|---|---|
| Open Elective -3 | i)ECEN4126 ii)ECEN4127 | i) Ad Hoc Networks and Security Challenges ii) Introduction to VLSI Design |
|------------------|---|---|

Table 3: Open Elective 3 (to be offered by ECE department)

4th Year 2nd Semester:

| A. Theory | | | | | | | | |
|---------------------|---------------------------|---|--|--------------------|----------|----------|----------|---------------|
| Sl. No. | Category | Course Code | Course Title | Contact Hours/Week | | | | Credit Points |
| | | | | L | T | P | Total | |
| 1 | Professional Elective - 4 | i)ECEN4241 ii)ECEN4242 iii)ECEN4243 iv)ECEN4244 | i) Introduction to MEMS ii) Satellite Communication iii) Ad Hoc wireless networks iv) Nano Technology | 3 | 0 | 0 | 3 | 3 |
| 2 | Professional Elective-5 | i)ECEN4231 ii)ECEN4232 iii)ECEN4233 | i) Wireless Sensor Networks ii)CDMA – the Technology and Applications iii) Machine Intelligence and Introduction to Python | 3 | 0 | 0 | 3 | 3 |
| 3 | Open Elective -4 | i) INFO4221 ii)AEIE4221 iii)ELEC4221 iv) BIOT4222 v) HMTS4222 vi) BIOT | i) Fundamentals of Cryptography ii)Introduction to Embedded System iii) Illumination Engineering iv) Non-conventional Energy v)Elementary Spanish vi) Biology for Engineers | 3 | 0 | 0 | 3 | 3 |
| Total Theory | | | | 9 | 0 | 0 | 9 | 9 |

| B. Sessional | | | | | | | | |
|--------------------------|---|-----------------|--------------------------------|---|---|----|-----------|-----------|
| 4 | Project Work ,Seminar, Internship etc. | ECEN4295 | Project Work II & Dissertation | 0 | 0 | 16 | 16 | 8 |
| 5 | Project Work ,Seminar, Internship etc. | ECEN4297 | Comprehensive Viva Voce | - | - | - | - | 1 |
| Total Sessional | | | | 0 | 0 | 16 | 16 | 9 |
| Total of Semester | | | | | | | 25 | 18 |

| | | |
|------------------|---|---|
| Open Elective -4 | i) ECEN4221 ii) ECEN4222 | i) Cellular and Mobile communication ii) Optical Fiber Communication |
|------------------|---|---|

Table 4: Open Elective 4 (to be offered by ECE Department)

Honours Courses



Honours Credit Chart (ECE)

| Sl. No. | Semester | Paper Code | Course Title | Contact Hours / Week | | | Credit Points |
|--------------------|----------|------------|--|----------------------|---|---|---------------|
| | | | | L | T | P | |
| 1 | 1st | HMTS1011 | Communication for Professionals | 3 | 0 | 0 | 3 |
| | | HMTS1061 | Professional Communication Laboratory | 0 | 0 | 2 | 1 |
| 2 | 2nd | ECEN1011 | Basic Electronics | 3 | 0 | 0 | 3 |
| | | ECEN1061 | Basic Electronics Laboratory | 0 | 0 | 2 | 1 |
| 3 | 4th | ECEN2211 | Control Systems | 3 | 0 | 0 | 3 |
| | | ECEN2261 | Control Systems Laboratory | 0 | 0 | 2 | 1 |
| 4 | 6th | ECEN3211 | Wireless and Cellular Communication | 3 | 0 | 0 | 3 |
| | | ECEN3261 | Wireless and Cellular Communication Laboratory | 0 | 0 | 2 | 1 |
| 5 | 7th | ECEN4111 | Microelectronics and Analog VLSI design | 3 | 0 | 0 | 3 |
| | | ECEN4161 | Microelectronics and Analog VLSI design | 0 | 0 | 2 | 1 |
| Grand Total | | | | | | | 20 |

Definition of Credit (as per AICTE):

- 1 Hour Lecture (L) per Week = 1 Credit
- 1 Hour Tutorial (T) per Week = 1 Credit
- 1 Hour Practical (P) per Week = 0.5 Credits
- 2 Hours Practical (Lab) per Week = 1 Credit

Range of Credits (as per AICTE):

- ✓ A total of 160 credits will be necessary for a student to be eligible to get B Tech degree.
- ✓ A student will be eligible to get B Tech degree with Honours if he/she completes an additional 20 credits. These could be acquired through various Honours Courses offered by the respective departments.
- ✓ A part or all of the above additional credits may also be acquired through MOOCs. Any student completing any course through MOOC will have to submit an appropriate certificate to earn the corresponding credit.
- ✓ For any additional information, the student may contact the concerned HODs.

On line courses recommended to the students of ECE Department

| Code | Name | Credit Points | Corresponding Online Course | Offered by | Platform | Comment |
|----------|---|---------------|---|----------------|----------|--|
| ECEN1011 | Basic Electronics | 3 | Fundamentals of Semiconductor Devices | IISc Bangalore | NPTEL | |
| ECEN1061 | Basic Electronics Lab | 1 | | | | |
| | | | | | | |
| HMTS1011 | Communication for Professionals | 3 | Effective Business Communication | IIM Bangalore | Swayam | Both online courses need to be done |
| HMTS1061 | Professional Communication Lab | 1 | Developing Soft Skills and Personality | IIT Kanpur | Swayam | |
| | | | | | | |
| ECEN2211 | Control Systems | 3 | Control Systems | IIT Madras | NPTEL | |
| ECEN2261 | Control Systems Lab | 1 | | | | |
| | | | | | | |
| ECEN3211 | Wireless and Cellular Communication | 3 | Introduction to Wireless and Cellular Communication | IIT Madras | NPTEL | |
| ECEN3261 | Wireless and Cellular Communication Lab | 1 | | | | |
| | | | | | | |
| ECEN4111 | Microelectronics and Analog VLSI Design | 3 | Analog IC Design | IIT Madras | NPTEL | |
| ECEN4161 | Microelectronics and Analog VLSI Design Lab | 1 | | | | |

| Sl. No. | Course Type | AICTE Suggested | AEIE | BIOT | CIVL | CHEN | CSEN | ECEN | ELEC | INFO | MECH |
|---------|--------------------|-----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| 9 | Honours Courses | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | Grand Total | 180 | 180 | 180 | 180 | 180 | 180 | 180 | 180 | 180 | 180 |

Definition of Credit (as per AICTE):

- 1 Hour Lecture (L) per Week = 1 Credit
- 1 Hour Tutorial (T) per Week = 1 Credit
- 1 Hour Practical (P) per Week = 0.5 Credits
- 2 Hours Practical (Lab) per Week = 1 Credit

Range of Credits (as per AICTE):

- ✓ A total of 160 credits will be necessary for a student to be eligible to get B Tech degree.
- ✓ A student will be eligible to get B Tech degree with Honours if he/she completes an additional 20 credits. These could be acquired through various Honours Courses offered by the respective departments.
- ✓ A part or all of the above additional credits may also be acquired through MOOCs. Any student completing any course through MOOC will have to submit an appropriate certificate to earn the corresponding credit.
- ✓ For any additional information, the student may contact the concerned HODs.

1ST YEAR 1ST SEMESTER

| | | | | | |
|-----------------------------------|----------|----------|----------|--------------|----------------------|
| Course Title : Chemistry I | | | | | |
| Course Code : CHEM1001 | | | | | |
| Contact hrs per week: | L | T | P | Total | Credit points |
| | 3 | 1 | 0 | 4 | 4 |

Course outcomes:

The subject code CHEM1001 corresponds to chemistry theory classes for the first year B. Tech students, which is offered as Engineering Chemistry and is common for all branches of engineering subjects. The course provides basic knowledge of theory based subjects like quantum mechanics, thermodynamics, reaction dynamics, electrochemistry, structure and reactivity of molecules. The course outcomes of the subject are

1. Knowledge of understanding the operating principles and reaction involved in batteries and fuel cells and their application in automobiles as well as other sectors to reduce environmental pollution.
2. An ability to design and conduct experiments, as well as to organize, analyzes, and interprets data.
3. An ability to analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces for engineering applications.
4. Have knowledge of synthesizing nano materials and their applications in industry, carbon nano tube technology is used in every industry now-a-days.
5. Understanding of bulk properties and processes using thermodynamic considerations.
6. Elementary knowledge of IR, UV, NMR and X-ray spectroscopy is usable in structure elucidation and characterisation of various molecules. Knowledge of electronic effect and stereochemistry for understanding mechanism of the major chemical reactions involved in synthesis of various drug molecules.

MODULE 1[10 L]

Atomic structure and Wave Mechanics:

Brief outline of the atomic structure, Dual character of electron, De Broglie's equation, the Heisenberg uncertainty principle, brief introduction of quantum mechanics, the Schrodinger wave equation, Hermitian operator, solution of the Schrodinger equation for particle in a one dimensional box, interpretation of the wave function Ψ , concept of atomic orbital. 3L

Thermodynamics:

Carnot cycle, 2nd law of thermodynamics, entropy, Clausius inequality, free energy and work function, Clausius Clapeyron Equation, Chemical Potential, Activity and Activity coefficient. Gibbs Duhem Relation. 4L

Spectroscopic Techniques & Application

Electromagnetic spectrum: EMR interaction with matter - absorption and emission of radiation. Principle and application of UV- visible and IR spectroscopy

Principles of NMR Spectroscopy and X-ray diffraction technique. 3L

MODULE 2 [10 L]

Chemical Bonding

Covalent bond, VSEPR Theory, hybridization, molecular geometries, Dipole moment, Intermolecular forces, V.B. and M.O. theory and its application in Homo and Heteronuclear diatomic molecules, Band theory of solids, Pi- molecular orbital of ethylene and butadiene. 5L

Periodicity

Effective nuclear charge, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electro-negativity, inert pair effect. 3L

Ionic Equilibria

Acid Base Equilibria, Salt Hydrolysis and Henderson Equation, Buffer solutions, pH indicator, Common ion Effect, Solubility product, Fractional Precipitation . 2L

MODULE 3 [10 L]

Conductance

Conductance of electrolytic solutions, Strong and Weak electrolytes, effect of temperature and concentration. Kohlrausch's law of independent migration of ions, transport numbers and hydration of ions. Application of conductance Acid-base and precipitation titration. 3L

Electrochemical Cell

Thermodynamic derivation of Nernst equation, Electrode potential and its application to predict redox reaction; Standard Hydrogen Electrode, Reference electrode, cell configuration, half-cell reactions, evaluation of thermodynamic functions; Reversible and Irreversible cells; Electrochemical corrosion.

Electrochemical Energy Conversion: Primary & Secondary batteries, Fuel Cells. 4L

Reaction dynamics

Rate Laws, Order & Molecularity; zero, first and second order kinetics. Pseudo-unimolecular reaction, Arrhenius equation.

Mechanism and theories of reaction rates (Transition state theory, Collision theory). Catalysis: Homogeneous catalysis (Definition, example, mechanism, kinetics). 3L

MODULE 4 [10]

Stereochemistry

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. 4L

Structure and reactivity of Organic molecule

Inductive effect, resonance, hyperconjugation, electromeric effect, carbocation, carbanion, free radicals, aromaticity. 3L

Organic reactions and synthesis of drug molecule

Introduction to reaction mechanisms involving substitution, addition, elimination and oxidation- reduction reactions. Synthesis of commonly used drug molecules. 3L

TEXT BOOKS

1. Atkins' Physical Chemistry, P.W. Atkins (10th Edition)
2. Organic Chemistry, I. L. Finar, Vol-1 (6th Edition)
3. Engineering Chemistry, Jain & Jain,(16th Edition)
4. Fundamental Concepts of Inorganic Chemistry, A. K. Das, (2nd Edition)
5. Engineering Chemistry -I, Gourkrishna Dasmohapatra, (3rd Edition)

REFERENCE BOOKS

1. General & Inorganic Chemistry, R. P. Sarkar
2. Physical Chemistry, P. C. Rakshit, (7th Edition)
3. Organic Chemistry, Morrison & Boyd , (7th Edition)
4. Fundamentals of Molecular Spectroscopy, C.N. Banwell, (4th Edition)
5. Physical Chemistry , G. W. Castellan, (3rd Edition)
6. Basic Stereo chemistry of Organic Molecules, Subrata Sen Gupta, (1st Edition)

| | | | | | |
|--|----------|----------|----------|--------------|----------------------|
| Course Title : Chemistry I Laboratory | | | | | |
| Course Code : CHEM1051 | | | | | |
| Contact hrs per week : | L | T | P | Total | Credit points |
| | 0 | 0 | 3 | 3 | 1.5 |

Course outcomes:

The subject code CHEM1051 corresponds to chemistry laboratory classes for the first year B. Tech students. This course enhances the students' experience regarding handling of various chemicals along with various laboratory equipment. Hands on experiments increase the depth of knowledge that is taught in the theory classes as well as it increases research aptitude in students because they can see the direct application of theoretical knowledge in practical field. The course outcomes of the subject are

1. Knowledge to estimate the hardness of water which is required to determine the usability of water used in industries.
2. Estimation of ions like Fe^{2+} , Cu^{2+} and Cl^- present in water sample to know the composition of industrial water.
3. Study of reaction dynamics to control the speed and yield of various manufactured goods produced in polymer, metallurgical and pharmaceutical industries.
4. Handling physico-chemical instruments like viscometer, stalagmometer, pH-meter, potentiometer and conductometer.
5. Understanding the miscibility of solutes in various solvents required in paint, emulsion, biochemical and material industries.
6. Knowledge of sampling water can be employed for water treatment to prepare pollution free water.

List of Experiments:

1. Estimation of iron using KMnO_4 : self indicator.
2. Iodometric estimation of Cu^{2+} .
3. Determination of Viscosity.
4. Determination of surface tension.
5. Adsorption of acetic acid by charcoal.
6. Potentiometric determination of redox potentials.
7. Determination of total hardness and amount of calcium and magnesium separately in a given water sample.
8. Determination of the rate constant for acid catalyzed hydrolysis of ethylacetate.
9. Heterogeneous equilibrium (determination of partition coefficient of acetic acid in n-butanol and water mixture).
10. Conductometric titration for the determination of strength of a given HCl solution against a standard NaOH solution.
11. pH-metric titration for determination of strength of a given HCl solution against a standard NaOH solution.

12. Determination of chloride ion in a given water sample by Argentometric method (using chromate indicator solution)

| | | | | | |
|-------------------------------------|----------|----------|----------|--------------|----------------------|
| Course Title : Mathematics-I | | | | | |
| Course Code: MATH1101 | | | | | |
| Contact hrs per week: | L | T | P | Total | Credit points |
| | 3 | 1 | 0 | 4 | 4 |

Course Outcomes

1. MATH1101.1 Apply the concept of rank of matrices to find the solution of a system of linear simultaneous equations.
2. MATH1101.2 Develop the concept of eigen values and eigen vectors.
3. MATH1101.3 Combine the concepts of gradient, curl, divergence, directional derivatives, line integrals, surface integrals and volume integrals.
4. MATH1101.4 Analyze the nature of sequence and infinite series
5. MATH1101.5 Choose proper method for finding solution of a specific differential equation.
MATH1101.6 Describe the concept of differentiation and integration for functions of several variables with their applications in vector calculus.

The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Module I [10L]

Matrix:

Inverse and rank of a matrix; Elementary row and column operations over a matrix; System of linear equations and its consistency; Symmetric, skew symmetric and orthogonal matrices; Determinants; Eigen values and eigen vectors; Diagonalization of matrices; Cayley Hamilton theorem; Orthogonal transformation.

Module II [10 L]

Vector Calculus:

Vector function of a scalar variable, Differentiation of a vector function, Scalar and vector point functions, Gradient of a scalar point function, divergence and curl of a vector point function, Directional derivative, Related problems on these topics,

Infinite Series:

Convergence of sequence and series; Tests for convergence: Comparison test, Cauchy's Root test, D' Alembert's Ratio test (statements and related problems on these tests), Raabe's test; Alternating series; Leibnitz's Test (statement, definition); Absolute convergence and Conditional convergence.

Module III [10 L]

First order ordinary differential equations:

Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p , equations solvable for y , equations solvable for x and Clairaut's type.

Ordinary differential equations of higher orders:

General linear ODE of order two with constant coefficients, C.F. & P.I., D-operator methods, Method of variation of parameters, Cauchy-Euler equations.

Module IV [10L]

Calculus of functions of several variables

Introduction to functions of several variables with examples, Knowledge of limit and continuity, Determination of partial derivatives of higher orders with examples, Homogeneous functions and Euler's theorem and related problems up to three variables,

Multiple Integration

Concept of line integrals, Double and triple integrals. Green's Theorem, Stokes Theorem and Gauss Divergence Theorem.

Suggested Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2000.
2. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2006.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
5. K. F. Riley, M. P. Hobson, S. J. Bence. Mathematical Methods for Physics and Engineering, Cambridge University Press, 23-Mar-2006.
6. S. L. Ross, Differential Equations", Wiley India, 1984.
7. G.F. Simmons and S.G. Krantz, Differential Equations, McGraw Hill, 2007.
8. Vector Analysis(Schaum's outline series): M.R. Spiegel, Seymour Lipschutz, Dennis Spellman (McGraw Hill Education)
9. Engineering Mathematics: S. S. Sastry (PHI)
10. Advanced Engineering Mathematics: M.C. Potter, J.L. Goldberg and E.F. Abonfadel (OUP), Indian Edition.
11. Linear Algebra (Schaum's outline series): Seymour Lipschutz, Marc Lipson (McGraw Hill Education)

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|--|----------|----------|----------|--------------|----------------------|
| Course Title : Basic Electrical Engg. | | | | | |
| Course Code : ELEC1001 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 3 | 1 | 0 | 4 | 4 |

Course Outcomes

After attending the course, the students will be able to

1. Analyse DC electrical circuits using KCL, KVL and network theorems like Superposition Theorem, Thevenin's Theorem, Norton's Theorem and Maximum Power Transfer Theorem.
2. Analyse DC Machines; Starters and speed control of DC motors.
3. Analyse magnetic circuits.
4. Analyse single and three phase AC circuits.
5. Analyse the operation of single phase transformers.
6. Analyse the operation of three phase induction motors.

Module-I: [11 L]

DC Network Theorem: Kirchhoff's laws, Nodal analysis, Mesh analysis, Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Star-Delta conversion. [6L]

Electromagnetism: Review of magnetic flux, Force on current carrying conductors, Magnetic circuit analysis, Self and Mutual inductance, B-H loop, Hysteresis and Eddy current loss, Lifting power of magnet. [5L]

Module-II[10L]

AC single phase system: Generation of alternating emf, Average value, RMS value, Form factor, Peak factor, representation of an alternating quantity by a phasor, phasor diagram, AC series, parallel and series-parallel circuits, Active power, Reactive power, Apparent power, power factor, Resonance in RLC series and parallel circuit.

Module-III [11 L]

Three phase system: Generation of three-phase AC power, Balanced three phase system, delta and star connection, relationship between line and phase quantities, phasor diagrams, power measurement by two wattmeter method. [4L]

DC Machines: Construction, EMF equation, Principle of operation of DC generator, Open circuit characteristics, External characteristics, Principle of operation of DC motor, speed-torque characteristics of shunt and series machine, starting of DC motor, speed control of DC motor. [7L]

Module-IV [10L]

Transformer: Construction, EMF equation, no load and on load operation and their phasor diagrams, Equivalent circuit, Regulation, losses of a transformer, Open and Short circuit tests, Efficiency, Introduction to

three phase transformer.[6L]

Three-phase induction motor: Concept of rotating magnetic field, Principle of operation, Construction, Equivalent circuit and phasor diagram, torque-speed/slip characteristics, Starting of Induction Motor.[4L]

Text Books:

1. Basic Electrical engineering, D.P Kothari & I.J Nagrath, TMH, Second Edition
2. Basic Electrical Engineering, V.N Mittle & Arvind Mittal, TMH, Second Edition
3. Basic Electrical Engineering, Hughes
4. Electrical Technology, Vol-I,Vol-II,Surinder Pal Bali, Pearson Publication
5. A Text Book of Electrical Technology, Vol. I & II, B.L. Theraja, A.K. Theraja, S.Chand & Company

Reference Books:

1. Electrical Engineering Fundamentals, Vincent Del Toro, Prentice-Hall
2. Advance Electrical Technology, H.Cotton, Reem Publication
3. Basic Electrical Engineering, R.A. Natarajan, P.R. Babu, Sictech Publishers
4. Basic Electrical Engineering, N.K. Mondal, Dhanpat Rai
5. Basic Electrical Engineering, Nath & Chakraborti
6. Fundamental of Electrical Engineering, Rajendra Prasad, PHI, Edition 2005.

| | | | | | |
|---|---|---|---|-------|---------------|
| Course Title : Basic Electrical Engg. Laboratory | | | | | |
| Course Code : ELEC1051 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 0 | 0 | 2 | 2 | 1 |

Course Outcomes: The students are expected to

1. Get an exposure to common electrical apparatus and their ratings.
2. Make electrical connections by wires of appropriate ratings.
3. Understand the application of common electrical measuring instruments.
4. Understand the basic characteristics of different electrical machines.

List of Experiments:

1. Characteristics of Fluorescent lamps
2. Characteristics of Tungsten and Carbon filament lamps
3. Verification of Thevenin's & Norton's theorem.
4. Verification of Superposition theorem
5. Verification of Maximum Power Transfer theorem
6. Calibration of ammeter and voltmeter.
7. Open circuit and Short circuit test of a single phase Transformer.
8. Study of R-L-C Series / Parallel circuit
9. Starting and reversing of speed of a D.C. shunt Motor
10. Speed control of DC shunt motor.
11. No load characteristics of D.C shunt Generators
12. Measurement of power in a three phase circuit by two wattmeter method.

| | | | | | |
|---|---|---|---|-------|---------------|
| Course Title : Engineering Graphics and Design | | | | | |
| Course Code : MECH1052 | | | | | |
| Contact hrs per week: | L | T | P | Total | Credit Points |
| | 1 | 0 | 4 | 5 | 3 |

Course Outcomes:

After going through the course, the students will be able

1. To understand the meaning of engineering drawing.
2. To have acquaintance with the various standards (like lines, dimensions, scale etc.) and symbols followed in engineering drawing.
3. To represent a 3-D object into 2-D drawing with the help of orthographic and isometric projections.
4. To read and understand projection drawings.
5. To draw the section view and true shape of a surface when a regular object is cut by a section plane.
6. To use engineering drawing software (CAD).

Lecture Plan (13 L)

- | | |
|--|-------|
| 1. Importance and principles of engineering drawing | (1 L) |
| 2. Concepts of Conic sections and Scale | (1 L) |
| 3. Introduction to concept of projection (Projections of points, lines and surfaces) | (4 L) |
| 4. Definitions of different solids and their projections | (1 L) |
| 5. Section of solids and sectional view | (1 L) |
| 6. Isometric projection | (2 L) |
| 7. Introduction to CAD | (2 L) |
| 8. Viva Voce | (1 L) |

Detailed contents of Lab hours (52 hrs)

Module 1: Introduction to Engineering Drawing covering,

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lines, lettering & dimensioning, Conic section like Ellipse (General method only); Involute; Scales – Plain, Diagonal.

(4 hrs + 4 hrs)

Module 2: Orthographic Projections covering,

Principles of Orthographic Projections - Conventions - Projections of Points and lines inclined to both planes; Projections on Auxiliary Planes. Projection of lamina.

(4 hrs+4 hrs + 4 hrs)

Module 3: Projections of Regular Solids covering, those inclined to both the Planes- Auxiliary Views.

(4 hrs + 4 hrs)

Module 4: Sections and Sectional Views of Right Angular Solids covering,

Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids.(4 hrs)

Module 5: Isometric Projections covering,

Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions.

(4 hrs + 4 hrs)

Module 6: Overview of Computer Graphics covering,

listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.]; Isometric Views of lines, Planes, Simple and compound Solids.

(4 hrs)

Module 7: Customisation & CAD Drawing

consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

(2 hrs)

Annotations, layering & other functions covering

applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation.

(2 hrs)

Module 8: Demonstration of a simple team design project that illustrates

Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame.

(4 hrs)

References:

1. Bhatt, N.D., Panchal V.M. & Ingle P.R., (2014) “Elementary Engineering Drawing” ; Charotan Publishing House
2. Narayana, K.L. and Kannaaiah P “Engineering Graphics”; TMH

3. Lakshminarayanan, V. and Vaish Wanar, R.S “Engineering Graphics” Jain Brothers.
4. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education.
5. Agarwal B. & Agarwal C. M. (2012), Engineering graphics, TMH Publications.

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|---|----------|----------|----------|--------------|----------------------|
| Course Title : Communication for Professionals | | | | | |
| Course Code : HMTS1011 | | | | | |
| Contact hrs per week: | L | T | P | Total | Credit Points |
| | 3 | 0 | 0 | 3 | 3 |

Course Outcomes:

Students will be able to-

1. Write business letters and reports
2. Communicate in an official and formal environment.
3. Effectively use the various channels of communication at work place.
4. Use language as a tool to build bridges and develop interpersonal relations in multi-cultural environment.
5. Learn to articulate opinions and views with clarity.
6. Use various techniques of communication for multiple requirements of globalized workplaces.

Module- I [9hrs]

Introduction to Linguistics

Phonetics- Vowel and Consonant Sounds (Identification & Articulation)

Word- stress, stress in connected speech

Intonation (Falling and Rising Tone)

Voice Modulation

Accent Training

Vocabulary Building

The concept of Word Formation

Root words from foreign languages and their use in English

Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives

Synonyms, Antonyms and standard abbreviations

Module- II [10hrs.]

Communication Skills

Definition, nature & attributes of Communication

Process of Communication

Models or Theories of Communication

Types of Communication

Levels or Channels of Communication

Barriers to Communication

Module- III [10hrs.]

Professional Writing Skills

Letter Writing : Importance, Types , Process, Form and Structure, Style and Tone

Proposal Writing: Purpose, Types of Proposals, Structure of Formal Proposals.

Report Writing: Importance and Purpose, Types of Reports, Report Formats, Structure of Formal Reports, Writing Strategies.

Module- IV [10hrs]

Communication skills at Work

Communication and its role in the workplace

Benefits of effective communication in the workplace

Common obstacles to effective communication

Approaches and Communication techniques for multiple needs at workplace: persuading, convincing, responding, resolving conflict, delivering bad news, making positive connections,

Identify common audiences and design techniques for communicating with each audience

References:

1. Kumar,S. &Lata, P. Communication Skills, OUP, New Delhi2011
2. Rizvi,Ashraf,M. Effective Technical Communication, Mc Graw Hill Education(India) Pvt. Ltd..Chennai,2018
3. Raman, M. and Sharma, S., Technical Communication: Principles and Practice, 2nd Ed., 2011

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|--|----------|----------|----------|--------------|----------------------|
| Course Title: Professional Communication Laboratory | | | | | |
| Course Code: HMTS1061 | | | | | |
| Contact hrs per week: | L | T | P | Total | Credit Points |
| | 0 | 0 | 2 | 2 | 1 |

Course Outcomes-

Students will be skilled in the following areas:

1. Communicate in an official and formal environment.
2. Effectively communicate in a group and engage in relevant discussion.
3. Engage in research and prepare presentations on selected topics.
4. Understand the dynamics of multicultural circumstances at workplace and act accordingly.
5. Organize content in an attempt to prepare official documents.
6. Appreciate the use of language to create beautiful expressions

Module- I [4hrs]

Techniques for Effective Speaking

Voice Modulation: Developing correct tone

Using correct stress patterns: word stress, primary stress, secondary stress Rhythm in connected speech

Module- II [6hrs]

Effective Speaking and Social awareness The Art of Speaking

Encoding Meaning Using Nonverbal Symbols

How to Improve Body Language

Eye Communication, Facial Expression, Dress and Appearance

Posture and Movement, Gesture, Paralanguage

Encoding meaning using Verbal symbols: How words work and how to use words

Volume, Pace, Pitch and Pause

Cross-Cultural Communication : Multiple aspects/dimensions of culture

Challenges of cross-cultural communication

Improving cross-cultural communication skills at workplace.

Module- III [6hrs]

Group Discussion: Nature and purpose

Characteristics of a successful Group Discussion

Group discussion Strategies: Getting the GD started, contributing systematically, moving the discussion

along, promoting optimal participation, Handling conflict, Effecting closure.

Module- IV [10hrs]

Professional Presentation Skills

Nature and Importance of Presentation skills

Planning the Presentation: Define the purpose, analyze the Audience, Analyze the occasion and choose a suitable title. Preparing the Presentation: The central idea, main ideas, collecting support material, plan visual aids, design the slides Organizing the Presentation: Introduction-Getting audience attention, introduce the subject, establish credibility, preview the main ideas, Body-develop the main idea, present information sequentially and logically, Conclusion- summaries, re-emphasize, focus on the purpose, provide closure.

Improving Delivery: Choosing Delivery methods, handling stage fright

Post-Presentation discussion: Handling Questions-opportunities and challenges.

References:

1. Carter, R. And Nunan, D. (Eds), The Cambridge guide to Teaching English to Speakers of Other Languages, CUP, 2001
2. Edward P. Bailey, Writing and Speaking At Work: A Practical Guide for Business Communication, Prentice
3. Hall, 3rd Ed., 2004
4. Munter, M., Guide to Managerial Communication: Effective Business Writing and Speaking, Prentice Hall, 5th Ed., 1999
5. R. Anand, Job Readiness For IT & ITES- A Placement and Career Companion, , McGraw Hill Education.2015
6. Malhotra, A.,Campus Placements, McGraw Hill Education.2015

1ST YEAR 2ND SEMESTER

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|---------------------------------|----------|----------|----------|--------------|----------------------|
| Course Title : Physics I | | | | | |
| Course Code : PHYS1001 | | | | | |
| Contact hrs per week: | L | T | P | Total | Credit Points |
| | 3 | 1 | 0 | 4 | 4 |

Course Outcomes:

1. To develop basic understanding of the modern science to the technology related domain.
2. Analytical & logical skill development through solving problems.
3. To impart idea of concise notation for presenting equations arising from mathematical formulation of physical as well as geometrical problems percolating ability of forming mental pictures of them.
4. Imparting the essence and developing the knowledge of controlling distant object like satellite, data transfer through optical fiber, implication of laser technology, handling materials in terms of their electrical and magnetic properties etc.
5. To understand how the systems under force field work giving their trajectories which is the basic of classical Field theory
6. To impart basic knowledge of the electric and magnetic behavior of materials to increase the understanding of how and why electronic devices work

Module 1 : Mechanics (7+5)= 12L

Elementary concepts of grad, divergence and curl. Potential energy function; $F = -\text{grad } V$, Equipotential surfaces and meaning of gradient; Conservative and non-conservative forces, Curl of a force field; Central forces ; conservation of angular momentum; Energy equation and energy diagrams; elliptical, parabolic and hyperbolic orbit; Kepler Problem; Application : Satellite manoeuvres .

Non-inertial frames of reference; rotating coordinate system; five term acceleration formula- centripetal and coriolis accelerations; applications: Weather system, Foucault pendulum.

Module 2: Optics =(4 +3+ 5) = 12L

Oscillatory Motion:

Damped harmonic motion – Over damped, critically damped and lightly damped oscillators; Forced oscillation and resonance. Electrical equivalent of mechanical oscillator, Wave equation, plane wave solution.

Optics:

Elementary features of polarization of light waves. Double refraction, Production and analysis of linearly, elliptic and Circularly polarized light, Polaroid and application of polarizations.: Polarimeter.

Laser & Fiber Optics:

Characteristics of Lasers, Spontaneous and Stimulated Emission of Radiation, Meta-stable State, Population Inversion, Lasing Action, Einstein's Coefficients and Relation between them, Ruby Laser, Helium-Neon Laser, Semiconductor Diode Laser, Applications of Lasers.

Fiber optics - principle of operation, numerical aperture, acceptance angle, Single mode , graded indexed fiber.

Module 3: Electrostatics (8+4) = 12

L L Electrostatics in free space

Calculation of electric field and electrostatic potential for a charge distribution, Divergence and curl of electrostatic

field, Laplace's and Poisson's equation for electrostatic potential. Boundary conditions of electric field and electrostatic potential. Method of images , energy of a charge distribution and its expression in terms of electric field.

Electrostatics in a linear dielectric medium

Electrostatic field and potential of a dipole, Bound charges due to electric polarization, Electric displacement, Boundary conditions on displacement, Solving simple electrostatic problem in presence of dielectric – point charge at the centre of a dielectric sphere, charge in front of dielectric slab, Dielectric slab and dielectric sphere in uniform electric field.

Module 4: (6+3+3) = 12L

Magnetostatics :

Biot-Savart law, divergence and curl of static magnetic field; vector potential and calculating it for a given magnetic field using Stokes' theorem; equation for vector potential and it's solutions for given current densities.

Magneto statics in a linear magnetic medium:

Magnetization and associated bound currents; Auxiliary magnetic field H ; boundary conditions on B and H . Solving for magnetic field due to simple magnet like a bar magnet; Magnetic susceptibility; ferromagnetic, paramagnetic and diamagnetic materials; Qualitative discussion of magnetic field in presence of magnetic materials.

Faraday's Law:

Differential form of Faraday's law expressing curl of electric field in terms of time derivative of magnetic field and calculating electric field due to changing magnetic fields in quasi static approximation. Energy stored in a magnetic field.

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|---|----------|----------|----------|--------------|----------------------|
| Course Title: Physics I Laboratory | | | | | |
| Course Code: PHYS1051 | | | | | |
| Contact hrs per week: | L | T | P | Total | Credit Points |
| | 0 | 0 | 3 | 3 | 1.5 |

Course Outcomes:

1. To gain practical knowledge by applying the experimental methods to correlate with the Physics theory.
2. To learn the usage of electrical and optical systems for various measurements.
3. Apply the analytical techniques and graphical analysis to the experimental data.
4. Understand measurement technology, usage of new instruments and real time applications in engineering studies.
5. To develop intellectual communication skills and discuss the basic principles of scientific concepts in a group.

Minimum of six experiments taking at least one from each of the following four groups:

Group 1 : Experiments in General Properties of matter

1. Determination of Young's modulus by Flexure Method
2. Determination of bending moment and shear force of a rectangular beam of uniform cross- section.
3. Determination of modulus of rigidity of the material of a rod by static method
4. Determination of rigidity modulus of the material of a wire by dynamic method.
5. Determination of coefficient of viscosity by Poiseulle's capillary flow method.

Group 2: Experiments in Optics

1. Determination of dispersive power of the material of a prism
2. Determination of wavelength of light by Newton's ring method.
3. Determination of wavelength of light by Fresnel's biprism method.
4. Determination of the wavelength of a given laser source by diffraction method

Group 3: Electricity & Magnetism experiments

1. Determination of dielectric constant of a given dielectric material.
2. Determination of resistance of ballistic galvanometer by half deflection method and study of variation of
3. logarithmic decrement with series resistance.
4. Determination of the thermo-electric power at a certain temperature of the given thermocouple.
5. Determination of specific charge (e/m) of electron.

Group 4: Quantum Physics Experiments

7. Determination of Planck's constant.
8. Determination of Stefan's radiation constant.
9. Verification of Bohr's atomic orbital theory through Frank-Hertz experiment.
10. Determination of Rydberg constant by studying Hydrogen/ Helium spectrum.
11. Determination of Hall co-efficient of semiconductors.
12. Determination of band gap of semiconductors.
13. To study current-voltage characteristics, load response, areal characteristics and spectral response of photo voltaic solar cells.

Books of reference:

1. Optics – Eugene Hecht Pearson Education India Private Limited
2. Introduction to Electrodynamics, David J. Griffiths, Pearson Education India Learning Private Limited
3. Waves and Oscillations by N.K. Bajaj
4. Principles of Physics, 10ed, David Halliday, Robert Resnick Jearl Walker , Wiley
5. Electricity, Magnetism, and Light, Wayne M. Saslow, Academic Press
6. Classical mechanics, Narayan Rana, Pramod Joag, McGraw Hill Education
7. Introduction to Classical Mechanics, R Takwale, P Puranik, McGraw Hill Education
8. Optics, Ghatak, McGraw Hill Education India Private Limited
9. Refresher Course in B.Sc. Physics – Vol1 and Vol 2 – C.L.Arora

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|-------------------------------------|----------|----------|----------|--------------|----------------------|
| Course Title: Mathematics II | | | | | |
| Course Code: MATH1201 | | | | | |
| Contact hrs per week: | L | T | P | Total | Credit Points |
| | 3 | 1 | 0 | 4 | 4 |

Course Outcomes

1. MATH1201. 1. Demonstrate the knowledge of probabilistic approaches to solve wide range of engineering problem.
2. MATH1201. 2. Recognize probability distribution for discrete and continuous variables to quantify physical and engineering phenomenon.
3. MATH1201. 3. Develop numerical techniques to obtain approximate solutions to mathematical problems where analytical solutions are not possible to evaluate.
4. MATH1201. 4. Analyze certain physical problems that can be transformed in terms of graphs and trees and solving problems involving searching, sorting and such other algorithms.
5. MATH1201. 5. Apply techniques of Laplace Transform and its inverse in various advanced engineering problems.
6. MATH1201. 6. Interpret differential equations and reduce them to mere algebraic equations using Laplace Transform to solve easily.

The objective of this course is to familiarize the students with numerical techniques, integral transforms, graph theory and probability. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling various problems in the discipline.

Module-I Fundamentals of Probability [10L]

Random experiment, Sample space and events

Classical and Axiomatic definition of probability

Addition and Multiplication law of probability

Conditional probability

Bayes' Theorem

Random variables

General discussion on discrete and continuous distributions

Expectation and Variance

Examples of special distribution: Binomial and Normal Distribution

Module-II Numerical Methods [10L]

Solution of non-linear algebraic and transcendental equations: Bisection Method, Newton-Raphson Method, Regula-Falsi Method.

Solution of linear system of equations: Gauss elimination method, Gauss-Seidel Method, LU Factorization Method, Matrix Inversion Method.

Solution of Ordinary differential equations: Euler's and Modified Euler's Method , Runge-Kutta Method of

4th order.

Module-III Basic Graph Theory [10L]

Graphs: Digraphs, Weighted graph, Connected and disconnected graphs, Complement of a graph, Regular graph, Complete graph, Subgraph

Walks, Paths, Circuits, Euler Graph, Cut sets and cut vertices

Matrix representation of a graph, Adjacency and incidence matrices of a graph

Graph isomorphism

Bipartite graph

Definition and properties of a tree

Binary tree, Spanning tree of a graph, Minimal spanning tree, properties of trees

Algorithms: Dijkstra's Algorithm for shortest path problem, Determination of minimal spanning tree using DFS, BFS, Kruskal's and Prim's algorithms

Module-IV Laplace Transformation [10L]

Basic ideas of improper integrals, working knowledge of Beta and Gamma functions (convergence to be assumed) and their interrelations.

Introduction to integral transformation

Functions of exponential order, Definition and existence of Laplace Transform(LT) (statement of initial and final value theorem only)

LT of elementary functions, Properties of Laplace Transformations , Evaluation of sine , cosine and exponential integrals using LT

LT of periodic and step functions

Definition and properties of inverse LT

Convolution Theorem (statement only) and its application to the evaluation of inverse LT

Solution of linear ODEs with constant coefficients (initial value problem) using LT

Suggested Books:

1. Advanced Engineering Mathematics , E.Kreyszig, Wiley Publications
2. Introduction to Probability and Statistics for Engineers and Scientists, S.Ross, Elsevier
3. Introductory methods of Numerical Analysis, S.S. Sastry, PHI learning
4. Introduction to Graph Theory, D. B. West, Prentice-Hall of India
5. Engineering Mathematics, B.S. Grewal, S. Chand & Co.

| | | | | | |
|--|----------|----------|----------|---------------|----------------------|
| Course Title: Programming for Problem Solving | | | | | |
| Course Code: CSEN1001 | | | | | |
| Contact Hours per week | L | T | P | Tot al | Credit Points |
| | 3 | 0 | 0 | 3 | 3 |

Course outcome:

1. CO 1: Understand and remember functions of the different parts of a computer.
2. CO 2: Understand and remember how a high-level language (C programming language, in this course) works, different stages a program goes through.
3. CO 3: Understand and remember syntax and semantics of a high-level language (C programming language, in this course).
4. CO 4: Understand how code can be optimized in high-level languages.
5. CO 5: Apply high-level language to automate the solution to a problem.
6. CO 6: Apply high-level language to implement different solutions for the same problem and analyze why one solution is better than the other.

Learning Objectives: Introduction to the concept of computer and computation and solving of problems using C as a programming language. Coverage of C will include basic concepts, arithmetic and logic, flow control, and data handling using arrays, structures, pointers and files.

Total load – 40 hours

Module I: [10L] Fundamentals of Computer

History of Computers, Generations of Computers, Classification of Computers.

Basic Anatomy of Computer System, Primary & Secondary Memory, Processing Unit, Input & Output devices. Basic Concepts of Assembly language, High level language, Compiler and Assembler.

Binary & Allied number systems (decimal, octal and hexadecimal) with signed and unsigned numbers (using 1's and 2's complement) - their representation, conversion and arithmetic operations. Packed and unpacked BCD system, ASCII. IEEE-754 floating point representation (half- 16 bit, full- 32 bit, double- 64 bit).

Basic concepts of operating systems like MS WINDOWS, LINUX How to write algorithms & draw flow charts.

Module II: [10L] Basic Concepts of C

C Fundamentals:

The C character set identifiers and keywords, data type & sizes, variable names, declaration, statements. Operators & Expressions:

Arithmetic operators, relational and logical operators, type, conversion, increment and decrement operators, bit wise operators, assignment operators and expressions, precedence and order of evaluation. Standard input and output, formatted output -- printf, formatted input scanf.

Flow of Control:

Statement and blocks, if-else, switch-case, loops (while, for, do-while), break and continue, go to and labels.

Module III: [10L]

Program Structures in C

Basic of functions, function prototypes, functions returning values, functions not returning values. Storage classes -

auto, external, static and register variables – comparison between them. Scope, longevity and visibility of variables. C preprocessor (macro, header files), command line arguments.

Arrays and Pointers:

One dimensional arrays, pointers and functions – call by value and call by reference, array of arrays. Dynamic memory usage– using malloc(), calloc(), free(), realloc(). Array pointer duality.

String and character arrays; C library string functions and their use.

Module IV: [10L]

Data Handling in C

User defined data types and files:

Basic of structures; structures and functions; arrays of structures.

Files – text files only, modes of operation. File related functions – fopen(), fclose(), fscanf(), fprintf(), fgets(), fputs(), fseek(), ftell();

Text Books

1. Schaum's outline of Programming with C – Byron Gottfried
2. Teach Yourself C- Herbert Schildt
3. Programming in ANSI C – E Balagurusamy

Reference Books

1. C: The Complete Reference – Herbert Schildt
2. The C Programming Language- D.M.Ritchie, B.W. Kernighan

| | | | | | |
|--|----------|----------|----------|--------------|----------------------|
| Course Title: Programming for Problem Solving Lab | | | | | |
| Course Code: CSEN1051 | | | | | |
| Contact hrs per week: | L | T | P | Total | Credit Points |
| | 0 | 0 | 4 | 4 | 2 |

Course Outcomes:

After completion of this course the students should be able:

1. To write simple programs relating to arithmetic and logical problems.
2. To be able to interpret, understand and debug syntax errors reported by the compiler.
3. To implement conditional branching, iteration (loops) and recursion.
4. To decompose a problem into modules (functions) and amalgamating the modules to generate a complete program.
5. To use arrays, pointers and structures effectively in writing programs.
6. To be able to create, read from and write into simple text files.

Software to be used: GNU C Compiler (GCC) with LINUX NB: Cygwin (Windows based) may be used in place of LINUX

Topic 1: LINUX commands and LINUX based editors

Topic 2: Basic Problem Solving

Topic 3: Control Statements (if, if-else, if-elseif-else, switch-case)

Topic 4: Loops - Part I (for, while, do-while)

Topic 5: Loops - Part II

Topic 6: One Dimensional Array

Topic 7: Array of Arrays

Topic 8: Character Arrays/ Strings Topic

9: Basics of C Functions

Topic 10: Recursive Functions

Topic 11: Pointers

Topic 12: Structures

Topic 13: File Handling

Text Books

1. Schaum's outline of Programming with C – Byron Gottfried
2. Teach Yourself C- Herbert Schildt
3. Programming in ANSI C – E Balagurusamy

| | | | | | |
|---------------------------------------|---|---|---|-------|---------------|
| Course Title: Business English | | | | | |
| Course Code: HMTS1202 | | | | | |
| Contact hrs per week: | L | T | P | Total | Credit Points |
| | 2 | 0 | 0 | 2 | 2 |

Course Outcomes:

The learner will

1. Acquire competence in using English language to communicate.
2. Be aware of the four essential skills of language usage-listening, speaking, reading and writing.
3. Be adept at using various modes of written communication at work.
4. Attain the skills to face formal interview sessions.
5. Write reports according to various specifications.
6. Acquire the skill to express with brevity and clarity.

Module- I [6hrs.]

Grammar (Identifying Common Errors in Writing)

Subject-verb agreement

Noun-pronoun agreement

Misplaced Modifiers

Articles

Prepositions

Redundancies

Module- II [6hrs.]

Basic Writing Strategies Sentence Structures

Use of phrases and clauses in sentences

Creating coherence

Organizing principles –accuracy, clarity, brevity

Techniques for writing precisely

Different styles of writing: descriptive, narrative, expository

Importance of proper punctuation

Module- III (8hrs)

Business Communication- Scope & Importance

Writing Formal Business Letters: Form and Structure-Parts of a Business letter, Business Letter Formats, Style and Tone, Writing strategies.

Organizational Communication: Agenda & minutes of a meeting, Notice, Memo, Circular Organizing e-mail messages, E-mail etiquette

Job Application Letter: Responding to Advertisements and Forced Applications, Qualities of well-written

Application Letters: The You-Attitude, Length, Knowledge of Job Requirement, Reader-Benefit Information, Organization, Style, Mechanics – Letter Plan: Opening Section, Middle Section, Closing Section

Resume and CV: Difference, Content of the Resume – Formulating Career Plans: Self Analysis, Career Analysis, Job Analysis, Matching Personal Needs with Job Profile – Planning your Resume – Structuring the Resume: Chronological Resume, The Functional Resume, Combination of Chronological and Functional Resume, Content of the Resume: Heading, Career Goal or Objectives, Education, Work Experience, Summary of Job Skills/Key Qualifications, Activities, Honors and Achievements, Personal Profile, Special Interests, References

Module- IV [6hrs]

Writing skills

Comprehension: Identifying the central idea, inferring the lexical and contextual meaning, comprehension passage - practice

Paragraph Writing: Structure of a paragraph, Construction of a paragraph, Features of a paragraph, Writing techniques/developing a paragraph.

Précis: The Art of Condensation-some working principles and strategies. Practice sessions of writing précis of given passages.

Essay Writing: Characteristic features of an Essay, Stages in Essay writing, Components comprising an Essay, Types of Essays-Argumentative Essay, Analytical Essay, Descriptive Essays, Expository Essays, Reflective Essays

References:

1. Theories of Communication: A Short Introduction, Armand Matterlart and Michele Matterlart, Sage Publications Ltd.
2. Professional Writing Skills, Chan, Janis Fisher and Diane Lutovich. San Anselmo, CA: Advanced Communication Designs.
3. Hauppauge, Geffner, Andrew P. Business English, New York: Barron's Educational Series.
4. Kalia, S. & Agarwal, S. Business Communication, Wiley India Pvt. Ltd., New Delhi, 2015
5. Mukherjee, H.S., Business Communication- Connecting at work., , Oxford University Press.2nd Edition.2015
6. Raman, M. and Sharma, S., Technical Communication: Principles and Practice, 2nd Ed., 2011.

| | | | | | |
|--|---------------|---------------|---------------|-------------------|---------------------------|
| Course Title: Language Laboratory | | | | | |
| Course Code: HMTS1252 | | | | | |
| Contact hrs per week: | L 3 | T 1 | P 0 | Total 4 | Credit Points 4 |

Course Outcomes:

The learner will

1. Acquire the techniques to become an effective listener.
2. Acquire the skill to become an effortless speaker.
3. Organize and present information for specific audience.
4. Communicate to make a positive impact in professional and personal environment.
5. Engage in research and prepare authentic, formal, official documents.
6. Acquire reading skills for specific purpose.

Module- I (4hrs)

Listening Skills

1. Principles of Listening: Characteristics, Stages.
2. Types of Listening: Passive listening, Marginal or superficial listening, Projective Listening, Sensitive or Empathetic Listening, Active or Attentive listening.
3. Guidelines for Effective Listening
4. Barriers to Effective Listening
5. Listening Comprehension

Module- II [8hrs]

Interviewing

1. Types of Interviews, Format for Job Interviews: One-to-one and Panel Interviews, Telephonic Interviews, Interview through video conferencing.
2. Interview Preparation Techniques, Frequently Asked Questions, Answering Strategies, Dress Code, Etiquette, Questions for the Interviewer, Simulated Interviews.

Module- III [6hrs]

1. Public Speaking: The Speech Process: The Message, The Audience, The Speech Style, Encoding, Feedback.
2. Characteristics of a good speech : content and delivery, structure of a speech
3. Modes of delivery in public speaking: Impromptu, Extemporaneous, Prepared or Memorized, Manuscript.
4. Conversation: Types of conversation: formal and informal, Strategies for effective conversation, Improving fluency.
5. Situational conversation practice: Greetings and making introductions, Asking for information and giving instructions, agreeing and disagreeing.
6. Conversational skills in the business scenario: One-to-one and Group communication, Gender and Culture

7. Sensitivity, Etiquette, Sample Business Conversation, Telephonic Conversation

Module- IV [8hrs]

Presentation Skills

1. Speaking from a Manuscript, Speaking from Memory, Impromptu Delivery, Extemporaneous Delivery, Analyzing the Audience, Nonverbal Dimensions of Presentation
2. Organizing the Presentation: The Message Statement, Organizing the Presentation: Organizing the Speech to Inform, The Conclusion, Supporting Your Ideas – Visual Aids: Designing and Presenting Visual Aids, Selecting the Right Medium.
3. Project Team/Group Presentations

References:

1. Carter, R. And Nunan, D. (Eds), The Cambridge guide to Teaching English to Speakers of Other Languages, CUP, 2001
2. Edward P. Bailey, Writing and Speaking At Work: A Practical Guide for Business Communication, Prentice
3. Hall, 3rd Ed., 2004
4. Munter, M., Guide to Managerial Communication: Effective Business Writing and Speaking, Prentice Hall, 5th Ed., 1999
5. Sen, S., Mahendra, A. & Patnaik, P., Communication and Language Skills, Cambridge University Press, 2015
6. Locker, Kitty O. Business and Administrative Communication McGraw-Hill/ Irwin.
7. Chaney, L. and Martin, J., Intercultural Business Communication. Prentice Hall

| | | | | | |
|---|----------|----------|----------|--------------|----------------------|
| Course Title : Workshop /Manufacturing Practices | | | | | |
| Course Code : MECH1051 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 1 | 0 | 4 | 5 | 3 |

Course Outcomes:

Upon completion of this course

1. The students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.
2. The students will be able to fabricate components with their own hands.
3. They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
4. By assembling different components, they will be able to produce small devices of their interest.
5. The students will be able to describe different components and processes of machine tools.
6. The students will be able to apply the knowledge of welding technology and they can perform arc and gas welding to join the material.

(i) Lectures & videos: (13 hours) detailed contents

1. Introduction on Workshop and Safety Precautions. (1 lecture)
2. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing
3. methods (3 lectures)
4. CNC machining, Additive manufacturing (1 lecture)
5. Fitting operations & power tools (1 lecture)
6. Electrical & Electronics (1 lecture)
7. Carpentry (1 lecture)
8. Plastic moulding, glass cutting (1 lecture)
9. Metal casting (1 lecture)
10. Welding (arc welding & gas welding), brazing (2 lecture)
11. Viva-voce (1 lecture)

(ii) Workshop Practice :(52 hours)[L : 0; T:0 ; P : 4 (2 credits)]

1. Machine shop (12 hours)
2. Fitting shop (8 hours)
3. Carpentry (4 hours)
4. Electrical & Electronics (4 hours)
5. Welding shop (Arc welding 4 hrs + gas welding 4 hrs) (8 hours)

6. Casting (4 hours)
7. Smithy (4 hours)
8. Plastic moulding& Glass Cutting (4 hours)
9. Sheet metal Shop (4 hours)

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Suggested Text/Reference Books:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., “Elements of Workshop Technology”, Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. And Steven S. Schmid, “Manufacturing Engineering and Technology”, 4th edition, Pearson Education India Edition, 2002.
3. Gowri P. Hariharan and A. Suresh Babu, ”Manufacturing Technology – I” Pearson Education, 2008.
4. Roy A. Lindberg, “Processes and Materials of Manufacture”, 4th edition, Prentice Hall India, 1998.
5. Rao P.N., “Manufacturing Technology”, Vol. I and Vol. II, Tata McGrawHill House, 2017.

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|---|----------|----------|----------|--------------|----------------------|
| Course Title : Basic Electronics | | | | | |
| Course Code : ECEN1011 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 3 | 0 | 0 | 3 | 3 |

Course Outcomes:

After going through this course, the students will be able to

1. Categorize different semiconductor materials based on their energy bands and analyze the characteristics of those materials for different doping concentrations based on previous knowledge on semiconductors acquired.
2. Describe energy band of P-N Junction devices and solve problems related to P-N Junction Diode both from device and circuit perspectives.
3. Design different application specific circuits associated with diodes operating both in forward and reverse bias.
4. Analyze various biasing configurations of Bipolar Junction Transistor and categorize different biasing circuits based on stability.
5. Categorize different field-effect transistors based on their constructions, physics and working principles and solve problems associated with analog circuits based on operational amplifiers.
6. Design and implement various practical purpose electronic circuits and systems meant for both special purpose and general purpose and analyze their performance depending on the type of required output and subsequently the applied input.

Module I [10 L]

Basic Semiconductor Physics:

Crystalline materials, Energy band theory, Conductors, Semiconductors and Insulators, Concept of Fermi Energy level, intrinsic and extrinsic semiconductors, drift and diffusion currents in semiconductor

Diodes and Diode Circuits:

Formation of p-n junction, Energy Band diagram, forward & reverse biased configurations, V-I characteristics, load line, breakdown mechanisms, Zener Diode and its Application.

Rectifier circuits: half wave & full wave rectifiers: ripple factor, rectification efficiency.

Module II [8 L]

Bipolar Junction Transistors (BJT):

PNP & NPN BJT structures, current components in BJT, CE, CB, CC configurations, V-I Characteristics of CB & CE modes, regions of operation, Base width modulation & Early effect, thermal runaway, Concept of Biasing: DC load line, Q-point, basics of BJT amplifier operation, current amplification factors, different biasing circuits: fixed bias, collector to base bias, voltage divider bias.

Module III [9 L]

Field Effect Transistors (FET):

N-channel Junction Field Effect Transistor (JFET) structure & V-I characteristics.

Metal Oxide Semiconductor Field Effect Transistor (MOSFET): enhancement & depletion type MOSFETs (for both n & p channel devices), drain & transfer characteristics.

MOSFET as a digital switch, CMOS inverter, voltage transfer characteristic (VTC), NAND & NOR gate realization using CMOS logic.

Moore's Law, evolution of process node, state of integration (SSI, MSI, LSI, VLSI, ULSI), Classification of Integrated circuits (IC) and their applications.

Module IV [9 L]

Feedback in amplifiers:

Concept of feedback, advantages of negative feedback (qualitative), Barkhausen criteria.

Operational Amplifier:

Ideal OPAMP characteristics, OPAMP circuits: inverting and non-inverting amplifiers, Adder, Subtractor, Integrator, Differentiator, Basic Comparator.

Special Semiconductor Devices:

Light Emitting Diode (LED), Silicon Controlled Rectifier (SCR), Photodiode: Operations, characteristics & applications.

References:

1. Boylestad & Nashelsky: Electronic Devices & Circuit Theory
2. R.A Gayakwad: Op Amps and Linear IC's, PHI
3. D. Chattopadhyay, P. C Rakshit : Electronics Fundamentals and Applications
4. Adel S. Sedra, Kenneth Carless Smith: Microelectronics Engineering
5. Millman & Halkias: Integrated Electronics.
6. Salivahanan: Electronics Devices & Circuits.
7. Albert Paul Malvino: Electronic Principle.

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|--|----------|----------|----------|--------------|----------------------|
| Course Title : Basic Electronics Laboratory | | | | | |
| Course Code : ECEN1061 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 0 | 0 | 2 | 2 | 1 |

Course Outcomes:

1. The students will correlate theory with diode behavior.
2. They will design and check rectifier operation with regulation etc.
3. Students will design different modes with BJT and FET and check the operations.
4. They will design and study adder, integrator etc. with OP-AMPs.

List of Experiments

1. Familiarization with passive and active electronic components such as Resistors, Inductors, Capacitors, Diodes, Transistors (BJT) and electronic equipment like DC power supplies, multi-meters etc.
2. Familiarization with measuring and testing equipment like CRO, Signal generators etc.
3. Study of I-V characteristics of Junction diodes.
4. Study of I-V characteristics of Zener diodes.
5. Study of Half and Full wave rectifiers with Regulation and Ripple factors.
6. Study of I-V characteristics of BJTs in CB mode
7. Study of I-V characteristics of BJTs in CE mode
8. Study of I-V characteristics of Field Effect Transistors.
9. Determination of input-offset voltage, input bias current and Slew rate of OPAMPs.
10. Determination of Common-mode Rejection ratio, Bandwidth and Off-set null of OPAMPs.
11. Study of OPAMP circuits: Inverting and Non-inverting amplifiers, Adders, Integrators and Differentiators.

2nd. YEAR, 1st SEMESTER

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|--------------------------------------|----------|----------|----------|--------------|----------------------|
| Course Name : Analog Circuits | | | | | |
| Course Code : ECEN2101 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 3 | 0 | 0 | 3 | 3 |

COs:

After going through this course, the students will be able to

1. Apply the previous knowledge gathered from Basic Electrical and Basic Electronics papers.
2. Understand the concepts of BJT, MOSFET and biasing techniques of BJT and MOSFET based amplifier circuits.
3. Analyze frequency response of amplifier circuits.
4. Design different types sinusoidal oscillators and multivibrator circuits.
5. Construct algebraic equations based amplifier and analog computers using OP-AMP
6. Design stable high-gain amplifier circuits.

MODULE 1: Analog Signals and Devices [9L]

Basic concepts and device biasing [5L]:

Analog, discrete and digital signals. Diode: piecewise-linear model, clipping and clamping operation. BJT biasing circuits, Q-point and stability.

Small Signal analysis of Amplifiers [4L]:

Small signal (h-parameter and r_e model) analysis of BJT CE mode amplifier circuit (derive input impedance, output impedance, voltage gain, current gain for the amplifiers).

MODULE 2: Oscillators and Frequency Responses of Amplifiers [9L]

Frequency Responses of Amplifiers [2L]:

Frequency response of CE mode RC-coupled amplifier; effect of external and parasitic capacitors on cut-off frequencies.

Feedback & Oscillator Circuits [7L]:

Concept of feedback, Effects of negative feedback in amplifiers, Oscillators circuits: Phase-shift, Wien-Bridge, Hartley, Colpitt and crystal Oscillators.

MODULE 3: Operational Amplifiers (OPAMPs) [7L]

Fundamentals of OPAMP [4L]:

Basic building blocks of OPAMP: Differential Amplifiers, Current source and current mirror circuits. Types of differential amplifiers, AC and DC analysis of differential amplifiers; Characteristics of an ideal OPAMP.

Applications of OPAMP [3L]:

Inverting and non-inverting OPAMP amplifiers, Log-antilog amplifiers, Instrumentation amplifier, Precision rectifiers, basic comparator, Schmitt Trigger.

MODULE 4: Analog Circuit Applications [7L]

Power Amplifiers [4L]:

Concepts and operations of Class A, B and AB amplifiers; Calculation of DC power, AC power and efficiency of these amplifiers.

Applications Analog IC [3L]:

Description of 555 Timer IC, astable and mono-stable operations using 555. Study of 78XX and 79XX voltage regulator ICs.

Books:

1. Microelectronic Circuits by Adel S. Sedra, Kenneth C. Smith
2. Electronics Devices and Circuits by Robert L. Boylestad, Louis Nashelskey
3. Fundamentals of Microelectronics by Behzad Razavi
4. Integrated electronics by Jacob Millman, Christos C. Halkias

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|---|----------|----------|----------|--------------|----------------------|
| Course Name : Analog Circuits Laboratory | | | | | |
| Course Code : ECEN2151 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 0 | 0 | 2 | 2 | 1 |

Course Outcomes:

The students, after finishing the course, will be able to:

1. Study and compare frequency responses of amplifiers.
2. Design different timer circuits with 555 IC.
3. Design rectifiers and measure rectifier parameters.
4. Generate various waveforms using OP AMPs.

List of experiments:

Experiments using discrete components

1. Study of frequency response of RC coupled amplifier circuit.
2. Study of astable multi-vibrator using 555 timer IC.
3. Study of monostable multi-vibrator using 555 timer IC.
4. Study of full wave and half wave precision rectifier circuits.
5. Study of Wien-Bridge oscillator circuit.
6. Study of Phase Shift oscillator circuit.
7. Study of astable multi-vibrator using OPAMP.
8. Study of Triangular wave generator circuit using OPAMP.
9. Study of Schmitt trigger circuit.
10. Study of fixed voltage regulator circuits using 78XX and 79XX ICs.

Experiments using ASLKv2010 Starter Kit

11. Negative feedback amplifiers and instrumentation amplifiers to measure parameters like time response, frequency response, DC transfer characteristics,
12. Study of analog filters like LPF, HPF, BPF and BSF
13. Study of VCO and PLL
14. Automatic gain / volume control (AGC/AVC)
15. PC based Oscilloscope

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|---|----------|----------|----------|--------------|----------------------|
| Course Name : Circuit and Network Theory | | | | | |
| Course Code : ECEN2102 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 3 | 0 | 0 | 3 | 3 |

COURSE OUTCOMES

1. Apply the previous knowledge gathered from Basic Electrical Engineering for understanding the basic concepts of this subject.
2. Solve problems in various electric circuits using Network Theorems.
3. Analyze complex circuits in Laplace domain.
4. Understand the application of Graph theory to solve various network behaviour.
5. Evaluate the output of various Two port network without going through the detailed configuration.
6. Design various types of filters using SPICE software.

Module-I

Network equations: Concepts of voltage source and current source, Formulation of Node & Mesh equations. Loop and node variable analysis of transformed circuits. Network Theorems: Thevenin's, Norton's, Superposition, Maximum Power Transfer Theorem, Reciprocity theorem applied to circuits containing dependent sources. [5L]

Resonant Circuits: Series and Parallel resonance, Impedance and Admittance Characteristics, Quality Factor, Half Power Points, Bandwidth, Phasor diagrams. [4L]

Coupled Circuits: Coefficient of coupling, Dot convention, Analysis of coupled circuits. [2L]

Module-II [8 L]

Laplace Transform: Concept of complex frequency. Properties of Laplace transform linearity, differentiation, integration, initial value theorem and final value theorem. Transform of standard periodic and non-periodic waveforms. Circuit elements and their transformed equivalents, Independent and dependent sources and equivalence of sources, treatment of mutual couplings in t & s domain. Transient and steady state response of RL, RC, LC and RLC with or without stored energy. Concept of natural frequency and damping. Sketching transient response, determination of time domain specifications. Concept of Convolution theorem and its application. [8L]

Module-III [9L]

Graph theory: Graph of network: Concept of path, tree, tree branch, tree link, loop, tie set and cut set. Incidence Matrix, tie-set Matrix and f-cut set matrix and their properties. Loop currents and node-pair potentials, formulation of loop and node equilibrium equations in view of graph theory. [4L]

Two port networks: Open circuit Impedance & Short circuit Admittance parameter, Transmission parameters, Hybrid parameters and inverse hybrid parameters. Inter relation between parameters. Inter connection between two port networks. Driving point & transfer impedance & admittance. [5L]

Module-IV [8L]

Filter Circuits: Concept of filters, Classification of filters. Analysis and synthesis of Active Low pass, High pass, Band pass and Band reject filters using operational amplifier. Filter approximations: Butterworth, Chebyshev filters. [5L]

SPICE: Structure of a SPICE program, active and passive device/element statements, different study like DC analysis, transient analysis and ac analysis statement in SPICE. Plotting and printing statement, input and output Impedance calculation using SPICE, voltage and current controlled components in SPICE. [3L]

Total: 36L

Text Books:

1. Networks and Systems, D. Roy Chowdhury, New Age International Publishers
2. Circuit theory, Dr. Abhijit Chakrabarty, Dhanpat Rai & Co Pvt. Ltd.
3. Network Analysis, M.E. Valkenburg, Pearson Education .
4. Fundamental of Electric circuit theory, D. Chattopadhyay& P.C. Rakshit, S. Chand.

Reference Books:

1. Engineering Circuit Analysis, W.H. Hyat, J.E. Kemmerly& S.M. Durbin, The Mc Graw Hill Company.
2. Modern Network Analysis, F.M.Reza&S.Seely, McGraw Hill.

| | | | | | |
|--|----------|----------|----------|--------------|----------------------|
| Course Name : Circuit and Network Theory Laboratory | | | | | |
| Course Code :ECEN2152 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 0 | 0 | 3 | 3 | 1.5 |

Course Outcomes:

1. The students will be able to apply MATLAB/OCTAVE for circuit analysis.
2. They will derive transfer functions of electrical networks.
3. The students will analyze two port network
4. They will be able to design different filters.

List of Experiments:

1. Determination of Laplace transform and Inverse Laplace transform of different using MATLAB/OCTAVE.
2. Generation of Periodic, Exponential, Sinusoidal, Damped Sinusoidal, Step, Impulse, Ramp signal using MATLAB/OCTAVE in both discrete and analog form;
3. Representation of Poles and Zeros in s-plane, determination of partial fraction expansion in s-domain and cascade connection of second-order systems using MATLAB/OCTAVE
4. Find out the transfer function of an electrical Network containing RL, RC & RLC and find out pole-zero
5. Transient response of R-L and R-C network using SPICE
6. Transient response of R-L and R-C network using hardware components
7. Transient response of R-L-C series and parallel circuit using SPICE and hardware Verification
8. Verification of Network theorems (Reciprocity, Compensation theorem) using SPICE software
9. Determination of Impedance (Z), Admittance (Y) and Transmission (I) parameter of a two port network using SPICE or circuit maker.
10. Determination of Impedance (Z), Admittance (Y) and Transmission (I) parameter of a two port network using hardware.
11. Design of Butterworth Low Pass and High Pass filters: Simulation / Hardware.
12. Design of Band Pass and Band Reject filters using Butterworth Low Pass and High Pass filters: Simulation/Hardware.

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|--|----------|----------|----------|--------------|---------------------|
| Course Name : Signals And Systems | | | | | |
| Course Code : ECEN2103 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Point |
| | 3 | 0 | 0 | 3 | 3 |

Course Outcomes:

1. Students should be able to apply the previous knowledge of mathematics on differential calculus.
2. Students should be able to categorize and identify the different types of signals and systems.
3. Student should be able to analyze the frequency domain characteristics of signals using Fourier series, Fourier transforms, Laplace Transform, Z- Transform.
4. Students should be able to implement and extends the concepts of transformation tools to design of communication systems and filters.
5. Students should be able to analyze random signals and its properties, hence extending the concept towards in communications systems.
6. Students should be able to evaluate the response different systems with the applications of different mathematical tools.

Module No-1: Introduction to Signal and Systems: [8 L]

Classification of Signals: Discrete and continuous signal, Periodic aperiodic, even – odd, energy and power signals, deterministic and random signals, complex exponential and sinusoidal signals, periodicity, unit impulse, unit step, transformation of independent variable of signals, time scaling, time shifting.

Properties of Systems: Linearity, Causality, time invariance and stability. Dirichlet's conditions, Distortion-less systems, Invertible systems, Frequency response of LTI system-continuous and discrete system.

Module No-2: Analysis of continuous time signals: [8 L]

Convolution in continuous time, Correlation of continuous –time signals, Continuous time Fourier Series, Fourier transformation of continuous time signals and their properties.

Laplace transformation: analysis and characterization of LTI systems with examples and properties. Computation of impulse response and transfer function using Laplace transform, Analysis of basic electrical circuits using Laplace Transform, Parseval's theorem.

Module No-3: Analysis of discrete time signals: [10L]

Convolution in discrete time, Correlation of discrete time signals, Discrete time Fourier Series, Fourier transformation of discrete time signals and their properties.

Z-transform for discrete time signals, Region of convergence, System functions, Poles and zeros of system, analysis and characterization of LTI systems with examples and properties using z- transform , Computation of impulse response and transfer function using z-transform.

Module No-4: Application of Signals and Systems theory: [10 L]

4.1 Sampling Theorem, Types of sampling, Aliasing, Pre-alias filter, Reconstruction of a signal from its samples, Modulation for communication, Sampling of Band-pass signals, Filtering

4.2. **Random process and noise:** Random variable, random process, ensemble, sample function, time average, ensemble average, stationary and ergodic process, correlation between two random variables. Definitions-distribution & density function, mean values & moments, function of two random variables, spectral densities, response of LTI system to random inputs, Noise sources in circuits, noise in communication circuits and systems, noise voltage.

Text Books:

1. A.V.Oppenheim, A.S.Willsky and S.H.Nawab -Signals &Systems, Pearson
2. B.P.Lathi- Signal Processing & Linear Systems- Oxford
3. P.Ramesh Babu & R.Anandanatarajan- Signals and Systems 4/e- Scitech
4. Sanjay Sharma-Signals and Systems, Kataria Publication

References:

1. J.G. Proakis & D.G. Manolakis- Digital Signal Processing Principles, Algorithms and Applications,.
2. A.Nagoor Kani- Signals and Systems- McGraw Hill
3. S.Haykin & B.V.Veen, Signals and Systems- John Wiley
4. S.Haykin, Digital Communication- John Wiley
5. Digital signal Processing by S.K. Mitra-Tata McGraw Hill

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|---|----------|----------|----------|-------------------|--------------------------|
| Course Name : Signals And Systems Laboratory | | | | | |
| Course Code : ECEN2153 | | | | | |
| Contact Hours per week | L | T | P | Tot al | Credit Points |
| | 0 | 0 | 2 | 2 | 1 |

Course Outcomes:

1. The students after the course will learn to study signal synthesis using SA.
2. They will understand convolution of two signals.
3. The students will learn Fourier and Laplace transforms and applications.
4. They will be able to measure filter response.

Hardware Experiments:-

1. To Study Signal Synthesis via sum of harmonics using spectrum analyzer.
2. Study of sampling theorem.

Software Experiments:-

5. To study the generation of different type of continuous and discrete signals.
6. To study the different operation of signals.
7. To study convolution theorem in time and frequency domain.
8. To study the autocorrelation and crosscorrelation of signal.
9. To study the Fourier transform and Laplace transform.
10. Magnitude and phase response of the filters.

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|---|----------|----------|----------|--------------|----------------------|
| Course Name : Mathematical Methods | | | | | |
| Course Code : MATH2001 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 3 | 1 | 0 | 4 | 4 |

COs:

1. MATH2001.1 Construct appropriate mathematical models of physical systems.
2. MATH2001.2 Recognize the concepts of complex integration, Poles and Residuals in the stability analysis of engineering problems.
3. MATH2001.3 Generate the complex exponential Fourier series of a function and make out how the complex Fourier coefficients are related to the Fourier cosine and sine coefficients.
4. MATH2001.4 Interpret the nature of a physical phenomenon when the domain is shifted by Fourier Transform e.g. continuous time signals and systems.
5. MATH2001.5 Develop computational understanding of second order differential equations with analytic coefficients along with Bessel and Legendre differential equations with their corresponding recurrence relations.
6. MATH2001.6 Master how partial differentials equations can serve as models for physical processes such as vibrations, heat transfer etc.

MODULE I : [12L]

Functions of Complex Variables:

Complex numbers and its geometrical representation.

Functions of a complex variable – Limits, Continuity and Differentiability.

Analytic Functions, Cauchy- Riemann equations, Necessary and sufficient conditions for analyticity of complex functions (Statement only), Harmonic functions.

Line Integral on complex plane, Cauchy-Goursattheorem, Cauchy's Integral Formula. Taylor's and Laurent's series expansion.

Zeros, Different types of Singularities. Definitions of poles and residues, Residue Theorem, Evaluation of real integrals using residue theorem.

MODULE II : [12L]

Fourier series, Integrals and Transforms:

Definite Integral, Orthogonality Of Trigonometric Functions, Power Series And Its Convergence.

Periodic Functions , Even And Odd Functions , Dirichlet's Conditions , Euler Formulas For Fourier Coefficients , Fourier Series Representation Of A Function, E.G. Periodic Square Wave, Half Wave Rectifier, Unit Step Function.

Half Range Series, Parseval's Identity.

Fourier Integral Theorem, Fourier Transform, Fourier Sine And Cosine Transform, Linearity, Scaling, Frequency Shifting And Time Shifting Properties, Convolution Theorem.

Discussion Of Some Physical Problems: E.G Forced Oscillations.

MODULE III: [12L]

Series Solutions to Ordinary Differential Equations and Special Functions:

Series solution of ODE: Ordinary point, Singular point and Regular Singular point, series Solution when $x = a$ is an

$$x = a$$

ordinary point, Fresenius method.

Legendre's Equation, Legendre's polynomials and its graphical representation. Bessel's equation, Bessel's function of first kind and its graphical representation. Finite Difference Method and its application to Boundary Value Problem.

MODULE IV : [12L]

Partial Differential Equations:

Introduction to partial differential equations, Formation of partial differential equations, Linear and Nonlinear pde of first order, Lagrange's and Charpit's method of solution.

Second order partial differential equations with constant coefficients, Illustration of wave equation, one dimensional heat equation, Laplace's equation, Boundary value problems and their solution by the method of separation of variables.

Solution of Boundary value problems by Laplace and Fourier transforms.

Suggested Books:

1. Complex Variables and Applications Brown Churchill MC GrawHill
2. Complex Variable Murrey R. Spiegel Schaum's Outline Series
3. Theory of Functions of a Complex Variable Shanti Narayan, P. K. Mittal S. Chand
4. Integral Transforms for Engineers and Applied Mathematicians Larry C. Andrew, B. K. Shivamoggi Macmillan
5. Fourier Analysis with Boundary Value Problem Murrey R. Spiegel Schaum's Outline Series
6. Mathematical Methods Potter, Merle C., Goldberg, Jack. PHI Learning
7. Ordinary and Partial Differential Equations M. D. Raisinghania S. Chand
8. Elements of Partial Differential Equation Ian Naismith Sneddon Dover Publications
9. Advanced Engineering Mathematics Kreyszig Willey
10. Higher Engineering Mathematics B. V. Ramana Tata McGraw-Hill

| | | | | | |
|---|----------|----------|----------|--------------|----------------------|
| Course Name: Data Structure and Basic Algorithms | | | | | |
| Paper Code: CSEN2004 | | | | | |
| Contact hrs per week | L | T | P | Total | Credit Points |
| | 3 | - | - | 3 | 3 |

COURSE OUTCOMES

1. To understand the data structures, their advantages and drawbacks
2. To identify the efficiency aspects of the graph and sorting algorithms covered in this course.
3. To learn about the data structures/ methods/ algorithms mentioned in the course with a comparative perspective
4. To describe problem statements and to design the solutions using programming language
5. To analyze and apply most appropriate data structure/ method/algorithm in a program to enhance the efficiency
6. To develop an efficient program modifying an efficient one using the knowledge gathered from this course.

Module-1: Linear Data structures I [8L]

Introduction [2L]

- I. Concepts of Data and data structure, Data Type and Abstract Data Type.
- II. Algorithms and programs, Different types of algorithms with example
- III. Algorithm efficiency and analysis, time and space analysis of algorithms–order notations.

Array [3L]

- I. Different representations – row major, column major
- II. Sparse matrix - its implementation and usage

Linked List [3L]

- I. Singly linked list, its operations – with and without tail pointer
- II. Circular linked list, its operations, Doubly linked list,

Module-2: Linear Data structures II [8L] Stack [3L]

- I. Concept, Operations
- II. Implementation (using array, using linked list)
- III. Applications – Evaluation of expressions

Queue [3L]

- I. Concept, Operations
- II. Implementation (using array, using linked list)
- III. Circular queue, implementation (using array)

IV. Applications

Recursion [2L]

- I. Principles of recursion
- II. Use of stack
- III. Differences between recursion and iteration
- IV. Tail recursion

Module-3: Non-linear Data structures [8L] Trees [5L]

- I. Basic terminologies, tree representation (using array, using linked list)
- II. Binary trees-traversal (pre, in, post - order), reconstruction
- III. Binary search tree-operations (creation, insertion, deletion, searching)
- IV. Height balanced binary tree –AVL tree (insertion, deletion with examples only)

Graphs [3L]:

- I. Basic Terminologies and definitions
- II. Representations/ storage implementations—adjacency matrix, adjacency list,
- III. Graph traversal and connectivity—Depth first search (DFS), Breadth first search (BFS)

Module-4: Searching, Sorting, Hashing [8L] Sorting Algorithms [4L]

Bubble sort, Insertion sort, Selection sort
Merge sort, Quick sort,
Comparisons

Searching [2L]

Sequential search, binary search

Hashing [2L]:

Hashing functions, collision resolution techniques

Text Books:

1. “Data Structures And Program Design In C”, 2/E by Robert L. Kruse, Bruce P. Leung.
2. “Fundamentals of Data Structures of C” by Ellis Horowitz, Sartaj Sahni, Susan Anderson
3. “Data Structures in C” by Aaron M. Tenenbaum.
4. “Data Structures” by S. Lipschutz.
5. “Introduction to Algorithms” by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein.

| | | | | | |
|---|----------|----------|----------|--------------|----------------------|
| Course Name: Data Structure and Basic Algorithms Lab | | | | | |
| Paper Code: CSEN 2054 | | | | | |
| Contact hrs per week | L | T | P | Total | Credit Points |
| | - | - | 3 | 3 | 1.5 |

Course Outcomes:

1. To write well-structured programs
2. To analyze run-time execution of sorting methods, including selection, merge sort and Quick sort.
3. To implement any ADT using both array based and linked-list based data structures.
4. To design advance data structure using Non-Linear data structure.
5. To select appropriate data structures as applied to specified problem definition.
6. To determine and analyze the complexity of given Algorithms.

List of Experiments:

1. Implementation of array operations.
2. Stacks and Queues: adding, deleting elements
3. Circular Queue: Adding & deleting elements
4. Evaluation of expressions operations using stacks.
5. Implementation of linked lists: inserting, deleting, inverting a linked list.
6. Implementation of stacks & queues using linked lists:
7. Sparse Matrices: Multiplication, addition
8. Recursive and Non-recursive traversal of Trees.
9. Binary tree traversal.
10. DFS and BFS.
11. Application of sorting and searching algorithms.

| | | | | | |
|--|----------|----------|----------|--------------|----------------------|
| Course Name: Human Values and Professional Ethics | | | | | |
| Course Code : HMTS2001 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 3 | 0 | 0 | 3 | 3 |

COURSE OUTCOMES:

The students will:

1. be aware of the value system and the importance of following such values at workplace
2. learn to apply ethical theories in the decision making process
3. follow the ethical code of conduct as formulated by institutions and organizations
4. Implement the principles governing work ethics
5. Develop strategies to implement the principles of sustainable model of development
6. Implement ecological ethics wherever relevant and also develop eco-friendly technology

Module I (10 L)

Human society and the Value System

Values: Definition, Importance and application. Formation of Values: The process of Socialization
Self and the integrated personality Morality, courage, integrity

Types of Values:

Social Values: Justice, Rule of Law, Democracy, Indian Constitution, Secularism Aesthetic Values: Perception and appreciation of beauty

Organizational Values: Employee: Employer--- rights, relationships, obligations Psychological Values: Integrated personality and mental health

Spiritual Values & their role in our everyday life

Value Spectrum for a Good Life, meaning of Good Life

Value Crisis in Contemporary Society

Value crisis at---

Individual Level Societal Level Cultural Level

Value Crisis management Strategies and Case Studies

Module II [10L]

Ethics and Ethical Values Principles and theories of ethics

Consequential and non-consequential ethics

Egotism, Utilitarianism, Kant's theory and other non-consequential perspectives Ethics of care, justice and fairness, rights and duties

Ethics--

Standardization Codification Acceptance Application

Types of Ethics- Ethics of rights and Duties

Ethics of Responsibility Ethics and Moral judgment Ethics of care

Ethics of justice and fairness

Work ethics and quality of life at work

Professional Ethics

Ethics in Engineering Profession;

Moral issues and dilemmas, moral autonomy (types of inquiry) Kohlberg's theory, Gilligan's theory (consensus and controversy)

Code of Professional Ethics Sample Code of ethics like ASME, ASCE. IEEE Institute of Engineers, Indian Institute of materials management, Institute of Electronics and telecommunication engineers

Violation of Code of Ethics---conflict, causes and consequences

Engineering as social experimentation, engineers as responsible experimenters (computer ethics, weapons development)

Engineers as managers, consulting engineers, engineers as experts, witnesses and advisors, moral leadership Conflict between business demands and professional ideals

Social and ethical responsibilities of technologies.

Whistle Blowing: Facts, contexts, justifications and case studies

Ethics and Industrial Law

Institutionalizing Ethics: Relevance, Application, Digression and Consequences

Module III [10L]

Science, Technology and Engineering

Science, Technology and Engineering as knowledge and profession

Definition, Nature, Social Function and Practical application of science Rapid Industrial Growth and its Consequences

Renewable and Non- renewable Resources: Definition and varieties Energy Crisis

Industry and Industrialization Man and Machine interaction

Impact of assembly line and automation Technology assessment and Impact analysis Industrial hazards and safety

Safety regulations and safety engineering Safety responsibilities and rights

Safety and risk, risk benefit analysis and reducing risk Technology Transfer: Definition and Types

The Indian Context

Module IV [6L]

Environment and Eco- friendly Technology

Human Development and Environment Ecological Ethics/Environment ethics

Depletion of Natural Resources: Environmental degradation Pollution and Pollution Control

Eco-friendly Technology: Implementation, impact and assessment

Sustainable Development: Definition and Concept

Strategies for sustainable development Sustainable Development--- The Modern Trends

Appropriate technology movement by Schumacher and later development Reports of Club of Rome.

Suggested Readings:

1. Tripathi,A.N., Human Values, New Age International, New Delhi,2006
2. Ritzer, G., Classical Sociological Theory, The McGraw Hill Companies, New York,1996. 3)Doshi,S.L., Postmodern Perspectives on Indian Society, Rawat Publications, New Delhi,2008. 4)Bhatnagar, D.K., Sustainable Development, Cyber Tech Publications, New Delhi, 2008. 5)Kurzwell,R., The age of Spiritual Machines, Penguin Books, New Delhi,1999.
3. Weinberg, S.K., Social Problems in Modern Urban Society, Prentice Hall,Inc.,USA, 1970.
4. Giddens, Anthony 2009. Sociology. London: Polity Press (reprint 13th Edition).

2ND YEAR, 2ND SEMESTER

| | | | | | |
|---|----------|----------|----------|--------------|----------------------|
| Course Name : Analog Communication | | | | | |
| Course Code : ECEN2201 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 3 | 0 | 0 | 3 | 3 |

COs:

After completing this course, the students will be able to:

1. Understand & apply the concepts of various types of signals, techniques for signal transmission and signal modulation from the knowledge gathered earlier.
2. Identify various parameters associated with Amplitude Modulation, time and frequency domain representations, side band frequencies etc and apply these knowledge to solve numerical problems.
3. Understand principles of various generation and detection techniques of Amplitude Modulation.
4. Identify and apply detailed knowledge of Angle modulation and demodulation techniques.
5. Analyze various multiplexing techniques and radio receivers.
6. Understand system noise and apply this knowledge to compare the noise performance of Analog Communication systems.

Module-1:[9L]

Introduction to Analog Communication: Introduction to basic elements of communication systems, Concept of modulation and its needs.

Continuous Wave Linear Modulation:

- a) Amplitude modulation(AM-DSB/TC): Time domain representation of AM signal (expression derived using a single tone message), modulation index, frequency domain (spectral) representations, illustration of the carrier and side band components; transmission bandwidth for AM; Phasor diagram of an AM signal; Calculation of Transmitted power & sideband power & Efficiency ; concept of under, over and critical modulation of AM-DSB-TC.
- b) Other Amplitude Modulations: Single side band modulation (SSB) both TC & SC ,Double side band suppressed carrier (DSBSC) modulation: time and frequency domain expressions, bandwidth and transmission power for DSB. The basic concepts of VSB, Spectra and band-width.

Module -2 :[9L]

Generation & Detection of Amplitude Modulated signals:

- c) Generation: Multiplier modulator, Balanced Modulator, Switching modulator, Square law Modulator, Generation of SSB: Frequency Discrimination method, Phase Discrimination method
- d) Detection: Rectifier Detector, Square Law detector, Envelope detector, Synchronous detection for AM-SC signals, Effects of Frequency & Phase error in Synchronous detection.

Module-3:[9L]

Angle Modulation:

- e) Frequency Modulation (FM) and Phase Modulation (PM): Time and Frequency domain representations, Spectral representation of FM and PM for a single tone message, Phasor diagram.

- f) Generation of FM & PM: Narrow and Wide-band angle modulation, Basic block diagram representation of generation of FM & PM, Concept of VCO & Reactance modulator
- g) Demodulation of FM: Concept of frequency discriminators and phase discriminators, Phase Locked Loop.
- h) Comparison between AM and FM.

Module - 4 :[9L]

- i) Multiplexing: Frequency Division Multiplexing, Time Division Multiplexing,
- j) Radio Receivers –Performance Characteristics of Radio Receivers, Basic block diagram of TRF and Superhetrodyne Receiver. Comparison between TRF and Superhetrodyne Receiver.
- k) Noise in Communication System: Noise performance in Analog Communication systems: SNR calculation for DSB/TC, DSB-SC, SSB-TC, and SSBSC & FM.

Text Books:

1. B.P.Lathi -Communication Systems- BS Publications
2. Taub and Schilling , “Principles of Communication Systems”, 2nd ed., Mc-Graw Hill
3. Singh & Sapre—Communication Systems: 2/e, TMH
4. Haykin, Communication Systems- PHI

References:

1. Carlson—Communication System,4/e , Mc-Graw Hill
2. Proakis & Salehi Fundamentals of Communication Systems- Pearson
3. V Chandra Sekar – Analog Communication- Oxford University Press
4. P K Ghosh- Principles of Electrical Communications- University Press
5. L.W. Couch Ii, “Digital and Analog Communication Systems”, 2/e, Macmillan Publishing
6. Blake, Electronic Communication Systems- Cengage Learning

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|--|----------|----------|----------|-------------------|--------------------------|
| Course Name : Analog Communication Laboratory | | | | | |
| Course Code : ECEN2251 | | | | | |
| Contact Hours per week | L | T | P | Tota 1 | Credit Points |
| | 0 | 0 | 2 | 2 | 1 |

Course Outcomes:

1. The students will learn to analyze AM and FM signals using spectrum analyzer.
2. They will be able to design AM demodulator.
3. The students will be in a position to design FM demodulator.
4. They will know the procedure to measure Radio receiver parameters.

List of Experiments:

1. Measurement of modulation index varying modulating signal amplitude of an AM signal.
2. Design an AM demodulator (Envelope detector).
3. Spectral analysis of AM Signal.
4. Design of a voltage controlled oscillator (VCO).
5. Measurement of modulation index varying modulating signal amplitude of a FM signal.
6. Design a FM demodulator using PLL.
7. Spectral analysis of FM signal.
8. Study of Pre-Emphasis and De-Emphasis.
9. Measurement of selectivity, sensitivity and fidelity of a super-heterodyne receiver.
10. Experiment Beyond curriculum.

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|---|----------|----------|----------|--------------|----------------------|
| Course Name : Digital Systems Design | | | | | |
| Course Code : ECEN2002 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 3 | 0 | 0 | 3 | 3 |

Course outcomes:

1. Make use of the concept of Boolean algebra to minimize logic expressions by the algebraic method, K-map method, and Tabular method.
2. Construct different Combinational circuits like Adder, Subtractor, Multiplexer, De-Multiplexer, Decoder, Encoder, etc.
3. Design various types of Registers and Counters Circuits using Flip-Flops (Synchronous, Asynchronous, Irregular, Cascaded, Ring, Johnson).
4. Outline the concept of different types of A/D and D/A conversion techniques.
5. Realize basic gates using RTL, DTL, TTL, ECL, and CMOS logic families.
6. Relate the concept of Flip flops to analyze different memory systems including RAM, ROM, EPROM, EEROM, etc.

Module-1[8 L]

Data and number systems; Binary, Octal, and Hexadecimal representation and their conversions;

BCD, Gray codes and their conversions; Signed binary number representation with 1's and 2's complement methods, Binary arithmetic. Boolean algebra, De-Morgan's theorem, Various Logic gates-their truth tables and circuits; Representation in SOP and POS forms; Minimization of logic expressions by algebraic method, K- map method, Tabular method.

Module-2: [12 L]

Combinational circuits- Adder and Subtractor, BCD adder, Encoder, Decoder, Comparator, Multiplexer, De- Multiplexer and Parity Generator. [7]

Memory Systems: Concepts and basic designs of RAM, ROM, EPROM, EEROM, Programming logic devices and gate arrays. (PLAs and PLDs) [5]

Module-3: [8L]

Sequential Circuits- Basic memory element S-R, J-K, D, and T Flip Flops, Interconversions of Flip-Flop, State table and state transition diagram, sequential circuits design methodology, various types of Registers and Counters (Synchronous, asynchronous, Irregular, ring, johnson) and their design, Lockout and its remedy.

Module-4: [8 L]

a) Different types of A/D (Flash, SAR, Counter type, Dual slope) and D/A(R-2R, weighted resistor) conversion techniques. [4 L]

b) Logic families- RTL, DTL, TTL, ECL, and CMOS, their operation and specifications. [4 L]

Total: 36 hours

Textbooks:

1. Morris Mano-Digital Logic Design, PHI
2. R.P.Jain-Modern Digital Electronics, 2/e, Mc Graw Hill
3. Virendra Kumar-Digital technology, New Age Publication
4. S.Salivahanan, S.Arivazhagan-Digital Circuit & Design, Bikas Publishing
A. Anand kumar-Fundamental of Digital Circuits, PHI

References:

1. H.Taub & D.Shilling-Digital Integrated Electronics, Mc Graw Hill
2. Tocci, Widmer, Moss-Digital Systems, 9/e, Pearson
3. Leach & Malvino-Digital Principles &Application, 5/e, Mc Graw Hill
4. Floyed & Jain-Digital Fundamentals, Pearson

| | | | | | |
|---|----------|----------|----------|--------------|----------------------|
| Course Name : Digital Systems Design Lab | | | | | |
| Course Code : ECEN2052 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 0 | 0 | 2 | 2 | 1 |

Course Outcomes:

The students after finishing this course will be able to:

1. Design code converters.
2. Design adder and subtractor circuits.
3. Design decoders and multiplexer circuits.
4. Realize counters.

List of Experiments:

1. Realization of basic gates using Universal logic gates.
2. Code conversion circuits- BCD to Excess-3 and vice-versa.
3. Design of Four-bit parity generator and comparator circuits.
4. Construction of simple arithmetic circuits-Adder, Subtractor.
5. Construction of simple Decoder & Multiplexer circuits using logic gates.
6. Realization of different combinational circuits using Multiplexers.
7. Realization of RS, JK, and D flip-flops using Universal logicgates.
8. Realization of Asynchronous Up/Down counters.
9. Realization of Synchronous Up/Down counters.
10. Design of Sequential Counter with irregular sequences.
11. Realization of Ring and Johnson's counters.

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|---|----------|----------|----------|---------------|---------------------|
| Course Name : EM Theory And Transmission Lines | | | | | |
| Course Code : ECEN2203 | | | | | |
| Contact Hours per week | L | T | P | Tot al | Credit Point |
| | 3 | 0 | 0 | 3 | 3 |

Course Outcomes:

After going through this course, the students will be able to:

1. Apply their pre-requisite knowledge of Electrostatics and Magnetostatics.
2. Comprehend Electromagnetic wave propagation in different mediums.
3. Understand different electromagnetic phenomena associated with Transmission Lines.
4. Design of Impedance Matching Networks for two wire Transmission Lines.
5. Develop the ability to analyze the radiation characteristics of antenna configurations and identify respective areas of application.
6. Understand pattern synthesis and analysis in linear antenna array.

Module I: [6]

Faraday's law & Lenz's law, Transformer and Motional Electromotive Forces, Displacement Current, JC - JD Relation, Maxwell's equations, Time Varying Potentials, Time-harmonic fields, Wave Equation, Boundary Conditions between media interface; Uniform Plane wave.

Module II: [10]

Plane Wave Propagation in Lossy Dielectric, Loss-less Dielectric, Good Conductor, Free space; Poynting Theorem, Power flow, Poynting vector, Skin Depth, Surface Resistance, Wave Polarization; Reflection and Transmission for normal and oblique incidence.

Module III: [12]

Transmission Lines; Concept of Lumped parameters and Distributed parameters. Line Parameters, Transmission line equations and solutions, Physical significance of the solutions, Propagation constant, Characteristic Impedance; Wavelength; Velocity of Propagation; Condition for minimum distortion and minimum attenuation, Transmission line losses, Distortion-less Line, Reflection and Transmission coefficients; Standing Waves, VSWR, Input Impedance, Smith Chart -Applications; Load Matching Techniques / Quarter wave Matching, Bandwidth problem; Low loss RF transmission lines, line as circuit elements.

Module IV: [6]

Antenna Concepts, Antenna Characteristic; Hertzian dipole (Radiation Fields, Radiation Resistance, Radiation patterns, Directive Gain); Properties and typical applications of Half-wave dipole, Loop antenna, Yagi-Uda array, Basic Concepts of antenna array.

Text Books

1. Principles of Electromagnetics, 4th Edition, Matthew O H Sadiku, Oxford University Press.
2. Electromagnetic Field Theory & Transmission Lines, G.S.N. Raju, Pearson Education

3. Electromagnetic Waves Shevgaonkar, Tata-McGraw-Hill –R K
4. Antenna Theory: Analysis and Design, 3rd edition, C.A. Balanis, Wiley India.

Reference Books

1. Engineering Electromagnetics, 2ed Edition - Nathan Ida, Springer India.
2. Time Harmonic Electromagnetic Fields, Roger F. Harrington, IEEE Press Series.
3. Electromagnetic Theory & Applications, A. K. Saxena, Narosa Publishing House Pvt. Ltd.
4. Engineering Electromagnetics, 7th Edition - W.H. Hayt & J.A. Buck, Tata-McGraw-Hill.
5. Electromagnetic Waves and Transmission Lines- by G.Prasad, J.Prasad and J.Reddy-Scitech.

| | | | | | |
|--|----------|----------|----------|--------------|---------------------|
| Course Name : EM Theory and Transmission Lines Laboratory | | | | | |
| Course Code : ECEN2253 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Point |
| | 0 | 0 | 2 | 2 | 1 |

Course Outcomes:

1. The students will be able to plot SW pattern under different conditions.
2. They will learn generation and study of Smith Chart.
3. The students will be able to study radiation patterns of various types of antennae.
4. They will be able to undertake parametric study of antenna.

[At least THREE experiments from Module I and FOUR experiments from Module II]

Module I:

1. Plotting of Standing Wave Pattern along a transmission line when the line is open-circuited, short-circuited and terminated by a resistive load at the load end.
2. Measurement of Input Impedance of a terminated coaxial line using shift in minima technique.
3. Study of Smith chart on MATLAB/OCTAVE platform.
4. Simulation study of Smith chart - Single and double stub matching.

Module II:

5. Radiation Pattern study of dipole antenna.
6. Radiation Pattern study of a folded-dipole antenna.
7. Radiation pattern study of Helical Antenna.
8. Parametric study (Gain, Directivity, HPBW and FNBW) of three, five and seven element Yagi Uda configurations.
9. Radiation pattern study of a Pyramidal Horn Antenna.
10. Spectrum analysis of different analog signals (sine, triangular, square) using spectrum analyzer.

| | | | | | |
|---|----------|----------|----------|--------------|----------------------|
| Course Name : Electronic Devices | | | | | |
| Course Code : ECEN2204 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 3 | 0 | 0 | 3 | 3 |

Course Outcomes:

The students, after going through this course, will be able to:

1. Apply the previous knowledge of basic electronics engineering to appreciate the contents of this paper.
2. Understand both the particle and wave natures of electrons in Solid State Devices.
3. Identify unknown extrinsic semiconductor type using Hall Effect.
4. Describe working principles of different devices using mathematical models and energy band diagrams.
5. Justify different operations of solid state devices using relative position of Fermi energy levels across p-n junctions in devices.
6. Evaluate performance of different hetero junctions in semiconductor devices.

Module - 1: Semiconductor Physics [11L]

Recapitulation of Quantum Mechanics, Kronig Penny Model, Energy Band diagram, E-K diagram, Direct and Indirect Band-gap semiconductors, concept of effective mass, Carrier distribution in solid, concept of density of state (only expression), Fermi-Dirac distribution function, Fermi level, Intrinsic and Extrinsic semiconductors, idea of Degeneracy and Non- Degeneracy, Fermi level shift with the changes in doping and temperature. (6L)
Semiconductor under equilibrium: Carrier Concentration in terms of effective Density of States, Mass-Action Law. (2L)

Semiconductor under non-equilibrium: Excess Carrier Generation and recombination with expression, concept of quasi Fermi-level.

Drift and Diffusion of carrier with expressions, Scattering Effect, Hall Effect, Piezo-electric effect (3L)

Module - 2: Diodes: [11L]

Homo-junctions: p-n junction physics: derivations and plots of depletion charge, electric field, potential profiles; energy band diagram, depletion width, p-n junction capacitances, Varactor diode, Derivation of p-n junction current equations, junction resistances; concepts about linearly graded and abrupt junctions. (5L)

Basic operations of different diodes: Breakdown diodes, Tunnel diode, Photo diodes (P-N, P-I-N, APD), Photoconductor, Solar cell; Basic concept about Spontaneous and Stimulated emissions, LED. (3L)

Hetero-junctions: Physics of Metal-Semiconductor & Semiconductor-Semiconductor hetero-junctions, Rectifying & Non-rectifying natures of Hetero-junctions, basic concept of potential-well & 2D electron gas. (3L)

Module - 3: Bipolar Junction Transistors (BJT): [7L]

BJT operating principle, minority carrier distributions, Different modes of operations and respective energy band diagrams, input output characteristics of BJT in CB & CE modes, base width modulation, Early effect, punch through, thermal runaway; concepts about large and small signal modeling of the device, Eber's Moll model, Hybrid- π model. Basic operation of Photo-transistor.

Module - 4: Metal Oxide Semiconductor Field Effect Transistors (MOSFET): [7L]

Physics of 2-terminal MOS structures with proper band diagrams, formation of inversion layer; MOSFET classifications: Enhancement and Depletion type MOSFETs, basic operations and V-I characteristics of both the devices; concepts of Threshold voltage and Flat-band voltage, small signal model of MOSFET, Introduction to CMOS technology. Study of MOS capacitance.

Text Books :

1. Neamen- Semiconductor Physics and Devices- TMH
2. Bhattacharya & Sharma- Solid State Electronic Devices- Oxford
3. Streetman & Banerjee- Solid State Electronic Devices- PHI

Reference Books :

1. Milman, Halkias & Jit- Electronics Devices and Circuits- TMH
2. Bell-Electronics Devices and Circuits-Oxford
3. Bogart, Bisley & Rice- Electronics Devices and Circuits- Pearson
4. Boylestad & Nashelsky- Electronics Devices and Circuit Theory- Pearson

| | | | | | |
|---|----------|----------|----------|--------------|----------------------|
| Course Name : Advanced Numerical Methods | | | | | |
| Course Code : MATH2202 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 3 | 0 | 0 | 3 | 3 |

Course Outcome: After completing the course the student will be able to:

1. MATH2202.1 Analyze certain algorithms, numerical techniques and iterative methods that are used for solving system of linear equations.
2. MATH2202.2 Implement appropriate numerical methods for solving advanced engineering problems dealing with interpolation, integration and differentiation.
3. MATH2202.3 Apply the knowledge of matrices for calculating eigenvalues and eigenvectors and their stability for reducing problems involving Science and Engineering
4. MATH2202.4 Develop an understanding to reduce a matrix to its constituent parts in order to make certain subsequent calculations simpler.
5. MATH2202.5 Apply various optimization methods for solving realistic engineering problems.
6. MATH2202.6 Compare the accuracy and efficiency of the above mentioned methods.

Module I [9L]

System of Linear Equations :

- Gauss Elimination: pivoting and scaling.
- Gauss-Jordan, Gauss-Jacobi, Gauss-Seidel.
- Computational complexity of the above methods.
- Symmetric positive definite systems and indefinite systems: Cholesky factorization.
- Error Analysis: error prediction and acceleration.

Module II [9L]

Eigen Value problems:

Eigenvalue location, error and stability of eigenvalues.

QR algorithm.

Power method, inversion iteration in finding dominant eigenvalues and eigenvectors of sparse matrices.

Singular value decomposition, application of SVD.

Module III [9L]

Interpolation, Integration & Differentiation:

Purpose of interpolation, choice of interpolating function: Newton's forward and backward interpolation.

Polynomial interpolation: Lagrange's method.

Newton's divided difference interpolation.

Computational complexity of the above methods.

Piecewise polynomial interpolation: cubic spline interpolation.

General form of quadrature rule: Newton-Cotes quadrature.

Trapezoidal rule, Simpson's 1/3rd rule, Weddle's rule.

Gaussian quadrature rule.

Module IV [9L]

Optimization:

Unimodal functions.

One-dimensional unconstrained optimization algorithms: interval halving, Dichotomous search, Golden section search, Fibonacci search.

Cubic spline interpolation.

Nonlinear Least Squares.

Books:

Text Book

1. Trefethen L. N. and Bau D. Numerical Linear Algebra, SIAM
2. Watkins D. S. Fundamentals of Matrix Computation, Wiley
3. Smith G. D. Numerical Solutions to Partial Differential Equations, Oxford University Press
4. Jain M. K. and Iyengar S.R.K. Numerical methods for scientific and engineering computation
5. Conte S. D. and Boor C. D. Elementary Numerical Analysis - An Algorithmic Approach, McGraw Hill
6. Atkinson K. E. Introduction to Numerical Analysis, John Wiley
7. S. S. Rao, Engineering Optimization, New Age International Publishers

Reference Books

1. Golub G. H. and Van Loan C.F. Matrix Computation, John Hopkins U. Press, Baltimore
2. Stewart G. W. Introduction to Matrix Computations, Academic Press
3. Demmel J.W. Applied numerical linear algebra, SIAM, Philadelphia
4. Jain M.K. Numerical Solutions of Differential Equations
5. Smith, Numerical solutions of partial Differential Equations (Finite difference methods)
6. Heath M. T., Scientific Computing: An Introductory Survey, McGraw Hill
7. Joe D. Hoffman, Numerical Methods for Engineers and Scientists, McGraw Hill

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|--|----------|----------|----------|--------------|----------------------|
| Course Name : Advanced Numerical Methods Laboratory | | | | | |
| Course Code : MATH2252 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 0 | 0 | 2 | 2 | 1 |

Course outcomes: After completing the course the student will be able to:

1. MATH2252.1 Write programs in C to solve problems based on numerical methods.
2. MATH2252.2 Apply their knowledge of C programming to find non-iterative exact solutions of a system of equations.
3. MATH2252.3 Use C programming to develop algorithms to find iterative approximate solutions of a system of equations.
4. MATH2252.4 Demonstrate their ability of C programming to solve problems involving interpolation.
5. MATH2252.5 Use MATLAB/OCTAVE to implement algorithms in optimization problems.
6. MATH2252.6 Study the role of recurrence relations in optimization algorithms using

MATLAB/OCTAVE. Development of computer programs in C and/or MATLAB/OCTAVE for the following problems:

1. Gauss-elimination Method with complete and total pivoting.
2. Gauss-Seidel Method with diagonal dominance.
3. Newton's Forward Interpolation (polynomial to be printed).
4. Lagrange's interpolation (polynomial to be printed).
5. Implementation of one-dimensional unconstrained optimization algorithms (for example: Dichotomous search, Golden section search, Fibonacci search etc by MATLAB/OCTAVE).

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|---|----------|----------|----------|--------------|----------------------|
| Course Name : Environmental Sciences | | | | | |
| Course Code : EVSC2016 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 2 | 0 | 0 | 2 | 0 |

Course outcomes

The subject code EVS2016 corresponds to basic environmental chemistry for the 2nd year B.Tech students, which is offered as Environmental Sciences and is mandatory for all branches of engineering. The course provides basic knowledge of various environmental pollutions as well as its impact and ways to curb it. The course outcomes of the subject are

1. Understand the natural environment and its relationships with human activities.
2. Characterize and analyze human impacts on the environment.
3. Integrate facts, concepts, and methods from multiple disciplines and apply to environmental problems.
4. Educate engineers who can work in a multi-disciplinary environment to anticipate and address evolving challenges of the 21st century.
5. Understand and implement scientific research strategies, including collection, management, evaluation, and interpretation of environmental data.
6. Design and evaluate strategies, technologies, and methods for sustainable management of environmental systems and for the remediation or restoration of degraded environments.

Module 1 [6L]

Socio Environmental Impact

Basic ideas of environment and its component, Population growth: exponential and logistic; resources; sustainable development 3L

Concept of green chemistry, green catalyst, green solvents

Environmental disaster and social issue, environmental impact assessment, environmental audit, environmental laws and protection act of India. 3L

Module 2 [6L]

Air Pollution

Structures of the atmosphere, global temperature models

Greenhouse effect, global warming; acid rain: causes, effects and control.3L

Lapse rate and atmospheric stability; pollutants and contaminants; smog; depletion of ozone layer; standards and control measures of air pollution. 3L

Module 3 [6L]

Water Pollution

Hydrosphere; pollutants of water: origin and effects; oxygen demanding waste; thermal pollution; pesticides; salts.

Biochemical effects of heavy metals; eutrophication: source, effect and control. 2L

Water quality parameters: DO, BOD, COD.

Water treatment: surface water and waste water. 4L

Module 4 [6L]

Land Pollution

Land pollution: sources and control; solid waste: classification, recovery, recycling, treatment and disposal. 3L

Noise Pollution

Noise: definition and classification; noise frequency, noise pressure, noise intensity, loudness of noise, noise threshold limit value; noise pollution effects and control. 3L

Text/Books

1. GourKrishna Das Mahapatra, Basic Environmental Engineering and Elementary Biology, Vikas Publishing House P. Ltd.
2. A. K. De, "Environmental Chemistry", New Age International.
3. A. K. Das, Environmental Chemistry with Green Chemistry, Books and Allied P. Ltd

References/Books

1. S. C. Santra, Environmental Science, New Central Book Agency P. Ltd
2. D. De, D. De, Fundamentals of Environment & Ecology, S. Chand & Company Ltd.

| | | | | | |
|--------------------------------------|----------|----------|----------|--------------|----------------------|
| Course Name : Control Systems | | | | | |
| Course Code : ECEN2211 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 3 | 0 | 0 | 3 | 3 |

COURSE OUTCOMES:

1. Students will be able to relate their pre-requisite knowledge from Mathematics and Signals & Systems.
2. They will develop the ability to understand mathematical model of physical systems and study their nature, configuration and relevant mapping into equivalent models.
3. The concept and classification of control systems, will be applied to identify, analyze and solve stability related issues in time response, error analysis and stability analysis in an advanced way.
4. Students will be able to evaluate, categorize and justify the margin of stability with respect to the system's nature using frequency domain analysis tools.
5. Students will be able to conceptualize different methods of evaluating system behavior with the help of models compatible to simulation.
6. Students will be able to design controllers according to desired performance specifications which can be applied for system design in higher semesters.

MODULE – I

Introduction:

Concepts of Control Systems- Open Loop and Closed Loop Control Systems, Different Control Systems - Classification of Control Systems, Feed-Back Characteristics, Effects of feedback. [4L]

Transfer Function Representation Of LTI Systems:

Block diagram representation of systems -Block diagram algebra – Representation by Signal Flow Graph - Transfer function using Mason's Gain Formula. [5L]

MODULE -II

Time Domain Analysis:

Standard test signals - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants. [5L]

Stability Analysis:

The concept of stability- Difference between absolute and relative stability-Routh's stability criterion, Root Locus Technique. [5L]

MODULE – III [10 L]

Frequency Domain Analysis:

Frequency domain specifications-Bode diagrams, Phase margin & Gain margin-Stability Analysis from Bode Plots. [6L]

Polar Plots- Nyquist Plots-Stability Analysis. [4L]

MODULE –IV[11 L]

Classical Control Design Techniques:

Compensation techniques – Lag, Lead, Lead-Lag Controllers design in frequency Domain, PID Controllers. [5 L]

State Space Analysis Of Continuous Time Systems:

Concepts of state, state variables and state model, derivation of state models from block diagrams, Solving the Time invariant state Equations- State Transition Matrix and its properties – Concepts of Controllability and Observability . [6 L]

TEXT BOOKS:

1. Automatic Control Systems– by B. C. Kuo, John Wiley and Sons.
2. Control Systems Engineering – by I. J. Nagrath and M. Gopal, New Age International (P) Ltd.
3. Modern Control Engineering – by Katsuhiko Ogata , Prentice Hall of India Pvt. Ltd.
4. Modern Control Systems- by R.C. Dorf & R.H. Bishop- Addison- Wesley Longman.

REFERENCE BOOKS:

1. Control Systems Engg. by Norman S. Nise , John Wiley.
2. Control System Engineering by Ananda Natarajan , P. Ramesh Babu, Scitech Pub.
3. Automatic Control Systems- Basic analysis and design- by A. Wolovich- Oxford University Press.

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|---|----------|----------|----------|--------------|----------------------|
| Course Name : Control Systems Laboratory | | | | | |
| Course Code : ECEN2261 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 0 | 0 | 2 | 2 | 1 |

Course Outcomes:

1. The students will learn the study of feedback on systems.
2. They will be able to study systems of first and second order.
3. The students will be in a position to analyze steady state errors for systems.
4. They will be able to study the stability of a system using Bode plot etc.

List of Experiments:

1. Familiarization with MATLAB/OCTAVE Control System Toolbox and SIMULINK.
2. Study of the effect of feedback on systems.
3. Study of first order systems having different time constants.
4. Study of second order systems having different damping ratios.
5. Verification and validation of time domain specifications of second order systems.
6. Study of steady state errors for different 'types' of systems.
7. Study of system stability using Root Locus Technique.
8. Study of system stability using Nyquist plot.
9. Study of system stability using Bode plot.
10. Study of system relative stability using Nyquist Plot and Bode Plot.
11. Study of system representation using State Model.
12. Determination of PI, PD and PID controller action o

3RD YEAR 1ST SEMESTER

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|---|----------|----------|----------|--------------|----------------------|
| Course Name: Digital Communication | | | | | |
| Course Code: ECEN 3101 | | | | | |
| Contact Hours | L | T | P | Total | Credit Points |
| per week | 3 | 0 | 0 | 3 | 3 |

Course Outcomes:

After completing the course the student will be able to:

1. Apply the concepts of various techniques for analog signal transmission and modulation from the knowledge gathered earlier.
2. Understand the functions of different components of a digital communication system and understand Pulse code Modulation System.
3. Apply mathematical concepts to analyse the source coder and channel coder blocks of the digital communication system.
4. Analyze error performance of a baseband receiver in digital communication system in presence of noise and other interferences and apply this knowledge to design a receiver.
5. Compare performance of various digital modulation & demodulation techniques and understand concept of OFDM and Spread Spectrum Modulation system.
6. Design a digital communication system and evaluate the performance of the system in presence of noise.

Module I: [8L]

Building Blocks of Digital Communication System, Performance comparison of Analog and Digital communication technique.

Pulse Code Modulation: Sampling, Quantization, quantization noise, linear and nonlinear quantization, Companding, Source encoding, Differential pulse code modulation, Delta modulation, Adaptive delta modulation.

Module II: [8L]

Line Coder: Desirable properties of line code, Polar/ Unipolar /Bipolar / HDB signaling (NRZ and RZ schemes), Manchester signaling, Comparison of PSDs of these line codes,

Pulse Shaping, Inter Symbol Interference (ISI), Nyquist criterion for zero ISI, Eye pattern, Equalizer, zero forcing equalizer, Regenerative repeater, Bit synchronization, Frame synchronization.

Module III: [8L]

Digital Band pass Modulation schemes: Types of Digital Modulation, coherent and non-coherent Binary Modulation Techniques: ASK, PSK and FSK. Concept of

QAM and M-ary Modulation, M-ary phase shift keying, Quadrature Phase Shift Keying (QPSK), Offset Quadrature Phase shift Keying (OQPSK), Geometrical representation, generation, detection, and power spectral density of the above mentioned digital carrier modulation techniques . Minimum Shift Keying (MSK), Gaussian Minimum Shift Keying, Basic Concept of OFDM and Spread Spectrum Modulation.

Module IV: [8L]

Signal Vector Representation: Basis functions, signal space diagram, message point, geometric interpretation of signals.

Baseband signal receiver : Detection of known signals in presence of noise, Integrate and Dump type filter, probability of error calculation, , Optimum threshold detection, Optimum Receiver for AWGN channel , Matched Filter receiver, Correlator Receiver and its transfer function, Probability of error of matched filter, Concept of error function, complementary error function and Q function. Comparative study of bit error probability of various digital modulation techniques.

TEXT BOOKS:

1. Digital Communications, S. Haykin, WileyIndia.
2. Principles of Communication Systems, H. Taub and D.L.Schilling, TMH PublishingCo.
3. Digital Communications, J.G.Proakis, TMH PublishingCo.
4. B.P. Lathi, Modern Digital and Analog Communication System, Oxford UniversityPress.
5. Electronic Communications Systems, Wayne Tomasi, PearsonEducation.

REFERENCE BOOKS:

1. Digital Communications Fundamentals and Applications, B. Sklar and P.K.Ray,Pearson.
2. Digital Communication, A. Bhattacharya, TMH PublishingCo.
3. Wireless Communication and Networks: 3G and Beyond, I. SahaMisra, TMHEducation.
4. L.W. Couch II, Modern Communication System, Prentice Hall India.
5. Roden, Analog & Digital Communication Systems, 5e,SPD
6. Communication Systems (Analog and Digital), Sanjay Sharma, KatsonBooks

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|--|----------|----------|----------|--------------|----------------------|
| Course Name: Digital Communication Laboratory | | | | | |
| Course Code: ECEN3151 | | | | | |
| Contact Hours | L | T | P | Total | Credit Points |
| per week | 0 | 0 | 2 | 2 | 1 |

Course Outcomes:

After completing the following experiments, students will be able to:

1. Understand, design & implement PN sequences with shift registers and study performance of Pulse Amplitude Modulators and demodulators.
2. Implement and study Line codes like polar, unipolar (NRZ,RZ), Split phase and differentially encoded signals
3. Analyze and compare time domain and frequency domain representation of various digital modulation and demodulation schemes.
4. Acquire an insight into Digital Communication systems intotality

List of Experiments:

1. Design and implementation of 7-length PN sequences using shift register.
2. Implementation and study of Pulse Amplitude Modulation and demodulation.
3. Implementation and study of Line Codes: polar , unipolar (NRZ,RZ), Split phase and Differentially encoded signals
4. Implementation and Study of BASK Modulator.
5. Implementation and Study of BASK Demodulator
6. Implementation and Study of BFSK Modulator
7. Implementation and Study of BFSK Demodulator
8. Implementation and Study of BPSK Modulator
9. Experiment beyond curriculum.

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|--|----------|----------|----------|--------------|----------------------|
| Course Name : Digital Signal Processing | | | | | |
| Course Code : ECEN 3102 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 3 | 0 | 0 | 3 | 3 |

Course outcomes:

After completion of the course, the students will be able to:

1. Recall the concepts of trigonometry, complex algebra, Fourier transform to analyze different signals and systems.
2. Apply the concept of z-transformation, convolution to determine the transfer function of a system and evaluate the output of the system.
3. Extend the knowledge of discrete-time Fourier transform to interpret DFT, FFT and apply the concept as a frequency transformation tool.
4. Design transfer functions of IIR/FIR filters applying transformation techniques/windowing methods.
5. Construct and model digital filters from their transfer function, develop concept of multirate signal processing and architecture of digital signal processor.
6. Develop a thorough understanding of the central elements of digital signal processing theory and apply this theory to real-world signal processing applications.

Module I [7L]

Introduction to Digital signal processing

Prerequisites: Concept of discrete-time signal and systems: concept of convolution, graphical, analytical methods to compute convolution supported with examples and exercises, properties of convolution, interconnections of LTI systems with physical interpretations, stability and causality conditions, recursive and non-recursive systems, Introduction to Z-transform, ROC, properties of Z-transform

Z-Transform: mapping between s-plane and z-plane, convolution, correlation and multiplication using z-transform, initial value theorem, final-value theorem, Parseval's relation, inverse Z-transform by contour integration.

Basic elements of a digital signal processing system, Advantages of digital over analog signal processing, concept of frequency in continuous-time and discrete-time signals.

Module II [8L]

Discrete Fourier Transform

Concept and relations for DFT/IDFT, Twiddle factors and their properties,

DFT/IDFT as linear transformations, DFT/IDFT matrices, computation of DFT/IDFT by matrix method, multiplication of DFTs, circular convolution, computation of circular convolution by graphical, DFT/IDFT and matrix methods, linear filtering using DFT, aliasing error, filtering of long data sequences – Overlap-Save and Overlap-Add methods with examples and exercises. Computational burden on direct DFT

Fast Fourier Transform:

Radix-2 algorithm, decimation-in-time, decimation-in-frequency algorithms, signal flow graphs, Butterflies computations in one place, bit reversal, examples for DIT & DIF FFT Butterfly computations and exercises, IDFT using DIT & DIF-FFT.

Module III [13L]

Digital Filters

Filter Concepts: Introduction to the concept of Digital Filters, frequency response and filter characteristics, basic concepts of IIR and FIR filters.

IIR Filters:

Introduction to analog filter design: Butterworth and Chebyshev filters design,

Transformation techniques: Impulse invariant method and bilinear transformation, warping effect and prewarping. Design procedure for low pass digital Butterworth and Chebyshev filter design.

FIR Filters:

Linear phase filters: Condition for filter to have linear phase response and its frequency response (Type I, II, III, IV),

Design techniques:

Fourier series method, Gibb's phenomenon, Windowing method (Rectangular, Hamming and Hanning window. Comparison study of windows,, advantages & disadvantages of FIR & IIR Filters.

Module IV [8L]

Realization of Digital Filters: Introduction Realization of discrete time systems: FIR and IIR system. Different methods of realizations: Direct form I, Direct Form II, Cascade form structure, Parallel form structure. Their advantages and disadvantages with examples.

Multi-rate Signal Processing: Understanding and necessity of multi-rate system Decimation and interpolation -Time domain and frequency domain behaviour of multi-rate systems Advantages and disadvantages.(aliasing & anti-aliasing)

Introduction to Digital Signal Processor:TMS320C67XX families, architecture and applications

TEXT BOOKS:

1. Digital Signal Processing – Principles, Algorithms and Applications, J.G.Proakis&D.G.Manolakis, Pearson Ed.
2. Digital Signal processing – A Computer Based Approach, S.K.Mitra, TMH Publishing Co
3. Digital Signal Processing, P. Rameshbabu, Scitech Publications (India).
4. Digital Signal Processing, A. NagoorKani, TMH Education .
5. Theory and application of digital signal processing- L.R. Rabiner& B. Gold- PHI.
6. Analog & digital Signal Processing- A. Ambardar- Books/Cole Pub.

REFERENCE BOOKS:

1. Digital Signal Processing, Tarun Kumar Rawat, Oxford Press
2. Digital Signal Processing, S.Salivahanan, A.Vallabraj& C. Gnanapriya, TMH Publishing Co .
3. Digital Signal Processing; A Hands on Approach, C. Schuler &M.Chugani, TMH Publishing Co.
4. Digital Signal Processing S. Poornachandra& B. Sasikala, MH Education .
5. Digital Signal Processing; Spectral Computation and Filter Design Chi-Tsong Chen, Oxford University Press .
6. Texas Instruments DSP Processor user manuals and application notes .

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|---|----------|----------|----------|--------------|----------------------|
| Course Name : Digital Signal Processing Laboratory | | | | | |
| Course Code : ECEN 3152 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 0 | 0 | 2 | 2 | 1 |

Course outcomes:

The students will be able to:

1. Interpret the response of discrete time systems using the concept of convolution.
2. Apply different transformation tools-z-transform, discrete fourier transform, fast fourier transform on signals and justify their properties as well.
3. Compare the frequency response of FIR and IIR filters (LPF, HPF, BPF and BSF) of digital filters and implement the systems using suitable realization techniques.
4. Develop DSP processors based real time system to analyze different real time signals like speech signal, image signal and some other biomedical signals.

Simulation Laboratory using standard Simulator:

1. Convolution of two sequences using graphical methods and using commands- verification of the properties of convolution.
2. Z-transform of various sequences – verification of the properties of Z-transform.
3. Twiddle factors – verification of the properties.
4. DFTs / IDFTs using matrix multiplication and also using commands.
5. Circular convolution of two sequences using graphical methods and using commands, differentiation between linear and circular convolutions.
6. Verifications of the different algorithms associated with filtering of long data sequences and Overlap –add and Overlap-save methods.
7. Butterworth filter design with different set of parameters.
8. Chebyshev filter design with different set of parameters.
9. FIR filter design using rectangular, Hamming and Blackman windows.

Hardware Laboratory using DSP Processor:

1. Hardware implementation to verify Convolution, DFT and IDFT using TMS320C67xx processor.
2. Hardware implementation to verify the results of different digital filters using TMS320C67xx processor.

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|---|----------|----------|----------|--------------|----------------------|
| Course Name: Microwave Engineering | | | | | |
| Course Code: ECEN3103 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 3 | 0 | 0 | 3 | 3 |

Course outcomes:

After completing this course, the students will be able to:

1. Apply previous E.M. theory concepts to understand microwave engineering.
2. Identify high frequency electromagnetic wave propagation characteristics through guided media.
3. Analyze microwave passive components and circuits.
4. Students should be able to enhance their knowledge on semiconductor and vacuum tube devices operating at high frequency.
5. Design high frequency filters and amplifiers.
6. Implement the concepts in developing different prototype microwave systems.

Module I [12L]

Introduction:

RF & Microwave Spectrum, Typical applications of RF and Microwave Engineering, Safety considerations [1L]

Waveguides and Resonators:

Rectangular waveguides, TE & TM modes, TE₁₀ mode analysis, cut-off frequency, propagation constant, intrinsic wave impedance, phase and group velocity, Power transmission, attenuation, waveguide excitation, wall current; Introduction of circular waveguide; Rectangular waveguide resonator- Design consideration, resonant frequency, Q-factor of a rectangular cavity resonator, excitation. Circular waveguides, TE₁₁ mode analysis. Rectangular waveguide resonator [8L]

Planar Transmission Lines

Strip Line, Micro-strip lines, Coplanar waveguide, Slot line- design consideration, field patterns, propagation characteristics, Comparison for different characteristics of the above mentioned lines.[3L]

Module II [10L]

Microwave Network Representation

Impedance and Equivalent Voltage and Current, Impedance and Admittance Parameters, Scattering Matrix, Properties of Scattering Parameters for Reciprocal and Lossless Network, Generalized S parameters, S parameters of Two-port Networks with Mismatched Load [5L]

Microwave Passive Devices

T-Junctions: E/H/Hybrid T-junctions, Wilkinson Power Divider, Directional Couplers, Isolator, Phase Shifters, Circulators, Attenuators, Waveguide Filters, Methods for coupling of Microwave signal. [5L]

Module III [9L]

Microwave Tubes

Principle of Electron beam & Field interaction for energy exchange in resonant (two cavity klystron, Reflex Klystron, Magnetron) and TWT microwave active devices: Typical characteristics & applications (only physical explanation is required, no mathematical derivation required).[3L]

Semiconductor Microwave devices

TED (Gunn diode) & Avalanche Transit Time (IMPATT) device, Tunnel diode, Schottky diode, PIN diode characteristics & applications; Microwave field effect transistor (MESFET), High Electron Mobility Transistor (HEMT)[6L]

Module IV [11L]

Microwave Filter Design

Design procedure of filter design using insertion loss method (maximally flat and equi-ripple), low pass prototype design, conversion to other filter prototypes.[5L]

Microwave Amplifier Design

Basic consideration in the design of RF amplifier- Transistor S-parameter, Stability, matching network, noise figure; Matching network design using lumped elements and L-Section. Brief introduction to NBA, LNA [6L]

Text books:

1. Microwave Engineering, 3rd edition David M. Pozar, Wiley & Sons Inc.
2. Microwave Engineering, Monojit Mitra, Dhanpat Rai & Co.
3. Microwave Engineering, A Das & S Das, TMH.
4. Microwave Devices & Circuits, SY Liao, Pearson Education/PHI
5. Microwave Engineering Fundamentals, Design and Applications, Subal Kar, University Press.

References:

1. Microwave Engineering-Passive Circuits, PA Rizzi, Pearson Education.
2. Microwaves, K C Gupta, New Age Publishers.
3. Foundation of Microwave Engineering, 2^{ed} edition, Robert E Collin, McGraw Hill, Inc.
4. Microwave Devices & Circuit Design, GP Srivastava & VL Gupta, PHI
5. Advanced RF & Microwave Circuit Design: The Ultimate Guide to Superior Design, M. Radmanesh, Authorhouse

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|--|----------|----------|----------|--------------|----------------------|
| Course Name: Microwave Engineering Laboratory | | | | | |
| Course Code: ECEN3153 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 0 | 0 | 2 | 2 | 1 |

Course Outcome:

After completing the following experiments, students will be able to:

1. Understand electromagnetic wave propagation at high frequency.
2. Identify the difference between active and passive microwave devices
3. Analyze and Characterize Microwave Devices.
4. Design measurement setup to perform analysis of microwave devices.

LIST OF EXPERIMENTS:

1. Determination of phase and group velocities in a waveguide carrying TE_{10} Wave from Dispersion diagram [ω - β Plot].
2. Measurement of unknown impedance using shift in minima technique using a waveguide test bench/ Measurement of the susceptance of an inductive and or a capacitive window using shift in minima technique using a waveguide test bench.
3. Study of Reflex Klystron oscillator using X-band waveguide test bench.
4. Study of Gunn Diode Characteristics using X-band waveguide test bench.
5. Characterization of waveguide tee (magic tee / E-plane tee / H-plane tee) using waveguide test bench at X-band.
6. Analysis of directional coupler using X-band waveguide test bench set up.
7. Analysis of waveguide type filter using X-band waveguide test bench set up.

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|--|----------|----------|----------|--------------|----------------------|
| Course Name: Microprocessors and Microcontrollers | | | | | |
| Course Code: ECEN3104 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 3 | 0 | 0 | 3 | 3 |

Course Outcomes

1. Demonstrate the knowledge of Digital Electronics with learning of the microprocessor and microcontroller.
2. Develop the concepts of CPU, timing and control signals I/O devices, and various BUS structure.
3. Learn about interrupts, stack and subroutine and write ALPs for given problems with flowcharts.
4. Conceptualize the architecture of 8086 family & ARM basics along with its parallel application.
5. Understand interfacing of processor with memory and I/O devices and analyze their problems.
6. Analyze microcontroller 8051 architecture in terms of Ports, Memory, Counters and Timers.

Module I: Introduction [8L]

MPU, I/O devices, Memory, Timing and Control Signals, Bussed Architecture, Tristate logic, Latch, Address Bus, Data Bus and Control Bus. Intel 8085 Microprocessor Architecture – Signals – Addressing modes – Instruction classification Instruction set.

Module II: Microprocessors [14L]

8085 [6L]—Timing diagram – Memory Mapped and Peripheral I/O – ALP format – Programming 8085 – 8-bit and 16-bit Operation including stack-subroutine – Interrupt structure of 8085 microprocessor, Processing of vectored and Non-vectored interrupts, Latency time and Response time; Handling multiple interrupts.

8086 [8L] 16 & 32 bit family of microprocessors (8086 & ARM) - 8086 Architecture – 8086 Signals-Segmented Memory – EU and BIU -Instruction Set-Addressing Modes – Minimum and Maximum Modes of Operation- Even and Odd Memory Bank- Basics of Assembly Language Programming. ARM Architecture – Register Organization – Processor Modes – Instruction Set.

Module III: I/O Interfacing [8L]

Memory interfacing and I/O interfacing with 8085– PPI **8255** – Programmable keyboard display – Interface 8279 – Programmable interrupt controller **8259** –Programmable DMA controller 8257 – Programmable interval timer **8253/4**. ADC & DAC Interfacing.

Module IV: Microcontroller & Systems 8051 [6L]

Architecture of 8051 Microcontroller – Signals – I/O ports – Memory – Counters and Timers – Serial Data I/O – Interrupts. Interfacing - Keyboard, LCD, Stepper Motor Control.

Text books

1. Microprocessor Architecture, Programming & Application with 8085-R. Gaonkar (Penram International).
2. Ray & Bhurchandi, Advanced Microprocessors & Peripherals, McGrawhill Education.
3. The 8051 Microcontroller and Embedded systems - Mazidi, Mazidi and McKinley (Pearson).
4. Microprocessor and Programmed Logic by Kenneth L Short. 2nd Edition, Pearson.
5. Microprocessor 8086: Architecture Programming and Interfacing by S. Mathur
6. Computer Organization and Design ARM Edition: by David A. Patterson, John L. Hennessy

Reference books

1. Microprocessors and microcontrollers -N. Senthil Kumar, M. Saravanan and Jeevananthan, Oxford University Press
2. An Introduction to Microprocessor and Applications –Krishna Kant (Macmillan).
3. Fundamentals of Microprocessor and Microcontrollers by B. Ram. Dhanpat Rai Publications
4. Microprocessors and Microcontrollers by A. Nagoorkani McGrawhill Education.
5. INTEL MCS 51 MICROCONTROLLER FAMILY USER'S MANUAL (free download)
6. The 8086 Family User's Manual from Intel (free download)
7. INTEL MCS® -80/85 FAMILY USER'S MANUAL (free down load)
8. INTEL Data Sheet For 8255 (free down load)
9. INTEL Data Sheet For 8279 (free down load)
10. INTEL Data Sheet For 8259 (free down load)
11. INTEL Data Sheet For 8257 (free down load)
12. INTEL Data Sheet For 8253 (free down load)

| | | | | | |
|--|----------|----------|----------|--------------|----------------------|
| Course Name : Microprocessors and Microcontrollers Laboratory | | | | | |
| Course Code : ECEN 3154 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 0 | 0 | 2 | 2 | 1 |

Course Outcomes

1. Students should solve basic binary math operations using the computer.
2. Students should demonstrate programming proficiency using the various addressing modes and data transfer instructions of the target Microprocessors (8085, 8086) and Microcontroller (8051).
3. Students should program using the capabilities of the stack, the program counter, and the status register and show how these are used to execute a machine code program.
4. Students should apply knowledge of the processor's internal registers, instructions and operations to design a total system with input and output and design program for the processor I/O ports in order to interface the processor to external devices.

Experiments list with Microprocessor 8085

1. Addition of two 8 bit numbers
2. Subtraction using 8 bit numbers
3. Find largest number of array
4. Find smallest number of an array of numbers
5. Sort array in ascending order
6. Sort array in descending order
7. Multiplication with two 8 bit numbers
8. Division with 8 bit numbers
9. BCD to HEX conversion
10. HEX to BCD conversion

Experiments list with Microcontroller 8051

1. Addition of two 8 bit numbers
2. Find BCD sum
3. Nibble swap in ACC method1
4. Nibble swap in ACC method2
5. Multiplication and Division by two
6. Blinking LEDs with Timer Using 8051 in hardware

Experiments list with Microprocessor 8086

1. Data transfer using different addressing modes
2. Data move from source to destination using indirect addressing mode (*Block Move without overlap*)
3. Sixteen-Bit Data Addition and Subtraction

4. BCD Addition and Subtraction
5. Sixteen-Bit Multiplication and Division
6. Logical Operations on Sixteen Bit Data with 8086 Instructions

| | | | | | |
|--|----------|----------|----------|--------------|----------------------|
| Course Name : Information Theory and Coding | | | | | |
| Course Code : ECEN 3105 | | | | | |
| Contact | L | T | P | Total | Credit Points |
| Hours per week | 3 | 0 | 0 | 3 | 3 |

Course Outcome:

After completing the course the students will be able to:

1. Distinguish between different types of source codes.
2. Figure out equations for entropy, mutual information and channel capacity for all types of channels, utilizing their knowledge on the elements.
3. Explain and estimate the merit of various methods for generating and detecting different types of error correcting codes.
4. Formulate the basic equations of linear block codes, cyclic codes.
5. Outline the basics of convolution code, linear algebra and BCH code.
6. Develop overall understanding about different types of codes applied to both source and channel end during data transmission.

Module-1: Information theory, Source coding and channels [10L]

Information theory : Uncertainty and information, measure of information, Self and conditional Information, mutual information and entropy, Fixed length code, Variable length code, Prefix code, Instantaneous code, Kraft Inequality,

Source Code: Source coding theorem, Huffman codes, Shanon- Fano coding, Arithmetic code, Lempel-Ziv algorithm.

Channels: Discrete memory less channel, Channel matrix for different channel models- Lossless channel, Deterministic channel, Noise-less channel, Deterministic channel capacity, channel coding, information capacity theorem, The Shannon limit.

Module-2: Error Control cods: Linear Block Codes [7L]

Block code: Hamming codes Minimum distance, Error detecting and Error-correcting capabilities of block code.

Linear Block Code: Definition & properties of linear block codes, Matrix description of linear block codes, Encoding of linear block code, parity check matrix, decoding of a linear block code, Syndrome and Error detection, Standard Array , equivalent codes, perfect codes.

Module-3: Cyclic and BCH code [10L]

Cyclic Code: Definition & properties of cyclic codes, Code Polynomials, Generator Polynomials, Division algorithm for polynomials, a method for generating cyclic codes, matrix description of cyclic codes, Decoding of cyclic codes. Golay codes, LFSR.

Galois Field: Introduction to Linear Algebra, Introduction to Galois Field, Primitive elements, generator polynomials in terms of minimal polynomials, Calculation of minimal polynomial.

BCH Code: Elementary concept of BCH Codes, Encoding and Decoding, Elementary concept of Reed Solomon Code.

Module-4: Convolution Codes: [9 L]

Encoding convolution code: Polynomial description of convolution codes, Distance notions for convolution codes and the generating function.

Decoding of convolution codes: Viterbi decoder, distance and performance bounds for convolution codes.

Example of convolution code - Turbo codes, Turbo decoding.

Graphical representation of convolution code: State diagram, Tree, Trellis diagram.

Books:

1. Information theory, coding and cryptography - Ranjan Bose; TMH.
2. Introduction to Error Control Codes – S Gravano; Oxford Press
3. Information and Coding - N Abramson; McGraw Hill.
4. Introduction to Information Theory - M Mansurpur; McGraw Hill.
5. Information Theory - R B Ash; Prentice Hall. 8. Error Control Coding - Shu Lin and D J Costello Jr; Prentice Hall.

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|---|----------|----------|----------|--------------|----------------------|
| Course Name: Telecommunication Systems | | | | | |
| Course Code : ECEN 3131 | | | | | |
| Contact Hours | L | T | P | Total | Credit Points |
| per week | 3 | 0 | 0 | 3 | 3 |

Course Outcomes:

After completing the course the student will be able to:

1. Apply the previous knowledge of analog communication to appreciate the contents of this paper.
2. Understand basics of Telecommunications and its entities along with the evolution of different types of exchanges.
3. Identify concepts of Telecommunication like signaling techniques, setting up linksetc effectively.
4. Describe working principles and practical applications of FAX, EPABX, EFT, Email, ISDN etc effectively.
5. List salient features of EWSD, NGN, ADSL etc.
6. Evaluate performance of a telecom network using the concepts of Traffic Engineering and case studies based on the observation.

Module I: (8L)

Introduction to Telecommunication & Switching Systems

Evolution of Telecommunication: Brief description of Rotary Dial and Push Button telephone, Strowger and crossbar switch. Circuit Switching and Packet Switching, Digital Switching Systems- Time Division Time Switch, Time Multiplexed Space Switch, Time Multiplexed Time Switch, Hybrid Switching.

Module II: (10L)

Telecommunication Transmission Lines and Subscriber Loop Systems

Introduction to Global Telecom Link through Satellite Networks & Satellite based data networks, LAN, Metropolitan Area network, Fiber optic networks and submarine cable landing stations. Subscriber Loop, Hybrid Circuit for 2-wire to 4-wire conversion and vice versa. PCM Carriers, American and European standards of carrier channels. Introduction to Higher Order Multiplexing, SDH, DWDM and optical transport networks. BORSCHT Functions, Switching Hierarchy and Routing, Signaling Techniques- In channel and Common Channel Signaling, Signaling System 7 (SS7).

Module III: (10L)

Stored Program Control

Electronic Exchanges, Introduction to Cordless Telephones. Introduction to Modems, Electronics Fund Transfer, Videotex, email.

Transmission Channel: Broadband Transmission- ISDN, DSL, ADSL, ISDN, B-ISDN, Introduction to VoIP Telephony. Data terminal equipment (DTE) & Data communication equipment (DCE).

Introduction to New generation of Electronic Exchanges- EWSD (Electronic Worldwide Switch Digital), 5ESS system architecture, NGN (Next-Generation Network)

Module IV: (8L)

Traffic Engineering

Network Traffic load and parameters, Grade of service and blocking probability, Incoming Traffic and Service Time Characterization, Blocking Models and Loss Estimates, Delay systems, Birth-death process, Erlang-B congestion formula & Erlang-C formula.

Text Books:

- a) T. Viswanathan “Telecommunication Switching System and Networks”, PHI
- b) J.C Bellamy “Digital Telephony” – Wiley India

Reference Books:

- a) O Hersent, D Gurle, J P Petit “ IP Telephony” Pearson
- b) J. E Flood “Telecommunication Switching, Traffic and Networks” Pearson
- c) R L Freeman “Telecommunication System Engineering” Wiley-India
- d) A Gokhale “ Introduction to Telecommunication” – Cengage Learning

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|--|----------|----------|----------|--------------|----------------------|
| Course Name : Computer Networks | | | | | |
| Course Code : ECEN 3132 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 3 | 0 | 0 | 3 | 3 |

Course outcomes:

After completing the course the student will be able to:

1. Understanding of the fundamental concepts of computer networking.
2. Apply the basic taxonomy and terminology of the computer networking area.
3. Identify the different types of network devices and their functions within a network.
4. Understand internetworking principles, routing principles and algorithms such as IP, IPv6, distance vector, and link state.
5. Conclude advanced networking concepts and advanced courses in computer networking.
6. Gain expertise in some specific areas of networking such as the design and maintenance of individual networks.

Module I [5L]:

Overview of Data Communication and Networking: Introduction; Data communications: components, data representation (ASCII, ISO etc.), direction of data flow (simplex, half duplex, full duplex); network criteria, physical structure (type of connection, topology), categories of network (LAN, MAN, WAN); Internet: brief history, Protocols and standards; Reference models: OSI reference model, TCP/IP reference model, their comparative study.

Module II [10L]:

Types of errors, framing(character and bit stuffing), error detection & correction methods; Flow control Protocols: Stop & wait ARQ, Go-Back- N ARQ, Selective repeat ARQ, HDLC; Medium Access sub layer, Point to Point Protocol, Token Ring, Reservation, Polling, Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA; Traditional Ethernet, fast Ethernet (in brief).

Module III [10L]:

Internetworking & devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway; Addressing: IP addressing, subnetting; Routing techniques: static vs. dynamic routing; Unicast Routing Protocols: RIP, OSPF, BGP; Other Protocols: ARP, IP, ICMP, IPV6; Transport layer: Process to Process delivery; UDP; TCP; Congestion Control: Open Loop, Closed Loop choke packets; Quality of service: techniques to improve QoS, Leaky bucket algorithm, Token bucket algorithm,

Module IV [8L]:

Introduction to DNS, SMTP, SNMP, FTP, HTTP & WWW; Security: Cryptography (Public, Private Key based), Digital Signature, Firewalls; ISDN services & ATM, DSL technology, Cable Modem: Architecture & Operation in brief; Wireless LAN: IEEE 802.11, Introduction to blue-tooth.

Books:

1. B. A. Forouzan – “Data Communications and Networking (5th Ed.)” – TMH
2. A. S. Tanenbaum – “Computer Networks (4th Ed.)” – Pearson Education/PHI
3. W. Stallings – “Data and Computer Communications (5th Ed.)” – PHI/ Pearson Education
4. Zheng & Akhtar, Network for Computer Scientists & Engineers, OUP
5. Black, Data & Computer Communication, PHI

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|---|----------|----------|----------|--------------|----------------------|
| Course Name :Speech And Audio Processing | | | | | |
| Course Code : ECEN 3133 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 3 | 0 | 0 | 3 | 3 |

Course Outcomes:

After finishing this course the students will be able to

1. Apply their DSP course knowledge to a great extent.
2. Understand speech sounds, different digital models and synthesis filters.
3. Apply predictive techniques for efficient coding and decoding.
4. Estimate time warping, distance measures while recognizing speech, words.
5. Analyze filter bank design for optimum results.
6. Design complicated filters and compare & choose best models for speech processing.

Module I [7L]:

Digital speech processing and its applications, production and classification of speech sounds, lossless tube models, digital models for speech signals; Analysis and synthesis of pole-zero speech models, Levinson recursion, lattice synthesis filter.

Module II [10L]:

Time dependent processing of speech, pitch period estimation, frequency domain pitch estimation; Discrete-time short-time Fourier transform and its application, phase vocoder, channel vocoder. Homomorphic speech processing, waveform coders, hybrid coders and vector quantization of speech; Model based coding: Linear predictive, RELP, MELP, CELP; Speech synthesis.

Module III [10L]:

Principles of speech recognition, spectral distance measures, dynamic time warping, word recognition using phoneme units, hidden Markov models and word recognition, speech recognition systems, speaker recognition. Ear physiology, psychoacoustics, perception model and auditory system as filter bank; Filter bank design and modified discrete cosine transform algorithm for audio compression in MP3 and AAC coders; Standards for high-fidelity audio coding.

Module IV [9L]:

Filter bank design and modified discrete cosine transform algorithm for audio compression in MP3 and AAC coders; Standards for high-fidelity audio coding. Tree-structured filter banks, multi-complementary filter banks; Properties of wavelets and scaling functions, wavelet transform; Filter banks and wavelets, applications of wavelet signal processing in audio and speech coding.

Books:

1. Rabiner, L.R. and Schafer, R.W., “Digital Processing of Speech Signals”, Pearson Education ,2006
2. Quatieri, T.F., “Discrete-Time Speech Signal Processing:Principles and Practice”, Pearson Education. 2002
3. Furui, S., “Digital Speech Processing, Synthesis and Recognition”, 2nd Ed., CRC Press. 2000
4. Spanias, A., Painter, T. and Venkatraman, A., “Audio Signal Processing and Coding”, John Wiley & Sons. 2007
- 5 Gold, B. and Morgan, N., “Speech and Audio Signal Processing”, John Wiley & Sons. 2002

3RD YEAR 2ND SEMESTER

| | | | | | |
|--|----------|----------|----------|--------------|----------------------|
| Course Name:Digital VLSI Design | | | | | |
| Course Code : ECEN3201 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 3 | 0 | 0 | 3 | 3 |

Course outcomes:

1. Students will be able to relate to different MOS structures and functions in order to apply the knowledge in building CMOS circuits
2. Students will learn VLSI Design Cycle, Style and Methodology.
3. Students will be able to determine logic and performance of CMOS combinational and Sequential Circuit including Memory Array Design.
4. Students will be able to construct Physical Layout Design and Stick Diagram of Digital Gates.
5. Students will be able to make use of various synthesis flow and HDL modeling in ASIC Semi Custom Design.
6. Students will be able to interpret Si Testing and Debug related algorithms and Fault Modeling.

Module I: VLSI Design Flow and CMOS Combinational Circuits: [14L]

Unit1: Evolution of Microelectronics: Moore's Law, Process Node Definition, Evolution of Process Technology, Scale of Integration (SSI, MSI, LSI, VLSI, ULSI, GSI), VLSI Design Trend and Challenges.

Unit2: VLSI Design Cycle, Y-Chart, Design Styles: Full Custom Design, Std Cell based Semi Custom Design, Gate Array Design, PLD, FPGA: CLB, LUT, MUX.

Unit 3 : MOS as Digital Switch: Principle of operation and Characteristics of Enhancement-mode MOS transistor, MOS as Capacitor, NMOS vs PMOS, CMOS Combinational Circuit: NMOS inverter issues, CMOS Inverter Transient Analysis, DC Characteristics and Noise Margin, Dynamic Power Dissipation issues. Static CMOS Logic Gate Design, Pass Transistor Logic and Transmission Gate (TG) Design, Logical effort, pseudo-nMOS Gates, Dynamic and Domino logic.

Module II: CMOS Sequential Circuits and Physical Design[10L]

Unit 1 : Bi-stability principle, SR Latch circuit and Clocked SR Latch using CMOS. CMOS and Transmission Gate (TG) based D-latch & Edge triggered Master Slave flip-flop, Setup and Hold Definition, basic idea of 1-Transistor DRAM Operation. SRAM Array Design: 6-Transistor Bit-cell

Design, Write Circuit, Sense Amplifier and Read Circuit, Pre-Charge Circuit, Decoder and I/O Design.

Unit 2 : CMOS Cross Section, Layout and Mask layers, Inverter Layout, Lambda Rule vs Micron Rule, Std Cell Layout Topology, Stick Diagram, Euler Path Algorithm .

Module III: Synthesis and HDL [8L]

Unit 1 : Synthesis – High level Synthesis, Logic level Synthesis, Physical Automation: Brief ideas on Partitioning, Floor-planning, Placement, Routing and Compaction

Unit 2 : HDL: Front-end Design Flow using HDL (Behavioral, RTL and Gate Level), Verilog Coding, Verilog Modeling: Behavioral, Data-Flow, Structural and Mixed, Test Bench coding, FSM Example: Mealy Machine and Moore Machine,

Module IV: Test Methodology of VLSI Circuits: [6L]

Si Testing: Why Testing, Challenge of Si-Testing, Manufacturing Defects, Die (Inter and Intra) Variation, Yield, DPM, Logical Fault Modelling: Stuck at Faults (D-Algorithm), Bridging Fault, Transistor Stuck open/Stuck Short, ATPG, DFT, Scan Design, BIST.

Text Books:

1. Principles of CMOS VLSI Design, A Systems Perspective, Author: Neil Weste, Kamran Eshraghian, Addison Wesley, 2nd Edition, 2000 .
2. CMOS VLSI Design, A Circuits and Systems Perspective (3rd Edition) Author: Neil Weste, David Harris, Ayan Banerjee. Pearson, 2011. Fundamental of VLSI Devices – Y. Taur& T.H. Ning- Cambridge University Press.

Reference Books:

3. CMOS Digital Integrated Circuits, Analysis and Design, Author: Sung-Mo Kang, Yusuf Leblebici, Tata McGraw Hill (3rd Edition), 2006 .
4. Digital Integrated Circuit, Design Perspective, Author: .M. Rabaey, Prentice-Hall
5. VLSI Design and EDA TOOLS, Author: Angsuman Sarkar, Swapnadip De, Chandan Kumar Sarkar, SCITECH PUBLICATIONS (India) Pvt. Ltd., 2011.

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|--|----------|----------|----------|--------------|----------------------|
| Course Name: Digital VLSI Design Laboratory | | | | | |
| Course Code : ECEN3251 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 0 | 0 | 2 | 2 | 1 |

Course Outcomes:

After completing the following experiments, students will be able to:

1. Learn Industry Standard Backend and Frontend CAD Tools
2. Design CMOS Combinational Digital Gates
3. Design TG Sequential Digital Gates
4. Learn Industry Standard Verilog HDL Design, simulation and Synthesis.

List of Experiments:

3 Category of Experiments:

1. **Backend:** Sub Micron and Deep Sub Micron Technology based Experiments:
Backend Design flow using **Industry Standard Mentor Graphics** CAD Tool including **Eldo** Circuit Simulator (SPICE Analysis):
 - a. Transient analysis of CMOS Inverter Circuit
 - b. DC & Parametric analysis of CMOS Inverter
 - c. Design and Analysis of Various CMOS Logic Gates (NAND, NOR, other CMOS gates)
 - d. Design and Analysis of Various TG (Transmission Gate) based Logic Gates (XOR, XNOR)
 - e. Implementation of TG based Various Sequential Gates (D-Latch, D-Flip-Flop) and Setup/Hold Analysis.
2. **Frontend:** Introduction to **XILINX-Vivado** Simulator: Verilog Coding and Test Bench Simulation
 - a. Logic Design and Verification of Digital Gates: Mux, Encoder, Decoder
 - b. Logic Design and Verification of a 4bit Ripple-Carry Adder
 - c. Logic Design and Verification of Sequential Gates: D-Latch, D-Flip-Flop
 - d. Logic Design and Verification of a Finite State Machine
3. **Synthesis and P & R:FPGA** Flow using XILINX Hardware Kits: Implementing and verifying many of above experiments in FPGA hardware Kits.

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|---|----------|----------|----------|--------------|----------------------|
| Course Name: OBJECT ORIENTED PROGRAMMING USING C++ | | | | | |
| Course Code : CSEN3208 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 3 | 0 | 0 | 3 | 3 |

Course Outcomes:

Students who complete the course will demonstrate the ability to do the following:

1. Learn object oriented concepts and various syntax and semantics using C++ and merits of object oriented approach over procedural approach.
2. Understand various properties of OOP for appropriate use in problem solving.
3. Analyze the real life problem to identify the related objects and abstract them to classes
4. Apply various object oriented properties and reusable components in solution building.
5. Evaluate for using standard patterns and for improving performance of solution using exception handling.
6. Develop the object oriented application using C++.

Module-I:

- **Overview of Object Oriented Concepts [2L]**
 - Difference between OOP and other conventional programming – advantages and disadvantages
 - Class, object, message passing, inheritance, encapsulation, polymorphism
- **Basic Programming with C++ [8L]**
 - Data Types, Operators
 - Control Statements and Loops
 - Functions and Parameters
 - Arrays, Pointers and References
 - String Manipulation
 - Fundamentals of Class and Object
 - Constructor and Destructor

Module-II:

- **Classes and Objects [10L]**
 - Abstraction, Encapsulation, Access Specifier
 - Static Member and Friend Function
 - Function Overloading
 - Operator Overloading

Module-III:

- **Overloading and Inheritance [8L]**

- Inheritance
- Derived Class
- Polymorphism and Overriding [4L]
 - Abstract Class
 - Runtime Polymorphism
 - Virtual Base Class
 - Overriding

Module-IV:

- **Exception Handling** [2L]
- **Namespace** [2L]
- **Templates** [4L]
 - Class Template
 - Function Template

Textbooks / References:

1. Bjarne Stroustrup – “The C++ Programming Language” – Pearson
2. Robert Lafore – "Object-oriented Programming in C++" – SAMS Publishing
3. E Balagurusamy – "Object Oriented Programming with C++" – 6th Edition – McGraw Hill
4. Steve Oualline – “Practical C++ Programming” – O’Reilly
5. James Rumbaugh & Michael Blaha – "Object Oriented Modeling and Design" – Prentice Hall, India

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|---|----------|----------|----------|--------------|----------------------|
| Course Name: Object Oriented Programming Concept by using C++ Laboratory | | | | | |
| Course Code : CSEN3258 | | | | | |
| Contact Hours | L | T | P | Total | Credit Points |
| per week | 0 | 0 | 2 | 2 | 1 |

Course Outcomes:

Students who complete the course will be able to

1. Perform object oriented programming to develop solutions to problems demonstrating usage of control structures, modularity, I/O. and other standard language constructs.
2. Demonstrate proficiency of object oriented programming in developing solutions to problems demonstrating usage of data abstraction, encapsulation, and inheritance.
3. Demonstrate ability to implement one or more patterns involving realization of an abstract interface and utilization of polymorphism in the solution of problems which can take advantage of dynamic dispatching.
4. Learn other features of the C++ language including use of templates, and handling exceptions.

Following topics are to be covered in the lab:

1. Basic Programming
2. Class
3. Constructor
4. Function Overloading
5. Operator Overloading
6. Inheritance
7. Polymorphism
8. Function Overriding
9. Exception Handling
10. Templates

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|---|----------|----------|----------|--------------|----------------------|
| Course Name: Economics for Engineers | | | | | |
| Course Code : HMTS3201 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 3 | 0 | 0 | 3 | 3 |

Course Outcome:

The student will be able to-

1. Evaluate a project and estimate the total cost of the project
2. Apply financial analytical methodologies to prepare a report regarding the financial performance of an organization
3. Participate actively in an organization's capital budgeting process
4. Provide vital inputs regarding the pricing of a product
5. Apply the knowledge of the interplay of various economic variables and indicators in workplace
6. Provide insight about different accounting concepts and apply broader concepts like costs, revenues, assets, liabilities, capital, profit, investment and interest

Module 1: (6L)

Market: Meaning of Market, Types of Market, Perfect Competition, Monopoly, Monopolistic and Oligopoly market. The basic concept of economics – needs, wants, utility.

National Income-GDP, GNP. Demand & Supply, Law of demand, Role of demand and supply in price determination, Price Elasticity. Inflation: meaning, reasons, etc.

Module 2: (4L)

Business: Types of business, Proprietorship, Partnership, Joint-stock company, and cooperative society – their characteristics.

Banking: role of commercial banks; credit and its importance in industrial functioning. Role of central bank: Reserve Bank of India. International Business or Trade Environment.

Module 3: (14 L)

Financial Accounting-Journals, Ledgers, Trial Balance, Profit & Loss Account, Balance Sheet.

Financial Statement Analysis (Ratio and Cash Flow analysis).

Cost Accounting- Terminology, Fixed, Variable and Semi-variable costs.

Break Even Analysis. Cost Sheet. Budgeting and Variance Analysis.

Marginal Cost based decisions.

Module 4: (12 L)

Time Value of Money: Present and Future Value, Annuity, Perpetuity. Equity and Debt, Cost of Capital.

Capital Budgeting: Methods of project appraisal - average rate of return - paybackperiod - discounted cash flow method: net present value, benefit cost ratio, internal rate of return. Depreciation and its types, Replacement Analysis, Sensitivity Analysis.

Suggested Readings:

1. R. Narayanswami, Financial Accounting- A Managerial Perspective. Prentice-Hall of India Private Limited. New Delhi
2. Horne, James C Van, Fundamentals of Financial Management. Prentice-Hall of India Private Limited, New Delhi
3. H. L. Ahuja., Modern Economic Theory. S. Chand. New Delhi.
4. Newman, Donald G., Eschenbach, Ted G., and Lavelle, Jerome P. Engineering Economic Analysis. New York: Oxford University Press. 2012.

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|---|----------|----------|----------|--------------|----------------------|
| Course Name : Digital Image Processing & Pattern Recognition | | | | | |
| Course Code : ECEN 3231 | | | | | |
| Contact | L | T | P | Total | Credit Points |
| Hours per week | 3 | 0 | 0 | 3 | 3 |

Course outcomes:

After completing the course the student will be able to:

1. Gain a working knowledge about the mathematical tools needed for Image Processing and Pattern Recognition.
2. Understand the need for different types of digital image transforms their properties and application.
3. Evaluates the technique for morphological operations and image compression.
4. Gain knowledge about the fundamentals of Pattern Recognition like recognition, decision making and statistical learning problems.
5. Identify parametric and non-parametric techniques, supervised and unsupervised learning of pattern recognition.
6. Design systems and algorithms for Image Processing and Pattern Recognition.

Digital Image Processing

Module 1 [12L]

Digital Image Acquisition: Sampling and quantization; spatial, grey level and temporal resolution.

Spatial domain Processing: Pixel point processing; linear and piecewise linear transformations, log and power law transformations, Image Histogram and histogram equalization,

Pixel Group Processing: Convolution in spatial domain, low frequency and high frequency filtering, mean and median filters.

Frequency Domain Processing: Relation with spatial domain convolution, standard low pass and high pass spatial domain filters.

Module 2 [8L]

Morphological operations: Dilation, Erosion, Opening and Closing, Boundary extraction, Region filling.

Colour Image Processing: RGB and HIS colour models and interrelation,

Image Compression Standards: Lossy and lossless compressions, BMP, TIFF & JPG image formats.

Module 3 [10L]

Introduction to the Pattern Recognition System: Components of Pattern Recognition System, Learning and adaptation, Supervised Learning (Classification) and Unsupervised Learning (Clustering), Bayesian Decision Theory: classifiers, discriminant functions, decision surfaces, Discriminant functions for Normal density, Error bounds for Normal density, Maximum Likelihood and Bayesian Parameter Estimation, Principal Component Analysis, Fisher Linear Discriminant, Hidden Markov Models.

Module 4 [10L]

Non-parametric Techniques & Feature Extraction: Parzen window estimation, k-nearest neighbour classification, Perceptron classifier, Support Vector Machines, Decision Tree based classifiers. Feature extraction – discrete cosine and sine transform, Principal Component analysis, Kernel Principal Component Analysis.

Text Books:

1. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Pearson.
2. R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley.
3. S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press.
4. C. M. Bishop, “Pattern Recognition and Machine Learning”, Springer.

References:

1. C. Solomon, T. Breckon, Fundamentals of Digital Image Processing: A Practical Approach with Examples, Wiley
2. K. Fukunaga, “Statistical pattern Recognition”, Academic Press.

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|---|----------|----------|----------|--------------|----------------------|
| Course Title: Internet of Things (IoT) for Communication | | | | | |
| Course Code : ECEN 3232 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 3 | 0 | 0 | 3 | 3 |

Course Outcomes:

1. The students will know about IoT and the concept behind.
2. Students will be able to explain about the importance of radio transmission for IoT applications and different standards to match varying requirements, M2M area network , Physical Layers, IEEE 802.15.4 family of protocols.
3. They will be able to explain M2M protocols for Sensor networks and be able to apply knowledge for building and home automation.
4. The students will know about ZigBee and ZigBee smart energy protocols.
5. The students will know about next generation IP-based protocols like 6LoWPAN and RPL.
6. They should be able to analyze communication systems with ideas from Smart Grid and Electric Vehicle Charging projects.

Module – I [6 L]

IoT- the concept and technology, M2M – the idea and the tools required. Reliable, interference free radio communication- the challenges and present scenario.

Module – II [12 L]

M2M- area network physical layers, IEEE802.15.4 – physical layer, Medium Access Control (MAC) layer, uses. Poweline communication for M2M applications. Legacy protocols for Sensor Networks, Building and Home automation.

Module – III [9 L]

ZigBee- standard ,ZigBee and 802.15.4, Network Layer, Security, Applications, Z-wave concept, Protocols for M2M metering using wireless M-BUS

Module – IV [9 L]

Next generation IP based protocols – 6LoWPAN and RPL, typical applications of wireless M2M applications- Smart Grid, Electric Vehicle Charging.

References:

- 1.The Internet of Things: Key Applications and Protocols- Olivier Hersent, David Boswarthick and Omar Elloumi, John Wiley and Sons Ltd., Published 2012.

| | | | | | |
|--|----------|----------|----------|--------------|----------------------|
| Course Title: Power Electronics | | | | | |
| Course Code : ECEN 3233 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 3 | 0 | 0 | 3 | 3 |

Course Outcomes:

1. The students will understand the importance of this course.
2. They will learn the details of power semiconductor devices (Construction, Characteristics and operation).
3. The students will understand the working of various types of rectifiers.
4. They will be able to analyze the choppers and converters and their operations.
5. They will be familiar with inverters and will recognize the role of power electronics in emerging areas.
6. The students will be able to design an efficient power supply for a given application.

Module I: [10L]

Power semiconductor devices: Power diodes- general purpose diode, fast recovery diodes, Schottky diode, PNP devices, Thyristor, DIAC, TRIAC, G.T.O. devices. Power Transistors, Power MOSFET, Rating of power devices, Losses and Cooling. Triggering circuits for SCR, SCR commutation circuits, UJT, Schmitt trigger circuits – Power MOS gate drive circuits.

Module II: [9L]

Uncontrolled and controlled Rectifiers: Single phase and poly phase half wave and full wave rectifiers with resistive load and RL load, freewheeling diode, Transformer ratings. Single phase & three phase Converter operation: Power factor and its improvement, regulation, Pulse converters, power factor control via PWM converters.

Module III: [8L]

D.C. Choppers: Principles, classification, use. Buck, Boost, Buck-Boost and Cuk Converters, Concept of resonant switching, Cycloconverter single and three phase circuits, blocked group operation, circulating current mode.

Module IV: [9L]

Single phase and three phase inverters, constant voltage source and constant current source inverters, HF inverters for heating. Application: D.C. and A.C. drives, S.M.P.S., Resonant converters, A.C. Line Filters, interference suppression. Speed control of AC/DC motors.

Books:

1. M.H.Rashid, 'Power Electronics: Circuits, Devices and Applications', Pearson Education, PHI Third Edition, New Delhi, 2004.
2. P.S.Bimbra "Power Electronics" Khanna Publishers, third Edition, 2003.
3. L. Umanand, "Power Electronics Essentials and Applications", Wiley, 2010.
4. P.C Sen, Power Electronics, TMH

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|---------------------------------------|----------|----------|----------|--------------|----------------------|
| Course Name : Network Security | | | | | |
| Course Code : ECEN 3234 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 3 | 0 | 0 | 3 | 3 |

Course outcomes:

After completing the course the student will be able to:

1. Understand various tools and protocols for different levels of security.
2. Compare various Cryptographic Techniques.
3. Describe the principles of public-key cryptosystems, hash functions, and digital signature.
4. Add secure coding in the developed applications.
5. Have enough knowledge about various Intrusion algorithm.
6. Design secure systems and applications.

Module 1 [10L]

Services, Mechanisms and attacks-the OSI security architecture-Network security model-Classical Encryption techniques-Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Simplified Data encryption standard (DES), DES, The strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of Operation, Evaluation Criteria for Advanced Encryption Standard, The AES Cipher.

Module 2 [10L]

Principles of Public-Key Cryptosystems, The RSA algorithm, Key Management, Diffie-Hellman Key Exchange, Elliptic Curve Arithmetic, Authentication functions, Hash Functions. Digital signatures, Authentication Protocols, Digital Signature Standard.

Module 3 [6L]

Web Security Consideration, Security socket layer (SSL) and Transport layer security, Secure Electronic Transaction. Intruders, Intrusion Detection, Password Management.

Module 4 [6L]

Viruses and Related Threats, Virus Countermeasures. Firewalls Design Principles, Trusted Systems.

Text Books:

1. William Stallings, "Cryptography and Network Security", 6th Edition, Pearson Education,
2. Charlie Kaufman, Radia Perlman and Mike Speciner, "Network Security, Private communication in a public world", 2nd Edition, Prentice Hall of India.
3. Douglas R. Simson, "Cryptography - Theory and Practice", CRC Press.

References:

4. Behrouz A. Ferouzan, "Cryptography & Network Security", Tata McGraw Hill.
5. Bruce Schneier, Niels Ferguson, "Practical Cryptography", Wiley Dreamtech India Pvt Ltd.
6. Charles Pfleeger, "Security in Computing", 4th Edition, Prentice Hall of India.

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|---|----------|----------|----------|--------------|----------------------|
| Course Name : Advanced Digital Communication | | | | | |
| Course Code : ECEN 3235 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 3 | 0 | 0 | 3 | 3 |

Course Outcomes:

1. Students will learn about the transmission techniques, synchronization in digital communication.
2. They will compare the multiple access schemes, OFDMA etc.
3. The students will acquire knowledge about the CDMA in details. Technologies like SIMO and MIMO.
4. The students will have clear idea about estimation and detection schemes. They will be able to design reliable channel coding system.
5. They will understand the differences between coding schemes – both source and channel types.
6. The students will be able to analyse the quality obtained in a digital link.

Module I [9L]

Review of random variables and random processes

Review of baseband digital signal transmission –PCM DM ADM ADPCM. Inter Symbol Interference (ISI)

Review of digital modulation schemes – BPSK DPSK QPSK M-ary PSK etc., idea of signal space, bandwidth efficiency. Nyquist criteria for no ISI in band limited channel

Module II [6L]

GMSK Orthogonal frequency division multiplexing (OFDM) – principles of generation and detection, OFDMA

Equalizer: Linear equalization, Decision feedback equalizer, iterative equalizer and decoding

Multiplexing and multiple access: TDM/TDMA FDM/FDMA Space DMA ALOHA – slotted ALOHA and reservation ALOHA

Module III [12L]

Spread spectrum modulation: Principle of DSS, processing gain, jamming margin, single tone interference, probability of error, Principle of frequency hopping spread spectrum (FHSS) – slow frequency and fast frequency hopping

Principle of CDMA Multiple access interference (MAI) and limit of simultaneous users Digital cellular CDMA system – forward and reverse link error rate performance.

Module IV [9L]

Optimum Detection and Estimation: Noise vector in signal space Bayes detection of received signal, optimum M-ary receiver design Decision region and minimum error probability

Optimum detection of 16 QAM signal, MPSK signal orthogonal and bi orthogonal signal Decision criterion: maximum likelihood, Neyman, Pearson and Minimax decision criterion Estimation: Linear estimation – simple mean, Linear mean, squared error Wiener filter Non linear estimation: Bayes estimation Source coding and Channel coding, Channel coding using different techniques.

BOOKS:

1. Digital Communications 4th edition J G Proakis MGH international Edition
2. Principle of Communication Systems Taub and Schilling 7th edition TMH
3. Digital Communications :Fundamentals and Applications 2nd edn 2008 Bernard Sklar and Pabitra Kumar Ray Pearson Education
4. Principle of Digital Communications Simon Haykin Wiley Student Edition
5. Digital Communications Zeimer and Tranter CRC Press
6. Analog and digital Communication, B.P. Lathi, Oxford University Press.

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|---|----------|----------|----------|--------------|----------------------|
| Course Title : Wireless and Cellular Communication | | | | | |
| Course Code : ECEN 3211 | | | | | |
| Contact hours per week : | L | T | P | Total | Credit Points |
| | 3 | 0 | 0 | 3 | 3 |

Course Outcome:

After completing this course, the students will be able to:

1. The students will learn about the evolution of radio communication.
2. They will be able to appreciate the challenges of RF communication.
3. Different wireless networks and their operations will be clear to them.
4. The students will learn about the current multiplexing and modulation schemes.
5. They will be able to understand the functioning of internet protocols.
6. Our students will be able to take up research work in communication domain.

Module I: [11L]

- **Introduction**

Brief introduction to wireless communication system and system, Evolution history of different wireless cellular networks generations- 1G, 2G, 3G and 4G networks, Brief introduction of 5G network, Potential challenges [2L].

- **Cellular Networks: Design Fundamentals**

Principle of cellular communication, Description of cellular system- Cellular Structure, Cell clustering, and Capacity enhancement techniques for cellular networks, Frequency Reuse- Co-channel and Adjacent channel interferences, Channel Assignment Strategy, Handoff Schemes, Mobility Management- Location, Radio Resource and Power management [4L]

Radio Propagation Path Loss Models :Large Scale and Small Scale

Introduction to Radio Wave Propagation, Multipath Propagation Mechanism and Effects on Wireless Communication, Propagation Models for Wireless Networks- Free space propagation model, Ground reflection (Two-Ray) model, Log distance path loss model, Log normal shadowing model, Brief Description on Outdoor and Indoor Propagation Models, Small-Scale Multipath Propagation- Influencing factors and Doppler shift, Parameters of Mobile Multipath Channel, Types of Small Scale Fading. [5L]

Module II: [9L]

- **Multiple Access Techniques for Wireless Communications**

Introduction to Multiple Access Techniques, Narrow Band Channelized Systems- Frequency Division Duplex and Time Division Duplex Systems, Frequency Division Multiple Access, Time Division Multiple Access, Wideband Systems- Principles of WDM, Spread Spectrum Multiple Access, Space Division Multiple Access, Orthogonal Frequency Division Multiple Access, Random Access Method- Pure and Slotted ALOHA, Carrier Sense Multiple Access with collision detection and collision avoidance . [4L]

- **Equalization and Diversity Techniques**

Fundamentals of Equalization, Types of Equalizer-Linear and Nonlinear Equalizer, Diversity Techniques-Frequency, Time and Space, RAKE Receiver. [2L]

- **GSM & GPRS: Architecture and Protocols- 2G & 2.5G**

Introduction, GSM Subsystems, GSM Subsystems entities, GSM Air Interface, GSM Frequency Bands and Allocation Strategies, GSM Channel Structure, GSM Call Set-up Procedure, GPRS (2.5G) Network Architecture, GPRS Attachment and Detachment Procedure. [3L]

Module III [10L]

- **Digital Modulation Techniques for Wireless Communications**

Digital Modulation-An overview, Types of Digital Modulation Techniques, Linear Modulation Techniques- Binary Phase Shift Keying, Quadrature Phase Shift Keying, Concept of M-ary Communication, Constant Envelope Modulation- Gaussian Minimum Shift Keying, Quadrature Amplitude Modulation, Spread Spectrum Modulation Techniques. [5L]

- **Overview of CDMA Systems- 2G**

CDMA Evolution-An overview, CDMA IS-95 Systems, CDMA Channel Concept-Forward and Reverse, Transmission Power Control- Near Far Problem and Multipath Phenomenon, Handoff Process. [3L]

- **The Universal Mobile Telecommunication System-3G**

UMTS Network Architecture, Frequency Allocation Strategy, UMTS Channels. Practical application of optical communication in IFL (Inter facility link)[2L]

Module IV [6L]

- **Fundamentals of Wireless Local Area Networks**

Introduction to wireless LAN 802.11X technologies, WLAN System Architecture, Bluetooth Introduction to Broadband wireless MAN, 802.16X technologies. [3L]

- **Mobile Internet Protocol**

Basic Mobile IP, Mobile IP Type-MIPv4 and MIPv6, Basic Entities of MIPv4, MIPv4 Operations, Registration, Tunneling and Reverse Tunneling, Triangular Routing. **[3L]**

Text Books:

1. Wireless Communications: Principles and Practice, T.S. Rappaport, Pearson Education
2. Wireless Communication and Networks: 3G and Beyond, I.SahaMisra, TMH Education.
3. Wireless Communication and Networking, Vijay K. Garg, Morgan Kaufmann Publishers Inc.

Reference Books:

1. Wireless Digital Communications: Modulations and Spread Spectrum Applications, K. Feher, Prentice Hall.
2. Wireless Communications and Networking, J.W.Mark and W. Zhuang, PHI.

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|--|----------|----------|----------|--------------|----------------------|
| Course Title : Wireless and Cellular Communication Laboratory | | | | | |
| Course Code : ECEN 3261 | | | | | |
| Contact hours per week : | L | T | P | Total | Credit Points |
| | 0 | 0 | 2 | 2 | 1 |

Course Outcome:

1. The students will be able to correlate different theories of wireless communication with practical experiments.
2. They will learn the procedures for testing radio parameters.
3. They will learn working of fiber optic links.
4. Students will be learn various real time applications of wireless communication system.

Experiments:

Exp1: RSSI measurement using the satellite trainer kit at 2.4 GHz in line of sight (LOS) and non-line of sight (NLOS) conditions for variable distance.

Exp2: Determine the importance of repeater station in wireless communication by the measurement of signal strength using satellite trainer kit at 2.4 GHz.

Exp3: Study the working of AT commands in the global system for mobile (GSM) and observe the waveforms of different timing signals.

Exp4: Study of Global Positioning System (GPS) and plotting of active satellite with SNR etc.

Exp5: Study of spread spectrum: DSSS modulation and demodulation.

Exp6: Study of LASER characteristics.

Exp7: Measurement of propagation loss, bending loss and connector loss in an optical fiber using B-link kit.

Exp8: Measurement of numerical aperture of a optical fiber using B-link kit.

Exp9: Study of time division multiplexing (TDM) using fiber optic data link.

Exp10: Experiment beyond Curriculum.

OPEN ELECTIVE -1

| | | | | | |
|---|----------|----------|----------|--------------|----------------------|
| Course Title: Artificial Intelligence In Radio Communication | | | | | |
| Course Code : ECEN 3221 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 3 | 0 | 0 | 3 | 3 |

Course Outcomes:

The students after studying this course will be able to:

1. Understand difference between passive radios and cognitive radios.
2. Explain difference between SDR and cognitive Radios
3. Apply in AI in radios.
4. Analyze weakness on cognitive radios
5. Develop radios based on Genetic Algorithm (GA).
6. Evaluate radio performance.

Module – I [10L]

SDR- history, concept (reconfigurable radios) ,SDR- benefits, problems, GNU radio design.

Cognitive Radios- brief history, basic concept;Cognitive Radio Design, Cognitive Engine Design.

AI in wireless communication; AI techniques in radios.

Module – II [10L]

Optimization of Radio Resources,

Multi-objective optimization- BER, Transmit Power, Bandwidth, Spectral Efficiency, Interference, SINR, dependence.

Module – III [8L]

Genetic Algorithms for Radio optimization,

Review, simple example, multi-objective GA, Wireless system- GA, simple CDBT example

Module – IV [8L]

Cognitive Radio Network, Distributed AI,

Example- Cognitive Engine, System Design, Interference, Over-the-air results.

Suggested Books:

1. Artificial Intelligence in Wireless Communications-By Rondeau, Thomas W; Bostian, Charles W, Artech House, 2009

2. Cognitive Radio Techniques : Spectrum Sensing, Interference Mitigation and Localization-
By Sithampanathan, Kandeepan; Giorgetti, Andrea, Artech House, 2012

3. Cognitive Radio Technology-By Bates, Martin; Fettee, Bruce A, Elsevier Science & Technology

4. All the titles are available with British Council Library- on line.

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|--|----------|----------|----------|--------------|----------------------|
| Subject Name: Fundamentals Of Sensors And Transducers | | | | | |
| Paper Code: AEIE3221 | | | | | |
| Contact hrs per week: | L | T | P | Total | Credit points |
| | 3 | 0 | 0 | 3 | 3 |

Course Outcomes:

After the completion of the course, the students will be able to:

1. Use different methods for converting a physical parameter into an electrical quantity.
2. Select the best fit transducers, including those for measurement of temperature, strain, motion, position and light intensity.
3. Choose proper sensor comparing different standards and guidelines to make sensitive measurements of physical parameters like displacement, stress, force, acceleration, flow, etc.
4. Acquire knowledge on high temperature sensing systems used in steel, aluminium, and copper plants.
5. Learn basic principle of smart sensors.
6. Identify different type of sensors used in real life applications and know their importance.

Module I [10 L]

Definition, principle of sensing & transduction, classification of transducers.

Resistive Transducers:

Potentiometric transducer- Construction, symbol, materials, loading effect, error calculations, sensitivity.

Strain gauge- Theory, type, materials, gauge factor, temperature compensation and dummy gauge, adhesive used to mount strain gauge.

Inductive sensor- Principle, common types, Reluctance change type, Mutual inductance change type, transformer action type. LVDT- Construction, working principle.

Module II [6 L]

Capacitive sensors: Variable distance-parallel plate type, variable area- parallel plate, variable dielectric constant type, calculation of sensitivity, Microphone, response characteristics.

Piezoelectric transducers: piezoelectric effect, charge and voltage co-efficient and relationships, crystal model, materials, natural & synthetic type, charge amplifier.

Ultrasonic sensors- Liquid velocity and level measurements.

Module III [12 L]

Thermal sensors:

Resistance Temperature Detector (RTD) - materials, temperature range, R-T characteristics, configurations, applications.

Thermistors- materials, shape, R-T characteristics, ranges and accuracy specification.

Thermocouple- Thermo electric laws, types, temperature ranges, series and parallel configurations, cold junction compensation, compensating cables.

Thermal Radiation sensors- types, constructions and comparison.

Introduction to semiconductor type temperature sensors.

Module IV [8 L]

Radiation sensors:

LED, LDR, photodiodes, Photovoltaic cells, photo emissive cell types, materials, construction, response, applications.

Geiger counters, Scintillation detectors.

Introduction to smart sensors.

References:

1. Sensor & transducers, D. Patranabis, 2nd edition, PHI
2. Instrument transducers, H.K.P. Neubert, Oxford University press.
3. Measurement systems: application & design, E.A.Doebelin, McGraw Hill

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|--|----------|----------|----------|--------------|----------------------|
| Subject Name: Fundamentals of RDBMS | | | | | |
| Paper Code: CSEN 3221 | | | | | |
| Contact hrs per week: | L | T | P | Total | Credit points |
| | 3 | 0 | 0 | 3 | 3 |

Course Outcome: At the end of the course, the students will be able to:

CSEN3221.1. Identify the basic concepts and various data model used in database design. Be able to model an application's data requirements using conceptual modeling tools like ER diagrams and design database schemas based on the conceptual model.

CSEN3221.2. Formulate relational algebra expression for queries and evaluate it using the concept of query processing and optimization.

CSEN3221.3. Create RDBMS schema mapping various business validations and formulate queries based on that schema using SQL to satisfy business requirements.

CSEN3221.4. Apply normalization and various types of dependencies for evaluating a relational database design.

CSEN3221.5. Apply and relate the concept of transaction, concurrency control and recovery in database.

CSEN3221.6. Understand with basic database storage structures and access techniques: file and page organizations, indexing methods including B tree, and hashing.

Module 1 [8L]

Introduction: Concept & Overview of DBMS, Data Models, Database Languages, Role of database administrator and database Users, Three Tier architecture of DBMS.

Entity-Relationship Model: Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features.

Module 2 [10L]

Relational Model:

Structure of relational Databases, Relational Algebra, Extended Relational Algebra Operations, Views, Modifications of the Database.

Relational Database Design: Functional Dependency, Different anomalies in designing a Database., Normalization using functional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Normalization using multi-valued dependencies.

Module 3 [8L]

SQL and Integrity Constraints: Concept of DDL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, views, Nested Subqueries, Stored procedures and triggers.

Module 4 [10L]

Internals of RDBMS: Transaction processing, Concurrency control and Recovery Management: transaction model properties, state serializability, lock base protocols, two phase locking.

File Organization & Index Structures: File & Record Concept, Placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes, Dynamic Multilevel Indexes using B tree and B+ tree.

Text Books:

1. Henry F. Korth and Silberschatz Abraham, —Database System Concepts, Mc.Graw Hill.
2. Elmasri Ramez and Navathe Shamkant, —Fundamentals of Database Systems, Benjamin Cummings Publishing Company.
3. Ramakrishnan: Database Management System, McGraw-Hill.
4. Gray Jim and Reuter Address, —Transaction Processing: Concepts and Techniques, Moragan Kauffman Publishers.
5. Jain: Advanced Database Management System Cyber Tech.
6. Date C. J., —Introduction to Database Management, Vol. I, II, III, Addison Wesley.
7. Ullman JD., —Principles of Database Systems, Galgottia Publication.

References:

1. James Martin, —Principles of Database Management Systems, 1985, Prentice Hall of India, New Delhi
2. Fundamentals of Database Systems, Ramez Elmasri, Shamkant B.Navathe, Addison Wesley Publishing Edition.
3. Database Management Systems, Arun K.Majumdar, Pritimay Bhattacharya, Tata McGraw Hill

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|---|---|---|---|-------|---------------|
| Course Name: Computational Mathematics | | | | | |
| Course Code: MATH3221 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 3 | 0 | 0 | 3 | 3 |

1. **MATH3221.1.** Identify patterns in data in the form of recurrences and using the latter to evaluate finite and infinite sums.
2. **MATH3221.2.** Explain combinatorial phenomena by using binomial coefficients, generating functions and special numbers.
3. **MATH3221.3.** Solve computational problems by applying number theoretic concepts such as primality, congruences, residues etc.
4. **MATH3221.4.** Analyze the properties of networks by invoking graph theoretic concepts such as connectivity, matchings, colouring etc.
5. **MATH3221.5.** Combine the concepts of recurrences, sums, combinatorics, arithmetic and graph theory in order to comprehend computational methods.
6. **MATH3221.6.** Interpret mathematically the algorithmic features of computational situations.

Module I:

Sums: Sums and recurrences, manipulation of sums, multiple sums, general methods, finite and infinite calculus, infinite sums 9L

Module II:

Binomial coefficients and special numbers: Basic identities involving binomial coefficients. Bernoulli numbers, Euler numbers, harmonic numbers, Fibonacci numbers, recurrence relations for these numbers. 9L

Module III:

Integer functions and arithmetic: Floors and ceilings, the binary operation ‘mod’, divisibility, primes, relative primality, the congruence relation ‘mod’, residues, Euler phi function, Fermat’s Little Theorem, Wilson Theorem, primitive roots, the law of quadratic reciprocity, (Statement only). 9L

Module IV:

Generating functions: Basic manoeuvres, well-known sequences and their generating functions, using generating functions to solve recurrences, generating functions for special numbers. 9L

References:

1. Ronald Graham, Donald Knuth, Oren Patashnik, 'Concrete Mathematics', Addison-Wesley
2. Douglas B. West, 'Introduction to Graph Theory', Pearson

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|---|---|---|---|-------|---------------|
| Course Name: ADVANCED PROBABILITY AND INFORMATION THEORY | | | | | |
| Course Code: MATH3222 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 3 | 0 | 0 | 3 | 3 |

After successfully completing this course the students will be able to:

1. **MATH3222.1:** Articulate the axioms (laws) of probability.
2. **MATH3222.2:** Compare and contrast different interpretations of probability theory selecting the preferred one in a specific context.
3. **MATH3222.3:** Formulate predictive models to tackle situations where deterministic algorithms are intractable.
4. **MATH3222.4:** Quantifies the amount of uncertainty involved in the value of a random variable or the outcome of a random process.
5. **MATH3222.5:** Apply the data processing inequality to data science, machine learning and social science.
6. **MATH3222.6:** Develop the concept of data compression in the process of encoding information in signal processing .

MODULE-I: SINGLE AND BIVARIATE PROBABILITY DISTRIBUTIONS

- Review of basic probability : Axiomatic definition, Addition and Multiplication law, Conditional probability and Bayes' Theorem
- Expectation and Variance of single variable discrete and continuous distributions
- Covariance and variance of sums of random variables
- Moment generating functions
- Markov's inequality, Chebyshev's inequality and law of large numbers
- Joint distribution using joint probability mass/density function
- Finding marginal pmf/pdf from joint distribution
- Multiplicative property of joint pmf/pdf in case of independent random variables

MODULE-II: MARKOV CHAINS AND STATISTICAL METHODS

- Markov Chains: Introduction
- Chapman-Kolmogorov equations
- Classification of states

- Some applications: Gambler's Ruin Problem
- Measures of Central tendency: Moments, skewness and Kurtosis
- Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions
- Spearman's Rank Correlation coefficient
- Curve fitting: Straight line and parabolas

MODULE-III: CLASSICAL INFORMATION THEORY-I

- Motivation with some relevant examples
- Entropy : Definition with examples
- Joint Entropy and Conditional Entropy
- Relative Entropy and Mutual Information
- Relationship Between Entropy and Mutual Information
- Chain Rules for Entropy, Relative Entropy and Mutual Information
- Jensen's Inequality and Its Consequences
- Log Sum Inequality and Its Applications

MODULE-IV: CLASSICAL INFORMATION THEORY-II

- Data-Processing Inequality
- Sufficient Statistics
- Fano's Inequality
- Asymptotic Equipartition Property Theorem
- Consequences of the Asymptotic Equipartition Property Theorem: Data compression
- High probability sets and the Typical set

Suggested Books:

1. Introduction to Probability Models, *S.M.Ross*, Elsevier
2. Fundamentals of Mathematical Statistics, *S.C.Gupta and V.K.Kapoor*, Sultan Chand and Sons
3. An Introduction to Probability theory and its applications Vol-I, *W. Feller*, John Wiley and Sons
4. Elements of Information Theory, *Thomas M. Cover and Joy A. Thomas*, Wiley
5. Information Theory and Reliable Communication, *Robert G. Gallager*, John Wiley and Sons

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|--|---|---|---|-------|---------------|
| Course Name: Scientific Computing | | | | | |
| Course Code: MATH3223 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 3 | 0 | 0 | 3 | 3 |

After successfully completing this course the students will be able to:

1. **MATH3223.1:** Analyze certain algorithms, numerical techniques and iterative methods that are used for solving system of linear equations.
2. **MATH3223.2:** Implement appropriate numerical methods for solving advanced engineering problems dealing with interpolation, integration and differentiation.
3. **MATH3223.3:** Apply the knowledge of matrices for calculating eigenvalues and eigenvectors and their stability for reducing problems involving Science and Engineering
4. **MATH3223.4:** Develop an understanding to reduce a matrix to its constituent parts in order to make certain subsequent calculations simpler.
5. **MATH3223.5:** Develop the concept of predictor-corrector methods in solving Initial Value Problems numerically.
6. **MATH3223.6:** Apply numerical techniques in solving Boundary Value Problems where the analytical methods fail.

Module I

System of Linear Equations :

- Linear systems, solving linear systems
- Gauss elimination, pivoting and scaling, Gauss-Jordan method
- Symmetric positive definite systems and indefinite systems, Cholesky factorization
- Iterative method: Gauss Jacobi and Gauss Seidel, Error prediction and acceleration

Module II

Eigen Value problems:

- QR algorithm
- Power Method
- Linear least square data fitting
- Singular Value Decomposition

Module III

Interpolation, Integration & Differentiation:

- Purpose of interpolation
- Choice of interpolating function, Polynomial interpolation
- Piecewise polynomial interpolation: cubic spline interpolation
- General form of quadrature rule; Newton-Cotes rule, Gaussian quadrature rule
- Numerical Differentiation: Methods Based on Finite Difference approximations

Module IV

Initial Value & Boundary Value Problem:

- Multistep method to solve Initial Value Problem and its stability
- Predictor-corrector method: Adam Moulton method, Milne's Method
- Solving Boundary Value Problems: Finite Difference Method, Shooting Method

Books:

Text Book

1. Trefethen L. N. and Bau D. *Numerical Linear Algebra*, SIAM
2. Watkins D. S. *Fundamentals of Matrix Computation*, Wiley
3. Smith G. D. *Numerical Solutions to Partial Differential Equations*, Oxford University Press
4. Jain M. K. and Iyengar S.R.K. *Numerical methods for scientific and engineering computation*
5. Conte S. D. and BoorC. D. *Elementary Numerical Analysis - An Algorithmic Approach*, McGraw Hill
6. Atkinson K. E. *Introduction to Numerical Analysis*, John Wiley

Reference Books

1. Golub G. H. and Van Loan C.F. *Matrix Computation*, John Hopkins U. Press, Baltimore
2. Stewart G. W. *Introduction to Matrix Computations*, Academic Press
3. Demmel J.W. *Applied numerical linear algebra*, SIAM, Philadelphia
4. Jain M.K. *Numerical Solutions of Differential Equations*
5. Smith, *Numerical solutions of partial Differential Equations (Finite difference methods)*
6. Heath M. T., *Scientific Computing: An Introductory Survey*, McGraw Hill
7. Joe D. Hoffman, *Numerical Methods for Engineers and Scientists*, McGraw Hill
8. W. Layton and M. Sussman, *Numerical Linear Algebra*.

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|---|---|---|---|-------|---------------|
| Course Name: Indian Constitution and Civil Society | | | | | |
| Course Code: INCO3016 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 2 | 0 | 0 | 2 | 0 |

Course Outcomes

The learner will be able to-

1. Analyse the historical, political and philosophical context behind the Indian Constitution-making process
2. Appreciate the important principles characterizing the Indian Constitution and institute comparisons with other constitutions
3. Understand the contemporaneity and application of the Indian Constitution in present times
4. Critique the contexts for constitutional amendments in consonance with changing times and society
5. Establish the relationship between the Indian Constitution and civil society at the collective as well as the individual levels
6. Consciously exercise the rights and the duties emanating from the Indian Constitution to one's own life and work

Module 1- 6L

Introduction to the Constitution of India-Historical Background

Making of Indian Constitution -the process of framing the constitution, the constituent assembly

Module II-6L

Salient Features of the Indian constitution

Comparison with the constitutions of other countries

Module III-6L

Relevance of the Constitution of India

Constitution and Governance

Constitution and Judiciary

Constitution and Parliament-Constitutional amendments

Module IV-6L

Constitution and Society- democracy, secularism, justice

Constitution and the individual citizen- Fundamental Rights, Directive Principles of state policy and Fundamental Duties

Reference Books

C.M.Elliot, (ed.), Civil Society and Democracy, OUP, Oxford, 20012..

David Held et.al (ed),The Idea of the Modern State, Open Univ. Press, Bristol, 1993

Neera Chandoke, State and Civil Society, Sage, Delhi, 19953

Open Elective -1 (to be offered by ECE Department)

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|---|----------|----------|----------|--------------|----------------------|
| Course Name: Designing With Processors And Controllers | | | | | |
| Course Code : ECEN 3222 | | | | | |
| Contact Hours per week | L | T | P | Total | Credit Points |
| | 3 | 0 | 0 | 3 | 3 |

Course Outcomes:

After completing the course the student will be able to:

1. Understand microprocessors and microcontrollers – their operation and programming.
2. Identify RISC processors from CISC processors and apply them in circuits.
3. Analyse operations of different serial and parallel buses and interrupts.
4. Evaluate different hardware designs and memory configurations.
5. Write RTOS for complex processor-based designs.
6. Design processor and controller based intelligent systems for real life problems.

Module I [8L]:

Designing with microprocessors and microcontrollers- the issues and solutions, Embedded systems VS General computing systems, Purpose of Embedded systems, optimizing design metrics, prominent processor and controller technology, RISC vs CISC.

Module II [10L]:

Devices and Communication Buses: I/O types, serial and parallel communication devices, wireless communication devices, timer and counting devices, watchdog timer, real time clock, serial bus communication protocols UART RS232/RS85, parallel communication network using ISA, PCI, PCT-X, Internet embedded system network protocols, USB, Bluetooth. Different types of I/O devices and interfacing: Keypad, LCD, VGA. Introduction to I/O interfaces: Interrupts, Interrupt hardware, Enabling and disabling interrupts, Concepts of handshaking, Polled I/O, Memory mapped I/O, Priorities, Stack and Queues. Vectored interrupts, Direct memory access, few types of Sensors and actuators.

Module III [10L]:

Memory: SRAM, DRAM, EEPROM, FLASH, CACHE memory organizations, (direct, associative, set associative mapping), Virtual memory, organization, mapping and management techniques, Fundamental issues in Hardware software co-design, Unified Modeling Language (UML), Hardware Software trade-offs DFG model, state machine programming model, model for multiprocessor

system. Introduction to ARM architecture, Processor design, ARM organization and implementation.

Module IV [8L]:

Real Time Operating Systems: Operating system basics, Tasks, Process and Threads, Multiprocessing and multitasking, task communication, task synchronization, qualities of good RTOS. Resource Management/scheduling paradigms: static priorities, static schedules, dynamic scheduling, best effort current best practice in scheduling (e.g. Rate Monotonic vs. static schedules), Real-world issues: blocking, unpredictability, interrupts, caching, Examples of OSs for embedded systems - RT Linux, VRTX, Mobile phones, RFID.

Books:

Text Books:

1. David Simon, "An Embedded Software Primer", (Addison Wesley), 2000.
2. Jack Ganssle, "The Art of Designing Embedded Systems", (Newnes), 1999.
3. G. Osborn, "Embedded microcontroller and processor design", (Pearson)
4. S. Heath, "Embedded System design ", (Elsevier)
5. Steve Furber, ARM System-on-Chip Architecture, (Pearson)

Reference Books:

1. Shibu, "Introduction to Embedded Systems" K. V. (TMH)
2. Frank Vahid, Tony Givargis, "Embedded System Design – A unified hardware and software introduction:" (John Wiley)
3. Rajkamal "Embedded Systems": (TMH)
4. L. B. Das "Embedded Systems" (Pearson)
5. RTS: Real-Time Systems, by C.M. Krishna and Kang G. Shin, McGraw-Hill, 1997, ISBN 0-07-057043.
6. J. A. Stankovic and K. Ramamritham, Advances in Hard Real-Time Systems, IEEE Computer Society Press, Washington DC, September 1993, 777 pages. Selected papers and references

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|--|----------|----------|----------|--------------|----------------------|
| Course Name: Analog And Digital Communication | | | | | |
| Course Code :ECEN 3223 | | | | | |
| Contact Hours | L | T | P | Total | Credit Points |
| per week | 3 | 0 | 0 | 3 | 3 |

Course Outcomes:

After completing the course the student will be able to:

1. Explain the necessity of communication, its history, evolution , the role of efficient communication in the present day.
2. Understand & apply the concepts of various types of signals, techniques for signal transmission and signal modulation from the knowledge gathered earlier.
3. Identify various parameters associated with Amplitude and frequency Modulation, time and frequency domain representations, side band frequencies etc and apply these knowledge to solve numerical problems.
4. Apply sampling theorem to sample analog signal properly and differentiate among pulse modulation & demodulation techniques and understand PCM, DPCM.
5. Analyze performance of various digital modulation & demodulation techniques and understand concept of OFDM and Spread Spectrum Modulationsystem.
6. Analyze various multiplexing and Multiple access techniques and compare modern multiple access schemes, explain the concept of frequency reuse, channel assignment strategies and make use of wireless communication tools

Module I –[10L]

Introduction-Signal Analysis and Transmission: Overview of communication- base-band transmission, various types of signals, analog signal, digital signal, fundamental limitations in communication system- noise, power and bandwidth. Fourier series and Fourier Transformation representations, ; Modulation and its need and types; Time domain and frequency domain analysis. **AMPLITUDE MODULATION**: Modulation principle and definitions, spectrum and power considerations, DSB,SSB, VSB and AM principles. Different type of modulator circuits.

DEMODULATOR Basic principle of coherent detections, envelope detectors.

FREQUENCY AND PHASE MODULATION Principles and definitions, Relationship between frequency and phase modulations. Phase and frequency deviations, Spectrum of FM signal, bandwidth considerations. Effect of modulation index on bandwidth, Narrow band and sideband FM and PM principles, **RADIO RECEIVER** Basic block diagram of TRF, Superhetrodyne principle,

Module II –[10L]

Digital Transmission: Sampling theorem, sampling rate, aliasing and aperture effect; analog pulse modulation -PAM (ideal, natural & flat topped sampling),PWM, PPM; basic concept of pulse code modulation, block diagram of PCM; quantizer; non-uniform quantizer, conceptual idea of A-law

&μ-law companding; encoding, coding efficiency, source, line coding channel coding & properties, NRZ & RZ, AMI, manchester coding PCM, DPCM, Delta modulation, adaptive delta modulation (basic concept and applications); baseband pulse transmission, matched filter (its importance and basic concept), error rate due to noise, nyquist criterion for distortion-less transmission.

Module III –[8L]

Digital Modulation Techniques: Types of Digital Modulation, coherent and non-coherent Binary Modulation Techniques, Bit rate, baud rate; information capacity generation and detection, digital carrier modulation techniques: ASK, PSK and FSK, DPSK . Concept of QAM and M-ary Communication, M-ary phase shift keying, (QPSK), Generation, detection, , Offset Quadrature Phase shift Queuing (OQPSK), Minimum Shift Keying (MSK), Basic Concept of OFDM and Spread Spectrum Modulation.

Module IV –[8L]

Multiplexing -TDM, FDM. Multiple Access Techniques and Radio Communication: Multiple access techniques, TDMA, FDMA and CDMA in wireless communication systems, advanced mobile phone system (AMPS), global system for mobile communications (GSM), cellular concept and frequency reuse, channel assignment and handoff, Bluetooth, introduction to satellite communication.

Text Books:

7. Taub and Schilling , “Principles of Communication Systems”, 2nd ed., Mc-Graw Hill
8. B.P.Lathi -Communication Systems- BS Publications
2. V Chandra Sekar – Analog Communication- Oxford University Press

References:

9. Carlson—Communication System,4/e , Mc-Graw Hill
10. Proakis&Salehi Fundamentals of Communication Systems- Pearson
11. Singh &Sapre—Communication Systems: 2/e, TMH
12. P K Ghosh- Principles of Electrical Communications- University Press
13. L.W.Couch II, “Digital and Analog Communication Systems”, 2/e, Macmillan Publishing
14. Blake, Electronic Communication Systems- Cengage Learning
15. S Sharma, Analog Communication Systems- Katson Books

