



VEL TECH MULTITECH Dr RANGARAJAN Dr.SAKUNTHALA ENGINEERING COLLEGE

(An ISO 9001: 2008 Certified Institution)

(Owned by Vel Trust)

(Approved by Govt. of Tamil Nadu and affiliated to Anna University and
Accredited by NBA, New Delhi)



SYLLABUS

WEEKLY SCHEDULE

III SEMESTER 2015 - 2016

DEPARTMENT OF EEE

IV YEAR DEGREE COURSE

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WEEK DETAILS

SL.NO.	WEEK	FROM	TO
1	WEEK1	24.06.2015	26.06.2015
2	WEEK2	29.06.2015	03.07.2015
3	WEEK3	06.07.2015	10.07.2015
4	WEEK4	13.07.2015	17.07.2015
5	WEEK5	20.07.2015	24.07.2015
6	WEEK6	27.07.2015	28.07.2015
7	WEEK7	03.08.2015	07.08.2015
8	WEEK8	10.08.2015	14.08.2015
9	WEEK9	17.08.2015	21.08.2015
10	WEEK10	24.08.2015	28.08.2015
11	WEEK11	31.08.2015	04.09.2015
12	WEEK12	07.09.2015	11.09.2015
13	WEEK13	14.09.2015	18.09.2015
14	WEEK14	21.09.2015	25.09.2015
15	WEEK15	28.09.2015	30.09.2015
16	WEEK16	05.10.2015	09.10.2015
17	WEEK17	12.10.2015	16.10.2015
18	WEEK18	19.10.2015	20.10.2015
19	WEEK19	27.10.2015	30.10.2015

SUBJECT CONTENTS

SL.NO	SUBJECT CODE	SUBJECT NAME
THEORY		
1	MA6351	Transforms and Partial Differential Equations
2	EE6301	Digital Logic Circuits
3	EE6302	Electromagnetic Theory
4	GE6351	Environmental Science and Engineering
5	EC6202	Electronic Devices and Circuits
6	EE6303	Linear Integrated Circuits and Applications
PRACTICAL		
7	EC6361	Electronics Laboratory
8	EE6311	Linear and Digital Integrated Circuits Laboratory

TEST / EXAM SCHEDULE

SL.NO	SUBJECT CODE	SUBJECT NAME	UNIT TEST I	UNIT TEST II	PRE MODEL EXAM	UNIT TEST IV
1	MA6351	Transforms and Partial Differential Equations	13.07.2015	03.08.2015	21.08.2015	14.09.2015
2	EE6301	Digital Logic Circuits	14.07.2015	04.08.2015	22.08.2015	15.09.2015
3	EE6302	Electromagnetic Theory	15.07.2015	05.08.2015	24.08.2015	16.09.2015
4	GE6351	Environmental Science and Engineering	16.07.2015	06.08.2015	25.08.2015	18.09.2015
5	EC6202	Electronic Devices and Circuits	17.07.2015	07.08.2015	26.08.2015	21.09.2015
6	EE6303	Linear Integrated Circuits and Applications	20.07.2015	10.08.2015	27.08.2015	22.09.2015

SL.NO	SUBJECT CODE	SUBJECT NAME	MODEL EXAM
1	MA6351	Transforms and Partial Differential Equations	05.10.2015
2	EE6301	Digital Logic Circuits	06.10.2015
3	EE6302	Electromagnetic Theory	07.10.2015
4	GE6351	Environmental Science and Engineering	08.10.2015
5	EC6202	Electronic Devices and Circuits	09.10.2015
6	EE6303	Linear Integrated Circuits and Applications	12.10.2015

MA6351 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

WEEK: 1

UNIT I PARTIAL DIFFERENTIAL EQUATIONS

Formation of partial differential equations – Singular integrals --
Solutions of standard types of first order partial differential equations

WEEK :2

Lagrange's linear equation -- Linear partial differential equations of second

WEEK :3

Higher order with constant coefficients of both homogeneous and non-homogeneous types.

WEEK 4: UNIT TEST-I

UNIT II FOURIER SERIES

Dirichlet's conditions – General Fourier series

WEEK 5:

Odd and even functions – Half range sine series –Half range cosine series – Complex form of Fourier series

WEEK 6:

Parseval's identity – Harmonic analysis..

WEEK 7: UNIT TEST-II

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS

Classification of PDE

WEEK 8 :

Method of separation of variables - Solutions of one dimensional wave equation

WEEK 9:

One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges)

WEEK 10: UNIT TEST-III

UNIT IV FOURIER TRANSFORMS

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms

WEEK 11:

Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

WEEK 12:

UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS

Z- transforms - Elementary properties – Inverse Z - transform (using partial fraction and residues)

WEEK 13: UNIT TEST-IV

Convolution theorem

WEEK14:

Formation of difference equations

WEEK 15:

Solution of difference equations using Z- transform

WEEK 16: UNIT TEST-V

WEEK 17: MODEL EXAM

WEEK18: MODEL PRACTICAL EXAM

TEXT BOOK:

1. Veerarajan T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.
2. Grewal B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, Delhi, 2012.
3. Narayanan S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students" Vol. II & III, S.Viswanathan Publishers Pvt Ltd. 199

REFERENCES:

1. Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 7th Edition, Laxmi Publications Pvt Ltd, 2007.
2. Ramana. B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2007.
4. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, Wiley India, 2007.
5. Ray Wylie C and Barrett.L.C, "Advanced Engineering Mathematics" Tata McGraw Hill Education Pvt Ltd, Sixth Edition, New Delhi, 2012.

6. Datta K.B., "Mathematical Methods of Science and Engineering", Cengage Learning India Pvt Ltd, Delhi, 2013..

EE6301 DIGITAL LOGIC CIRCUITS

WEEK 1:

UNIT I NUMBER SYSTEMS AND DIGITAL LOGIC FAMILIES

Review of number systems, binary codes, error detection and correction codes (Parity and Hamming code);

WEEK 2:

Digital Logic Families, comparison of RTL, DTL, TTL, ECL and MOS families Operation

WEEK 3:

Characteristics of digital logic family

WEEK 4: UNIT TEST-I

UNIT II COMBINATIONAL CIRCUITS

Combinational logic - representation of logic functions-SOP and POS forms, K-map representations minimization using K maps - simplification and implementation of combinational logic – multiplexers and demultiplexers - code converters, adders, subtractors

WEEK 5: UNIT TEST-II

UNIT III - SYNCHRONOUS SEQUENTIAL CIRCUITS

Sequential logic- SR, JK, D and T flip flops - level triggering and edge triggering - counters -asynchronous and synchronous type.

WEEK 6:

Modulo counters - Shift registers - design of synchronous sequential circuits - Moore and Mealy models- Counters, state diagram; state reduction; state assignment.

WEEK 7: UNIT TEST-III

UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS AND PROGRAMMABLE LOGIC DEVICES

Asynchronous sequential logic circuits-Transition table, flow table- race conditions, hazards & errors in digital circuits;

WEEK 8:

Analysis of asynchronous sequential logic circuits

WEEK 9:

Introduction to Programmable Logic Devices

WEEK 10:

PROM – PLA –PAL

WEEK 11:

UNIT V - VHDL

RTL Design

WEEK 12:

Combinational logic – Sequential circuit

WEEK 13: UNIT TEST-IV

Operators – Introduction to Packages

WEEK 14:

Subprograms – Test bench

WEEK 15:

Simulation /Tutorial Examples: adders, counters, flip flops, FSM, Multiplexers Demultiplexers

WEEK 16: UNIT TEST-V

WEEK 17: MODEL EXAM

WEEK18: MODEL PRACTICAL EXAM

TEXT BOOK:

1. Raj Kamal, ‘ Digital systems-Principles and Design’, Pearson Education 2nd edition, 2007.
2. M. Morris Mano, ‘Digital Design with an introduction to the VHDL’, Pearson Education, 2013.
3. Comer “Digital Logic & State Machine Design, Oxford, 2012

REFERENCES:

1. Mandal ”Digital Electronics Principles & Application, McGraw Hill Edu,2013.
2. William Keitz, Digital Electronics-A Practical Approach with VHDL,Pearson,2013.
3. Floyd and Jain, ‘Digital Fundamentals’, 8th edition, Pearson Education, 2003.
4. Anand Kumar, Fundamentals of Digital Circuits,PHI,2013.
5. Charles H.Roth,Jr,Lizy Lizy Kurian John, ‘Digital System Design using VHDL, Cengage, 2013.
6. John M.Yarbrough, ‘Digital Logic, Application & Design’, Thomson, 2002.
7. Gaganpreet Kaur, VHDL Basics to Programming, Pearson, 2013.

8. Botros, HDL Programming Fundamental, VHDL & Verilog, Cengage, 2013

EE6302 ELECTROMAGNETIC THEORY

WEEK I:

UNIT I ELECTROSTATICS – I

Sources and effects of electromagnetic fields – Coordinate Systems – Vector fields – Gradient

WEEK 2

Theorems and applications - Coulomb's Law – Electric field intensity

WEEK 3:

Field due to discrete and continuous charges – Gauss's law and applications

WEEK 4: UNIT TEST-I

UNIT II ELECTROSTATICS – II

Electric potential – Electric field and equipotential plots, Uniform and Non-Uniform field, Utilization factor

WEEK 5:

Electric field in free space, conductors, dielectrics - Dielectric polarization - Dielectric Strength

WEEK 6:

Electric field in multiple dielectrics – Boundary conditions, Poisson's and Laplace's equations, Capacitance, Energy density, Applications.

UNIT III: MAGNETOSTATICS

Lorentz force, magnetic field intensity (H) – Biot–Savart’s Law - Ampere’s Circuit Law – H due to straight conductors, circular loop, infinite sheet of current, Magnetic flux density (B) – B in free space, conductor, magnetic materials

WEEK 7:

UNIT TEST-II

Magnetization, Magnetic field in multiple media – Boundary conditions, scalar and vector potential, Poisson’s Equation

WEEK 8:

Magnetic force, Torque, Inductance, Energy density, Applications

WEEK 9: UNIT TEST-III

UNIT IV ELECTRODYNAMIC FIELDS

Magnetic Circuits - Faraday’s law – Transformer and motional EMF

WEEK 10:

Displacement current -Maxwell’s equations (differential and integral form)

WEEK 11:

Relation between field theory and circuit theory – Applications.

WEEK 12:

UNIT V ELECTROMAGNETIC WAVES

Electromagnetic wave generation and equations – Wave parameters; velocity, intrinsic impedance, propagation constant

WEEK13: UNIT TEST-IV

Waves in free space, lossy and lossless dielectrics, and conductors-skin depth -

Poynting vector

WEEK 14:

Plane wave reflection and refraction.

WEEK 15:

Standing Wave – Applications.

WEEK 16: UNIT TEST-V

WEEK 17: MODEL EXAM

WEEK18: MODEL PRACTICAL EXAM

TEXT BOOKS:

1. Mathew N. O. Sadiku, ‘Principles of Electromagnetics’, 4 th Edition ,Oxford University Press Inc. First India edition, 2009.
2. Ashutosh Pramanik, ‘Electromagnetism – Theory and Applications’, PHI Learning Private Limited, New Delhi, Second Edition-2009.
3. K.A. Gangadhar, P.M. Ramanathan ‘ Electromagnetic Field Theory (including Antennaes and wave propagation’, 16th Edition, Khanna Publications, 2007.

REFERENCES:

1. Joseph. A.Edminister, ‘Schaum’s Outline of Electromagnetics, Third Edition (Schaum’s OutlineSeries), Tata McGraw Hill, 2010
2. William H. Hayt and John A. Buck, ‘Engineering Electromagnetics’, Tata McGraw Hill 8th Revised edition, 2011.
3. Kraus and Fleish, ‘Electromagnetics with Applications’, McGraw Hill International Editions, FifthEdition, 2010.

4. Bhag Singh Guru and Hüseyin R. Hiziroglu “Electromagnetic field theory Fundamentals”, Cambridge University Press; Second Revised Edition, 2009.

GE6351 ENVIRONMENTAL SCIENCE AND ENGINEERING

WEEK 1:

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY

Definition, scope and importance of Risk and hazards; Chemical hazards, Physical hazards, Biological hazards in the environment – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers-Oxygen cycle and Nitrogen cycle – energy flow in the ecosystem – ecological succession processes – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems

WEEK 2: Introduction to biodiversity definition: genetic, species and ecosystem diversity – bio geographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.

WEEK 3: Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of

biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds Field study of simple ecosystems – pond, river, hill slopes, etc.,

WEEK 4: UNIT TEST-I

UNIT II ENVIRONMENTAL POLLUTION

Definition – causes, effects and control measures of: (a) Air pollution (Atmospheric chemistry-Chemical composition of the atmosphere; Chemical and photochemical reactions in the atmosphere - formation of smog, PAN, acid rain, oxygen and ozone chemistry

WEEK 5:

Mitigation procedures- Control of particulate and gaseous emission, Control of SO₂, NO_X, CO and HC) (b) Water pollution: Physical and chemical properties of terrestrial and marine water and their environmental significance; Waterquality parameters – physical, chemical and biological; absorption of heavy metals

WEEK 6:

Water treatment processes. (c) Soil pollution - soil waste management: causes, effects and control measures of municipal solid wastes – (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards–role of an individual in prevention of pollution – pollution case studies –Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

WEEK 7: UNIT TEST-II

UNIT III: NATURAL RESOURCES

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and overutilization of surface and ground water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture.

WEEK 8:

fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Energy Conversion processes – Biogas – production and uses, anaerobic digestion; case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources

WEEK 9:

Equitable use of resources for sustainable lifestyles. Introduction to Environmental Biochemistry: Proteins –Biochemical degradation of pollutants, Bioconversion of pollutants.

Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

WEEK 10: UNIT TEST-III

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization environmental ethics:

WEEK 11:

Issues and possible solutions – 12 Principles of green chemistry- nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air act – Water act – Wildlife protection act – Forest conservation act – The Biomedical Waste (Management and Handling) Rules.

WEEK 12:

1998 and amendments- scheme of labeling of environmentally friendly products (Ecomark). enforcement machinery involved in environmental legislation- central and state pollution control boards- disaster management: floods, earthquake, cyclone and landslides. Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT

Population growth, variation among nations – population explosion – family welfare programme – environment and human health

WEEK 13: UNIT TEST-IV

human rights – value education – HIV / AIDS – women and child welfare –Environmental impact analysis (EIA)

WEEK 14:

GIS-remote sensing-role of information technology in environment and human health.

WEEK 15:

Case studies.

WEEK 16: UNIT TEST-V

WEEK 17: MODEL EXAM

WEEK18: MODEL PRACTICAL EXAM

TEXT BOOKS:

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.

REFERENCES :

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances andStandards', Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ.,House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press 2005.

EC6202 ELECTRONIC DEVICES AND CIRCUITS

WEEK 1:

UNIT I PN JUNCTION DEVICES

PN junction diode –structure, operation and V-I characteristics, diffusion and transient capacitance

WEEK 2:

Rectifiers – Half Wave and Full Wave Rectifier

WEEK 3:

Display devices- LED, Laser diodes- Zener diode characteristics- Zener Reverse characteristics – Zener as regulator

WEEK 4: UNIT TEST-I

UNIT II TRANSISTORS

BJT, JFET, MOSFET- structure, operation, characteristics

WEEK 5:

Biasing UJT

WEEK 6:

Thyristor and IGBT - Structure and characteristics.

WEEK 7:

UNIT TEST-II

UNIT III AMPLIFIERS

BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response

WEEK 8:

MOSFET small signal model– Analysis of CS and Source follower

WEEK 9:

Gain and frequency response- High frequency analysis.

WEEK 10: UNIT TEST-III

UNIT IV MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER

BIMOS cascade amplifier, Differential amplifier – Common mode and Difference mode analysis – FET input stages,

WEEK 9:

Single tuned amplifiers – Gain and frequency response

WEEK 12:

Neutralization methods, power amplifiers –Types (Qualitative analysis).

UNIT V FEEDBACK AMPLIFIERS AND OSCILLATORS

Advantages of negative feedback – voltage / current, series

WEEK 13: UNIT TEST-IV

Shunt feedback –positive feedback –Condition for oscillations, phase shift

WEEK 14:

Wien bridge, Hartley,

WEEK 15:

Colpitts and Crystal oscillators

WEEK 16: UNIT TEST-V

WEEK 17: MODEL EXAM

WEEK18: MODEL PRACTICAL EXAM

TEXT BOOKS:

1. David A. Bell ,”Electronic Devices and Circuits”, Prentice Hall of India, 2004.

2. Sedra and smith, “Microelectronic Circuits “ Oxford University Press, 2004.

REFERENCES:

1. Rashid, “Micro Electronic Circuits” Thomson publications, 1999.

2. Floyd, “Electron Devices” Pearson Asia 5th Edition, 2001.

3. Donald A Neamen, “Electronic Circuit Analysis and Design” Tata McGraw Hill, 3rd Edition, 2003.

4. Robert L.Boylestad, “Electronic Devices and Circuit theory”, 2002.

5. Robert B. Northrop, “Analysis and Application of Analog Electronic Circuits to Biomedical Instrumentation”, CRC Press, 2004.

EE6303 LINEAR INTEGRATED CIRCUITS AND APPLICATIONS

WEEK 1:

UNIT I IC FABRICATION

IC classification, fundamental of monolithic IC technology, epitaxial growth,

WEEK 2:

masking and etching,diffusion of impurities. Realisation of monolithic ICs and packaging.

WEEK 3: Fabrication of diodes, capacitance, resistance and FETs.,

WEEK 4: UNIT TEST-I

UNIT II CHARACTERISTICS OF OPAMP

Ideal OP-AMP characteristics, DC characteristics, AC characteristics,, differential amplifier; frequencyresponse of OP-AMP

WEEK 5: Basic applications of op-amp – Inverting and Non-inverting Amplifiers-

WEEK 6: V/I & I/V converters ,summer,

WEEK 7: differentiator and integrator.

WEEK 8: UNIT TEST-II

UNIT III: APPLICATIONS OF OPAMP

Instrumentation amplifier, Log and Antilog Amplifiers, first and second order active filters

WEEK 9: comparators, multivibrators, waveform generators, clippers, clampers, peak detector

WEEK 10: S/H circuit, D/A converter (R- 2R ladder and weighted resistor types), A/D converters using opamps.

WEEK 11: UNIT TEST-III

UNIT IV. SPECIAL ICs

Functional block, characteristics & application circuits with 555 Timer Ic

WEEK 12: 566 voltage controlled oscillator Ic, 565-phase lock loop Ic ,Analog multiplier ICs.

WEEK 13:

UNIT TEST-IV

UNIT V APPLICATION ICs

IC voltage regulators –LM78XX,79XX Fixed voltage regulators

WEEK 14:.

LM317, 723 Variable voltage regulators, switching regulator- SMPS-

WEEK 15:.

LM 380 power amplifier- ICL 8038 function generator IC.

WEEK 16: UNIT TEST-V**WEEK 17: MODEL EXAM****WEEK18: MODEL PRACTICAL EXAM****TEXT BOOKS:**

1. David A.Bell, 'Op-amp & Linear ICs', Oxford, 2013.
2. D.Roy Choudhary, Sheil B.Jani, 'Linear Integrated Circuits', II edition, New Age, 2003.
3. Ramakant A.Gayakward, 'Op-amps and Linear Integrated Circuits', IV edition, Pearson Education, 2003 / PHI. 2000.

REFERENCES:

1. Fiore,"Opamps & Linear Integrated Circuits Concepts & Applications",Cengage,2010.
2. Floyd ,Buchla,"Fundamentals of Analog Circuits, Pearson, 2013.
3. Jacob Millman, Christos C.Halkias, 'Integrated Electronics - Analog and Digital circuits system',Tata McGraw Hill, 2003.
4. Robert F.Coughlin, Fredrick F. Driscoll, 'Op-amp and Linear ICs', PHI Learning, 6th edition,2012.

EC6361 ELECTRONICS LABORATORY

1. Characteristics of Semi conductor diode and Zener diode
2. Characteristics of a NPN Transistor under common emitter , common collector and common base configurations
3. Characteristics of JFET(Draw the equivalent circuit)
4. Characteristics of UJT and generation of saw tooth waveforms
5. Design and Frequency response characteristics of a Common Emitter amplifier
7. Characteristics of photo diode & photo transistor, Study of light activated relay circuit
8. Design and testing of RC phase shift, LC oscillators
9. Single Phase half-wave and full wave rectifiers with inductive and capacitive filters
10. Differential amplifiers using FET
11. Study of CRO for frequency and phase measurements
12. Astable and Monostable multivibrators
13. Realization of passive filters

EE6311 LINEAR AND DIGITAL INTEGRATED CIRCUITS LABORATORY

1. Implementation of Boolean Functions, Adder/ Subtractor circuits.
2. Code converters: Excess-3 to BCD and Binary to Gray code converter and vice-versa
3. Parity generator and parity checking
4. Encoders and Decoders

5. Counters: Design and implementation of 4-bit modulo counters as synchronous and Asynchronous types using FF IC's and specific counter IC.
6. Shift Registers: Design and implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitable IC's.
7. Study of multiplexer and demultiplexer
- 8 Timer IC application: Study of NE/SE 555 timer in Astable, Monostable operation.
9. Application of Op-Amp: inverting and non-inverting amplifier, Adder, comparator, Integrator and Differentiator.
10. Study of VCO and PLL ICs:
 - i. Voltage to frequency characteristics of NE/ SE 566 IC.
 - ii. Frequency multiplication using NE/SE 565 PLL IC.
