ENGINEERING FIRST YEAR: SEMESTER-II

22MA1201	**Mathematical Methods**	**BSC**	**3L: 1T: 0P**	**4 credits**

Course Learning Objectives:

- The objective of this course is to introduce vector spaces and linear transformation.
- Discuss Eigen values and Eigen vectors of a matrix and various properties.
- Setup double and triple integrals to find volume and surface area.
- Discuss directional derivatives and application of Green's, Stokes and Gauss theorems.
- Discuss numerical methods to find the roots of transcendental equations and Interpolation.
- Evaluate integrals by using numerical methods and solving IVP.

Course Content:

Unit – I: Linear Algebra: (12 hours)
Vector Spaces, Linear Combinations of Vectors, Linear dependence and Independence, Basis and Dimension, Linear Transformations, Matrix Representations of Linear transformation.

Unit – II: Eigen values and Eigen vectors: (8 hours)
Solving system of Homogeneous and Non-Homogeneous equations by using Gauss elimination method. Characteristic roots and Characteristic Vectors of a matrix - Cayley-Hamilton Theorem (without proof); Finding inverse and power of a matrix by Cayley-Hamilton Theorem.

Unit-III: Multiple integrals: (10 hours)
Double and triple integrals, computations of surface and volumes, Jacobeans of transformations, change of variables in double integrals, Change of Order of double integrals, integrals dependant on parameters - applications.

Unit–IV: Vector calculus: (12 hours)
Scalar and vector fields, level surfaces, directional derivative, Gradient, Curl, Divergence, Laplacian, line, surface integrals and Volume integrals, Green, Gauss and Stokes theorems (without Proof) and problems.

Unit – V: Root finding Methods and Interpolation: (10 hours)
Roots of polynomial and transcendental equations – bisection method, Regula-falsi method and Newton- Raphson method, Finite differences, Newton's forward and backward interpolation formulae.

Unit – VI: Numerical integration and numerical solution of IVP: (8 hours)
Trapezoidal rule, Simpson's $1/3^{rd}$ rule and $3/8^{th}$ rule for numerical integration, Solution of IVP by Euler and Runga-Kutta method.

Learning resources Text book:

1. ERWIN KREYSZIG, '*Advanced Engineering Mathematics'*, Wiley-India, 9th Edition.

Reference Books:
R. K. Jain and S. R. K. Iyengar, '*Advanced Engineering Mathematics',* Narosa Publishing House, New Delhi, 3rd Edition.
B.S.Grewal, '*A Text Book of Higher Engineering Mathematics'*, Khanna Publishers, 43rd Edition.
Gilbert Strang , 'Linear Algebra and its Applications', CENGAGE Learning 4th Edition.
Web resources:
https://onlinecourses.nptel.ac.in/noc20_ma54/preview
https://onlinecourses.nptel.ac.in/noc21_ma11/preview
RGUKT content

Course outcomes: At the end of the course, the student will be able to

CO 1	Write Matrix representation for transformations.
CO 2	Find Eigen values and Eigen vector for a Matrix.
CO 3	Setup and evaluating double and triple integrals.
CO 4	Apply Green's Stokes and Gauss Divergence Theorems.
CO 5	Approximate the roots of polynomial and transcendental equations.
CO 6	Approximate the Integral value by numerical methods and solve IVP using numerical methods.

For Theory courses only:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

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ENGINEERING FIRST YEAR: SEMESTER-II

22EC2102	**Digital Logic Design**	**PCC**	**2L: 0T: 0P**	**4 credits**

Course Learning Objective

- To discuss the concepts of Number systems and representations used in the computers, combinational design, sequential designs and complete system design at gate-level abstraction
- To discuss the important features of IC design like area, power and delay.
- To design a simple digital system at gate-level as per the design specifications.

Course Content

Unit-I **(6 hours)**

Number systems-Representations-Conversions, Boolean constants and variables, basic gates: operation and truth tables, describing logic gates algebraically, evaluating logic circuit outputs, implementing circuits from Boolean expressions, universality of gates, Boolean theorems, Demorgan's theorems, alternate logic gate representations, IEEE/ANSI standard logic symbols.

Unit-II **(12 hours)**

Combinational circuit minimization using Boolean laws and Karnaugh maps, multi-level synthesis, timing hazards, logic levels and noise margins, Fan-out, Fan-in. Single bit adders and subtractors, multi-bit adders, BCD adder, multi-bit subtraction using adders, signed multiplier, unsigned multiplier, code converters, parity bit generators/checkers, magnitude comparator. Delay, Area and Power analysis in combinational circuit designs. Conversion of real-time statements into Boolean expressions and design of gate-level logic circuits.

Unit-III **(10 hours)**

Bistable elements, Latches and Flip-flops : S-R latch , S' – R' Latch, S-R latch with enable, D latch, Race-around condition and elimination methods. Edge triggered D flip flop, Edge triggered D flip flop with asynchronous inputs, master-slave flip-flop, edge triggered J-K flip-flop with asynchronous inputs, T flip-flops. Excitation tables, Characteristic equations.
Flip-flop timing consideration: set-up time, hold-time discussion using positive edge-triggered D-Flip flop.

Unit-IV **(14 hours)**

Frequency division and counting. Design and analysis of asynchronous counters, Delay considerations and limitations on maximum clock frequency, Design and analysis of synchronous counters. BCD counter, Ring counter, Johnson counters. State diagram overview (Present States, Next states, Present outputs, Present inputs). Serial / Parallel data transfer registers: PIPO register,

SISO register, PISO register, SIPO register.

Unit-V **(10 hours)**

Decoders: Binary decoder, synthesis of logic functions using decoders, cascading binary decoders, seven-segment decoders, applications.
Multiplexers: synthesis of logic functions using multiplexers applications.
Demultiplexers: Realization, 1-4 and 1-8 line demultiplexers, demultiplexer tree. Encoders: Priority encoders. Implementation of functions using programmable logic devices: PAL, PLA, PROM.

Unit-VI **(8 hours)**

Memory – Structure and Timing: Static RAM, Dynamic Ram. Architecture: CPLD, FPGA
Design and analysis of Digital circuits: Digital Clock, Digital calendar, Traffic light controller, Mobile number sequence generators and other relevant topics

Learning Resources

Text books

Ronald J Tocci, Neal S.Widmer, Gregory L.Moss, *'Digital systems'* Pearson 10th edition.
John F.Wakerly, *'Digital Design'* , Pearson 4th edition

Reference books

Stephen Brown, Zvonko Vranesic, *'Fundamentals of Digital Logic with Verilog Design'*, TMH, 2nd edition.

Web Resources

Prof. Shankar Balachandran, NPTEL-IIT Madras, *'Digital Circuits & Systems'*
URL: https://nptel.ac.in/courses/117106114/
Prof. S Srinivasan, NPTEL-IIT Madras, *'Digital Circuits and Systems'*
URL: https://nptel.ac.in/courses/117106086/

Course Outcomes: At the end of the course, the student will be able to

CO 1	Apply the knowledge of simplification in obtaining optimal digital circuits
CO 2	Study and examine the SSI, MSI, LSI and Programmable elements
CO 3	Analyse the operation of synchronous and asynchronous state machines
CO 4	Design any combinational or sequential digital circuits to meet the given specifications
CO 5	Analyze any digital circuit and to debug such circuit
CO 6	Prototype a real time application on EDA tool

Assessment Method

Assessment Tool	Weekly tests/Assignments (in a semester)	Monthly tests (in a semester)	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

ENGINEERING SECOND YEAR: SEMESTER-I

22EC2182	**Digital Logic Design Laboratory**	**PCC**	**0L: 0T: 3P**	**1.5 credits**

Course Learning Objective

- Expose the student to the concepts of Digital System Design and itsapplications
- To understand the practical aspects of combinational and sequential circuitdesign
- To design a prototype digital logic designsystem
- .

List of Experiments

- Familiarization logic gate levels understand the concept of noise- margin. Troubleshooting digitalcircuits.
- Design of code converters and comparators (8-bit) on breadboard.
- Adder related experiments: Half adder , full adder , half subtractor, full subtractor , ripple carry adder, BCD adder, carry look ahead adder usingIC.
- Design of a binary multiplier and displaying its inputs and outputs on seven segment displayunit.
- Design and verification of SR, JK, D, T latch/flip-flops. Verification and elimination of Race AroundCondition.
- Flip-flop conversions and Design of frequencydividers.
- Design of synchronous counters (Up and Down) and displaying result on seven segment display unit
- Design n counter design (total 8 states design of mod 6, 7 with clear)
- mod7 with clear).
- Design and IC verification of Decadecounter.
- Cascading of counters.
- Synchronous counter design and displaying result on seven segment display unit
- Random sequence.
- Ring counter/Johnsoncounter.
- Familiarization with multiplexer, decoder, encoder. Design of Half adder, full adder, magnitude comparator and other examples using above familiarized components.
- Design of a mobile number sequence generator in synchronous state machine design and in asynchronous state machine design.
- Design of a digital clock in synchronous state machine design and in asynchronous state machine design

Design of gate level circuit for generation of complement and sign-magnitude form of a given 4-bit signed number.

Design and submission of term project

Note:
1. It is mandatory to perform experiment on any one of the EDA Tools (Multisim) before the experiment is done on hardware. All experiments must be unique, design specifications should not be common in thelab

Course outcome: After the completion of this Laboratory course, the student will be able to

CO 1	Understand the practical aspects in working of discrete digital components
CO 2	Utilize the ICs of Decoder, Multiplexer, Seven segment display unit in combination circuit design
CO 3	Utilize the ICs of suitable Flip-flops in sequential circuit design
CO 4	Utilize the Programmable Logic devices in digital design
CO 5	Understand the concepts of setup time, hold time, propagation delays
CO 6	Design circuits with optimal features of Area, Power and delay
CO 7	Design and implement prototypes of complete digital systems

Assessment Method

Assessment Tool	Experiments	Report/Viva-Voce/ Quiz/MCQ	*Term Projectand Viva-Voce	End SemesterLab Exam	Total
Weightage (%)	15%	15%	30%	40%	100%

*Term Project may be hardware implementation or on EDA (Multisim) platform
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ENGINEERING FIRST YEAR: SEMESTER-II

22EE1281	**Computational Laboratory**	**ESC**	**0L: 0T: 3P**	**1.5 credits**

Course Learning Objective

List of Experiments

Exercise 1: Python as a tool for computation
Exercise 2: Introduction of data visualization softwares such as Power BI, Tableau, Tensorflow
Exercise 3: Introduction and familiarization with MATLAB tool
Exercise 4: MATLAB for simulink and signal processing
Exercise 5: Simulations in LTSpice
Exercise 6: Simulations in MultiSim software

Design and submission of lab project

Note: Any other trending softwares related to EE can be introduced.

Learning Resources

Textbooks

J. Michael Fitzpatrick and AkosLedeczi,*' Computer Programming with MATLAB',*
Wordpress
Hanspeter langtangen, 'Python scripting for Computational Science', Springer publications
Reference books
Misza Kalechman, *'Practical MATLAB-Basics for Engineers'*, CRC Press.
Burkhard A.Meier, 'Python GUI Programming cookbook'. PACKT publications

Web Resources

J. Michael Fitzpatrick and AkosLedeczi, *'Introduction to Programming with MATLAB'.* URL: https://www.coursera.org/learn/matlab
Dr Sudarshan Iyengar, NTEL-IIT Ropar*, 'Joy of Computing using Python'.*
URL: https://www.nptel.ac.in/courses/106106182/
https://www.mathworks.com/academia/educators.html

Course outcome After the completion of this Laboratory course, the student will be able to

CO 1	To learn the MATLAB environment, python scripting and its programming fundamentals
CO 2	Ability to write Programs using commands and functions
CO 3	Able to simulate and visualize the data of various formats
CO 4	Able to understand perform operations on applications related to different fields
CO 5	Able to perform simulation of a simple prototype design project in Electronics and communication and relevant fields

Assessment Method

Assessment Tool	Experiments	Report/Viva-Voce/ Quiz/MCQ/Lab project	Total
Weightage (%)	25%	15%	40%
End Semester Examination weightage (%)			60%

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ENGINEERING FIRST YEAR: SEMESTER-II

22EG1281	**English-I Laboratory**	**HSC**	**0L : 1T : 3P**	**2.5 credits**

Course objectives:

- To facilitate computer-aided multi-media instruction enabling individualized and independent language learning
- To sensitize the students to the nuances of English speech sounds, word accent, intonation and rhythm
- To provide opportunities for practice in using English in day to day situations
- To improve the fluency in spoken English and neutralize mother tongue influence
- To train students to use language appropriately for debate, group discussion and public speaking

Course Content:

UNIT-I: (06 Contact Hours)
Theory: An Ideal Family by Katherine Mansfield
Spoken Skills: Situational Dialogues – Role-play – Expressions in various situations – Self Introduction – Introducing others – Greetings – Apologies – Requests – Giving directions

UNIT-II: (06 Contact Hours)
Theory: Energy -Alternative sources of Energy
Panel Debate on "On-grid & off-grid support to public participation in the production of solar energy in India", Reading the Wikipedia content on "The Green New Deal". Reflective session on the prospects of "The Green New Deal in India"
Writing Skills: Letter Writing (Formal & Informal) and Hands on Session on Letter Writing

UNIT-III: (06 Contact Hours)
Theory: Transport - Problems & solutions
Group Discussion on "The Future of Bullet Trains in India"
PPT on "The Dedicated Freight Corridors & the Future of Indian Economy" – Introduction to Speech
Spoken Skills: Sounds – Vowels, Consonants and Diphthongs – Pronunciation Exercises (Basic Level)

UNIT-IV: (06 Contact Hours)
Theory: Technology - Evaluating technology
PPT on "3R: Reduce, Recycle, Reuse" - Solo Debate on "Can Block Chain Technology Mitigate the Issue of Cyber Crimes and Hacking?"
Presentation Skills: JAM –Description of Pictures, Photographs, Process, Talking about wishes, Information Transfer

UNIT-V: (06 Contact Hours)
Theory: Environment - Ecology versus Development
Listening Skills: Listening Activity on YouTube video on "Greening the Deserts" - Students' seminar on "Waste to Wealth: Examples from around the Globe".

UNIT-VI: (06 Contact Hours)
Theory: Industry - Selling products
Reading Skills: Reading the material on "4Ps: Product, Price, Place, and Promotion" Role play on "How to sell your product and services"

References:
Non – Detailed Text Book: Panorama – A Course on Reading published by Oxford University Press, India
English for engineers and technologists by Orient Black Swan
A Textbook of English Phonetics for Indian Students 2nd Ed T. Balasubramanian. (Macmillan), 2012.
Speaking English Effectively, 2nd Edition Krishna Mohan & NP Singh, 2011. (Macmillan).
A Hand book for English Laboratories, E.Suresh Kumar, P.Sreehari, Foundation Books,2011
English Pronunciation in Use. Intermediate & Advanced, Hancock, M. 2009. CUP
Basics of Communication in English, Soundararaj, Francis. 2012.. *New Delhi: Macmillan*
English Pronouncing Dictionary, Daniel Jones Current Edition with CD.Cambridge, 17th edition, 2011.

Course outcomes*:* At the end of the course, the student will be able to

CO 1	Understand the issues affecting the economy and environment in India and across the globe
CO 2	Develop the instinct for problem solution
CO 3	Develop the ability to collect materials on various socio-economic- technological issues and prepare PPT for presentation
CO 4	Improving listening skills
CO 5	Inculcate speaking as a behaviour by repeated practice and exposure

Course Nature: THEORY + LABORATORY

Internal Assessment (40 Marks)	**External Assessment (**60 Marks)
Record Writing– 10 Marks	Reading Comprehension 15 Marks
Attendance – 10 Marks	Writing30 Marks

Continuous Assessment (Listening – 10 Marks + Oral Presentations – 10 Marks)	Speaking (Viva-Voce) 15 Marks

ENGINEERING FIRST YEAR: SEMESTER-II

22EC1201	**Electronic Devices & Circuits**	**ESC**	**3L: 1T: 0P**	**4 credits**

Course Learning Objectives

- To make the students understand the fundamentals of Electronic Devices and Circuits.
- To design simple Electronic circuits understanding the concept of design specification and design requirements.

Course Content

Unit-I **(6 hours)**

Introduction

Intrinsic and Extrinsic semiconductors, Fermi Level in Intrinsic and Extrinsic semiconductors. Mobility and conductivity, Diffusion currents and drift currents, Injected minority carrier charge, contact potential, currents in forward and reverse biased junction.

Unit-II **(10 hours)**

Diodes

The open circuited p-n Junction, Current components in a p-n diode, Volt-Ampere characteristics (Forward Bias and Reverse Bias and temperature dependence of the V/I characteristic, Diode Resistance (Static and Dynamic), Diode as a circuit element ,diode models, Load line concept, Small signal analysis of diode, Transition capacitance and Diffusion capacitance, Junction diode switching times; Zener diodes, Zener breakdown and Avalanche breakdown, Zener voltage regulator and its limitations.

Unit-III **(10 hours)**

PN Diode Applications

Half Wave, Full wave and Bridge rectifiers (their operation, performance calculations), with Filters (RC, LC, RLC), Ripple factor calculations, Clippers (two level) Transfer characteristics, clampers; Diode as a switch; Diode as a analog gate, Voltage Multipliers (Doubler and Tripler).

Unit-IV **(18 hours)**

MOSFETs

MOS capacitor, MOSFET construction, Types of MOSFET (Enhancement type and Depletion type), derivation of current equation, Regions of operation, second order effects (Channel-length modulation, body effect), MOSFET characteristics and operating point including load line analysis, MOSFET as a switch (inverter). Biasing of a MOSFET.

Unit-V **(8 hours)**

BJT Characteristics

BJT construction, Transistor Junction formation (Collector-Base, Base-Emitter Junctions), Current components; Modes of Transistor operations; Early Effect, BJT input and output characteristics in

different configurations, BJT as an inverter.

Unit-VI **(8 hours)**

Transistor Biasing and Stabilization-BJT

Biasing techniques-different types of biasing , Transistor as an amplifier, Thermal runaway, heat sinks, Thermal stabilization, Operating point stabilization against temperature and device variations, Stability factors, Bias stabilization and compensation techniques.

Learning resources

Text book

Jacob Milliman, Christos C. Halkias, and Satyabratajit, *'Electronic Devices and Circuits'* McGraw Hill, 3rd Edition,2012.

David A.Bell, *'Electronic Devices and Circuits'*, Oxford University Press, 5th edition, 2008.

Reference Books

Ben G.StreetMan, Sanjay Kumar Benerjee, *'Solid State Electronic Devices'*,6th edition.

Web Resources

Prof K Radhakrishna Rao, NPTEL-IIT Madras, *'Electronics for Analog Signal Processing-I'.* URL: https://nptel.ac.in/courses/117106087/

Dr. Mahesh B Patil, NPTEL-IIT Bombay, *'Basic Electronics'.*
URL: https://nptel.ac.in/courses/108101091/

Dr. Chitralekha Mahanta,NPTEL - IIT Guwahati, *'Basic Electronics',*
URL: https://nptel.ac.in/courses/117103063/

Course Outcomes : At the end of the course, the student will be able to

CO 1	Apply the knowledge of basic semiconductor physics and understand the working principles
CO 2	Analyze the characteristics of various electronic devices like diodes, transistor etc
CO 3	Classify and analyze the various circuit configurations of transistor and MOSFETs
CO 4	Designing circuits for different applications using diodes
CO 5	Analyze the concept of stability and biasing of transistors
CO 6	Troubleshooting circuits which utilizes diodes, transistors

Assessment Method

Assessment Tool	Weekly tests/Assignments (In semester)	Monthly tests (In semester)	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

ENGINEERING FIRST YEAR: SEMESTER-II

22EC1281	**Electronic Devices & Circuits Lab**	**ESC**	**0L: 0T: 3P**	**1.5 credits**

Course Learning Objective

To get a hands-on experience on the concepts present in Basic Electronics Theory course and thereby developing practical knowledge in analysis of electronic circuits using Diodes, BJTs and MOSFETs

List of Experiments

1. Introduction to Lab Components and Electronic instruments.
2. Soldering/De-soldering of components on PCB.
3. Characteristics of PN junction Diode, Zener Diode.
4. Characteristics of LED, Photodiode.
5. Design of voltage regulators using Zener Diodes.
6. Design of Half wave Rectifier, Full wave, Bridge wave rectifier with and without LC, RC filters.
7. Design and analysis of Clippers and Clampers.
8. Design and analysis of Voltage Multipliers.
9. Design and analysis of analog gate and digital gates.
10. Transfer characteristics of MOSFETs.
11. Characteristics of Common Base, Common Emitter, Common collector configurations of BJTs.`1
12. Stability analysis and biasing of BJT Circuits.
13. Design and submission of lab project

Note: It is mandatory to perform experiment on any one of the EDA Tools before the experiment is performed on hardware. All experiments must be unique, design specifications should not be common in the lab.

Course outcome:

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

CO 1	Experimental verification of transfer characteristics of diodes and transistors
CO 2	Design voltage regulators using diodes
CO 3	Design multilevel clippers and clampers using diodes
CO 4	Design and troubleshooting circuits which utilizes diodes
CO 5	Experimental analysis of different configurations of transistor circuits
CO 6	Design of BJT circuits considering stability and biasing practically
CO 7	Implementing and analysing a practical prototype of Diode/BJT application

Assessment Method

Assessment Tool	Experiments	Report/Viva-Voce/ Quiz/MCQ	*Term Project and Viva-Voce	End Semester Lab Exam	Total
Weightage (%)	15%	15%	30%	40%	100%

*Term Project may be performed either on hardware or on any EDA tool (LT spice preferred) platform.

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ENGINEERING FIRST YEAR: SEMESTER-II

22EE1201	**Network Theory**	**PCC**	**3L: 1T: 0P**	**4 credits**

Course Learning Objective

- To make the students capable of analyzing any given electrical network
- To equip students with network analysis tools like two port networks, Laplace transformations, and transient analysis.

Course Content

Unit- I **(10 hours)**

Basic concepts of Networks

Ohm's Laws and Kirchhoff's Laws, Open circuit and Short circuit, Current and Voltage division rule, Network Reduction Techniques – Series, Parallel, Series Parallel, Star–to-Delta or Delta-to-Star Transformations, Nodal Analysis and Mesh Analysis. Network theorem and applications. (Both Independent & Dependent sources).

Unit- II **(10 hours)**

Transient analysis of First order Circuits

Initial conditions (analysis & Problems) Natural and forced response of RL , RC Circuits, Transient analysis with different Excitations viz Step, Impulse and Sinusoidal.

Unit-III **(10 hours)**

Transient analysis of Second order Circuits

Initial conditions (analysis & Problems) Natural and forced response of RLC Circuits, Transient analysis with different Excitations viz Step and Sinusoidal.

Unit- IV **(10 hours)**

Circuit Analysis Using Laplace Transform

Introduction to Laplace transform, Circuit element models, Circuit Analysis using Laplace-examples, Transfer functions, Solution of circuit differential equations using Laplace transforms.

Unit-V **(12 hours)**

Two Port Network parameters.

Relationship of two port variables, Open circuit Impedance parameters, Short circuit Admittance parameters, Transmission Parameters, Hybrid Parameters, Relationship between parameter sets, Reciprocity and Symmetry, Interconnection of two port networks, Reciprocity Theorem.

Unit- VI **(8 hours)**

State Space Models For Electrical Networks