(2022 Batch Onwards)

B.Tech ECE(IOT)

Syllabus

IIIT Nagpur

B-Tech in ECE (IOT)

First Year

Year and Semester: First Year, First Semester.
Subject Name: Applied Mathematics for Engineers

Course Code	MAL-108	**Course Title**	Applied Mathematics for Engineers			
Category	**Core**	**Credit Assigned**	**L**	**T**	**P**	**C**
			3	**1**	**0**	4
Pre-requisite (If any)	-	**Type of Course**	**BS**			

Course Outcomes:

1. Application of line, surface, and volume integrals.
2. Apply the concepts of matrices for solving system of linear equations.
3. Solve first-order linear/nonlinear ordinary differential equations analytically using standard methods.
4. Demonstrate various models through higher order differential equations and solve such linear ordinary differential equations.
5. Analytical Solution of partial differential equations.

Course Contents:

Module 1

Vector Calculus: Scalar and vector fields, coordinate system- Cartesian, spherical, Cylindricalgradient of scalar point function, directional derivatives, divergence and curl of vector point function, solenoidal and irrotationalmotion.Vector integration: line, surface and volume integrals, Green‟s theorem, Stoke's theorem and Gauss divergence theorem (without proof).

Module 2

Matrices: Rank of matrix, consistency of a system of equations, linear dependence and independence, linear and orthogonal transformations, Eigen values and eigen vectors, Cayley – Hamilton theorem, reduction to diagonal form, Hermitian and skew Hermitian matrices, Quadratic forms.

Module 3

Ordinary Differential Equations:

First order differential equations: Exact equation,Integrating factors, Reducible to exact differential equations, Linear and Bernoulli'sform,orthogonal trajectories, Existence and Uniqueness of solutions. Solutions of second and higher order linear equation with constant coefficients, Linear independence and dependence, Method of variation of parameters, Solution of Cauchy's equation, simultaneous linear equations.

Module 4

Partial Differential Equations

Origin of first-order partial differential equations, Cauchy's problem, Linear equations, Integral surfaces passing through a given curve, Surfaces orthogonal to a given system of surfaces, Nonlinear partial differential equations of the first-order, Cauchy's method of characteristics, Compatible systems of first-order equations, Charpit's method, Jacobi's method, Linear partial differential equations, Characteristic curves, Separations of variables, Integral transform method for parabolic, hyperbolic and elliptic equations.

Text Books:

1. B. S. Grewal: "Higher Engineering Mathematics", Khanna publishers, 44th Ed.2018
2. E. Kreyszig: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed. (Reprint),
3. V. Ramana: "Higher Engineering Mathematics" McGraw-Hill Education, 11th Ed.

Reference Books:

1. Srimanta Pal &Subodh C. Bhunia: "Engineering Mathematics" Oxford University Press, 3rd Reprint, 2016. 24.01.2022 4/3
2. N.P Bali and Manish Goyal: "A textbook of Engineering Mathematics" Laxmi Publications, Latest edition.
3. C. Ray Wylie, Louis C. Barrett: "Advanced Engineering Mathematics" McGraw – Hill Book Co.Newyork, Latest ed.
4. Gupta C.B, Sing S.R and Mukesh Kumar: "Engineering Mathematic for Semester I and II", Mc- Graw Hill Education(India) Pvt. Ltd 2015.
5. H.K.Dass and Er. RajnishVerma: "Higher Engineering Mathematics" S.Chand Publication (2014). 7. James Stewart: "Calculus" Cengage publications, 7th edition, 4th Reprint 2019.

Year and Semester: First Year, First Semester.
Subject Name: Electronics Devices and Applications

Course Code:	ECL103	**Course Title:**	Electronics Devices and Applications			
Category:	Core (DC)	**Credit Assigned**	L	T	P	C
			3	0	2	4
Pre-Requisite (if Any)	Nil	**Type of Course**	Electronics and Communication Engineering			

COs:

1. To Relate and apply fundamentals of semiconductor devices, such as diode, BJT, DIAC, LED, UJT, MOSFET into various practical applications.
2. To understand the implementation of linear and non – linear analog block implementation and their testing.
3. To understand the Frequency response, stability and noise issues in amplifiers.
4. To apply concepts of basic electronic devices into electronic circuits and can analyze various parameters.
5. Design and analyze basic electronic circuits.

Course Contents

Module I
P &N Type Semiconductors, Diodes and Power Supplies, Theory of P-N Junction Diode, Junction Capacitance, Halfwave & Fullwave, Rectifiers, Filters, Ripple-Factor, Characteristics & Applications of Following Diodes, Zener as Regulators, Schottkey, Photodiode, LED, LCD, Varactor Diode &Tunnel Diode.

Module II

Junction Transistors Theory of Operation, Static Characteristics , Break Down Voltages, Current Voltage Power Limitations, Biasing of BJT Different Biasing Arrangements, Stability Factor, Thermal Runaway, Power Transistors.

Module III

Small Signal Analysis & High Frequency Analysis of BJT CE, CB, CC Amplifiers and Comparison High Frequency Analysis Calculation of Frequency Response, Gain Bandwidth Product. Power Amplifiers Classification A, B, AB, C Classes, Efficiency, Push Pull Configuration, Complimentary Symmetry, Second Harmonic & Cross Over Distortion.

Module IV

Positive and Negative Feedback Amplifiers Classification, Practical Circuits, Applications, Advantages. Oscillators Stability, Barkhausen Criteria, RC, LC & Crystal Oscillators. Field Effect Transistor & MOSFET, Principle of Operation & Characteristics.

TextS:

1. Milman and Halkias, “Integrated Electronics”, Second Edition, 2011, McGraw Hill.
2. Boylestad and Nashelsky, “Electronic Devices & Circuit theory”,2011, Tenth Edition,
3. Operational amplifiers, Design and applications","Tobey, Graeme, Huelsman", McGraw Hills, Edition.
4. Operational Amplifiers and Linear Integrated Circuits,Gaikwad R.A, Pearson 2015 Fourth Edition
5. Design of Analog CMOS Integrated Circuits, “Behzad Razavi”, Second Edition, TMH.

Reference:

1. David A. Bell, “Electronic Devices and Circuits” 2)Milman and Halkias, “Electronic Devices and Circuits”, Second Edition, 2011, McGraw
2.Design with OPAMPS and Analog Ics,FransisS.,"McGraw Hills,
1998.",Second Edition
3. OPAMPS and Linear Ics,"Fiore J.M., delmer-Thomson",USA 2001.

Year and Semester: First Year, First Semester.
Subject Name: Introduction to IoT

Course Code:	ECL104	**Course Title:**	Introduction to IoT			
Category:	Core (DC)	**Credit Assigned**	L	T	P	C
			3	0	2	4
Pre-Requisite (if Any)	Nil	**Type of Course**	Electronics and Communication Engineering			

COs:

6. Conceptualize interaction of IoT device with the physical world environment.
7. Understand individual components of IoT systems.
8. To estimate the requirements of IoT systems from individual components.
9. To conceptualize the sensor node for capturing data from the physical world.
10. To conceptualize complete IoT systems using components of IoT system.

Course Contents:

Module I
Introduction to IoT, Sensing, Actuation, Basics of Networking, Communication Protocols Sensor Networks Machine-to-Machine Communications Interoperability in IoT

Module II
Introduction to Arduino Programming Integration of Sensors and Actuators with Arduino Introduction to Raspberry Pi and programming, Implementation of IoT with Raspberry Pi Introduction to SDN, SDN for IoT

Module III
Data Handling and Analytics, Cloud Computing, and Fog Computing, Introduction to Industrial IoT

Module IV
Case Studies: Smart Cities and Smart Homes, Connected Vehicles, Smart Grid, Agriculture, Healthcare, Activity Monitoring

Text Books:
1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759
3. Raspberry Pi Cookbook, Software and Hardware Problems and solutions, Simon Monk, O'Reilly (SPD), 2016, ISBN 7989352133895

Reference books:
1. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015 3. Editors Ovidiu Vermesan
2. Peter Friess,'Internet of Things – From Research and Innovation to Market Deployment', River Publishers, 2014

Year and Semester: First Year, First Semester
Subject name: Programming Fundamentals

Course Code:	CSL112	**Course Title:**	Programming Fundamentals			
Category:	Core (DC)	**Credit Assigned**	L	T	P	C
			3	0	2	4
Pre-Requisite (if Any)	Nil	**Type of Course**	Computer Science and Engineering			

Course Contents:

Module – I

Basics of C++, Functions in c++: Basic Concepts of OOP, Benefits of OOP, OOP Languages, Applications of OOP. C++ program basics, data types, operators in c++, scope resolution, typecast operators, operator overloading, operator precedence. The main function prototyping, call by reference, inline functions, default arguments, constant arguments, function overloading, friend and virtual functions, maths library functions.

Module – II

Classes, objects, constructors, and destructors – C structures revisited, specifying a class, defining a member function, private member functions, memory allocation for objects, static data members and member functions, an array of objects, objects as function arguments, friendly functions, returning objects, pointers to members, constructors, Parametrized constructors, Multiple constructors, Copy constructor, Destructors.

Module – III

Operator overloading, inheritance, virtual functions and polymorphism – Overloading unary operators, overloading binary operators, rules for overloading operators, type conversions. Derived classes, single inheritance, multilevel inheritance, multiple inheritance, hierarchical inheritance, hybrid inheritance, virtual base classes, abstract classes, nesting of classes. Pointers, pointer to objects, this pointer, pointer to derived classes, virtual functions, pure virtual functions.

Module – IV

Console I/O operations, working with files and templates – C++ streams and stream classes, unformatted I/O operations, formatted console I/O operations, managing output with manipulators. Classes for file stream 8 operations, opening/closing of file, file pointers, and their manipulation, error handling during file operation, command-line arguments. Class templates, class templates with multiple parameters, function templates, overloading template functions, member function templates, non-type template arguments.

Module – V

Exception handling and Standard template library – Basics of exception handling, exception handling mechanism, throwing mechanism, catching mechanism, rethrowing exception, specifying exception. Components of STL, Containers, Algorithms, Iterators, Application of Container classes, Functions objects.

Text Books

1. Object Oriented Programming with C++; E Balagurusamy, ; 7th, McGraw Hill Education (India) Pvt. Limited; 2018.
2. The Complete Reference C++ (Indian Edition); Herbert Schildt, ; 4th, McGraw Hill Education (India) Pvt. Limited; 2017.

Reference Book

1. The C++ Programming Language; Bjarne Stroustrup, ; 3rd, Pearson India Education Services Pvt.Ltd; 2017.

Year and Semester: First Year, First Semester.
Subject Name: Electrical Systems

Course Code:	ECL105	**Course Title:**	Electrical Systems			
Category:	Core (DC)	**Credit Assigned**	L	T	P	C
			3	0	2	4
Pre-Requisite (if Any)	Nil	**Type of Course**	Electronics and Communication Engineering			

COs

- To enable the students to understand the basic ideas and principles of Electrical Engineering.
- To impart knowledge for understanding the details of electrical power systems, transformers, generators, motors etc.
- To enable the students to understand the basic ideas and principles of power electronics and conversion principle.
- To develop skills in the field of basic converters, inverters.
- To understand the basic principles and ideas of renewable energy systems, and electric vehicles

Course Contents:

DC circuits- electrical quantities such as voltage, current, power, energy, Kirchoff's law . AC Circuits: current, voltage, power, power factor, frequency , energy, circuit elements R, L and C, phasor diagram, impedance, real and reactive power in single phase circuits, magnetic circuits, B-H curve, hysteresis and eddy current , three phase circuits, different motors and transformers principles and applications, basics of protection – fuse, relay principles types, introduction to power electronic conversion principles, basic converters, inverters, introduction to power systems, renewable energy systems, and electric vehicles.

TEXT BOOKS/REFERENCE BOOKS:

1. Basic Electrical Engineering - D.P. Kothari and I.J. Nagrath, 3rd edition 2010, Tata McGraw Hill.

2. D.C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.

3. L.S. Bobrow, Fundamentals of Electrical Engineering", Oxford University Press, 2011

4. Electrical and Electronics Technology, E. Hughes, 10th Edition, Pearson, 2010

5. Electrical Engineering Fundamentals, Vincent Deltoro, Second Edition, Prentice Hall India, 1989

Year and Semester: First Year, First Semester.
Subject Name: Environmental Studies

Course Code:	HUL102	**Course Title:**	Environmental Studies			
Category:	HU	**Credit Assigned**	L	T	P	C
			2	0	0	2
Pre-Requisite (if Any)	Nil	**Type of Course**	Basic Science			

Course Outcomes:

1. Introduce to various natural resources, their importance and status.
2. Introduce to the concepts of ecosystem, their structure and functions.
3. Introduce to the concept of biodiversity conservation.
4. Introduce to possible causes of various forms of environmental pollution and their consequences, methods of prevention.
5. Introduce to various social and climatic changes due to pollution.

Course Contents:

Natural resources: Forest resources, Water resources, Mineral resources, Food resources, Energy resources, Land resources.

Ecosystem: Concept of an ecosystem, Structure and functions of an ecosystem, Producers, consumers and decomposers, Ecological succession, Food chain, food webs and pyramids.

Biodiversity and its conservation: Introduction, definitions: genetics, species and diversity, Value of biodiversity, Biodiversity at global, national and local level, India as a mega-diversity nation, Hot-spot of biodiversity, Threat to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, Conservation of biodiversity: in-situ and ex-situ conservation.

Environmental pollution: Definition, Causes, effects and control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards, Solid waste management: Causes, effects and control measures of urban and industrial wastes.

Social issues and environment: Sustainable development, Water conservation, Rain water harvesting, Watershed management, Climate change, Global warming, Acid rain, Ozone layer depletion, Nuclear accident, Holocaust, Environmental rules and regulations.

Human population and environment: Population growth, Environment and human health, Human rights, Value education, Role of information technology in environment and human health.

TextS:

1. Rajgopalan R., Environmental Studies.

Reference:

1. Benny Joseph, Environmental Studies, McGraw Hill.
2. ErachBarucha Environmental Studies University press (UGC**).**

Year and Semester: First Year, Second Semester.
Subject Name: Digital System Design with HDL

Course Code:	ECL106	**Course Title:**	Digital System Design with HDL			
Category:	Core (DC)	**Credit Assigned**	L	T	P	C
			3	0	2	4
Pre-Requisite (if Any)	Electronic Devices and Applications	**Type of Course**	Electronics and Communication Engineering			

COs:

1) Represent a digital system using basic digital blocks
2) Implement sequential and combinational digital circuits using gates
3) Model a digital system using Hardware Description Language
4) Develop programs in HDL
5) Design a system using HDL

Course Contents:

Module - 1:
Basic of logic circuits, latches, flip-flops, combinational and sequential circuit design.
Module - 2:
Introduction to HDL Programming and simulation, structural specification, behavioural specification, dataflow modelling.
Module - 3:
Testbench, testing using test vectors, testing using waveforms.
Module - 4:
Design organization, examples of HDL programming: adder, ALU, counters, shift registers, register bank, FSM design, etc.
Module - 5:
Subprogram, packages, libraries, Basic I/O, Programming mechanics Synthesis, RTL description, constraints attributes
Module - 6:
Structures: of RAM, ROM, PLA, PAL and FPGA

Text Books:

1) Pedroni V.A., "Digital Circuit Design with VHDL", Prentice Hall India, 2nd 2001 Edition.
2) M. Morris Mano, "Digital Logic and Computer Design," Prentice Hall, 2006
3) Donald E. Thomas and Philip R. Moorby, "The Verilog Hardware Description Language", Kluwer Academic Publishers.

Reference books:

1) Wakerly J.F., "Digital Design: Principles and Practices," Pearson India, 4th 2008 Edition.
2) Kohavi Z., Jha N.K., "Switching and Finite Automata Theory", Cambridge University Press, India, 2nd 2011 Edition.

Year and Semester: First Year, Second Semester.
Subject Name: Data Structures

Course Code:	CSL102	**Course Title:**	Data Structures			
Category:	Core (DC)	**Credit Assigned**	L	T	P	C
			3	0	2	4
Pre-Requisite (if Any)	Programming Fundamentals	**Type of Course**	Computer Science and Engineering			

Course Contents:

Module – I
Basics of data structures, Definition of Data Structures, Abstract Data Types, Usage, Types of Data Structures. List: Linked Representation, Singly Linked Lists Operations-Insertion, Deletion, Circular linked lists-Operations on Circular linked lists, Doubly Linked Lists- Insertion, Deletion.
(12)

Module – II
Stacks: Definition, Linked Implementations, Recursion Implementation, Queue: ADT, Definition, Array And Linked Implementations, Circular Queues-Insertion And Deletion Operations (8)

Module – III
Trees – definition, terminology, Properties of Binary Trees, Binary search tree. Searching, Insertion, Deletion, finding the height of BST, Iterative Tree Traversals, Recursive Tree Traversal. Evaluation and conversations of Expressions-Infix, prefix, and postfix. (8)

Module – IV
Priority Queues –Definition and applications, Max Priority Queue ADT-implementation-Max Heap-Definition, Insertion into a Max Heap, Deletion from a Max Heap, Sorting techniques (7)

Module – V
Graphs–Graph ADT, Graph Representations- Adjacency matrix, Adjacency lists, Graph Search methods - DFS and BFS. (6)

List of Practicals
1. Operations on Linked Lists 2. Operations on Linked Lists with Header node
3. Programs on Implementations of Stacks and Queues 4. Applications of Stacks and Queues
5. Binary Tree Traversals (Recursive and Iterative) 6. Operations on Search Trees
7. Evaluation and conversations of Expressions 8. Graph creation and representation
9. DFS and BFS Sorting techniques

Text Book

1. Data Structures Using C and C++ by Langsam, Tanenbaum, Prentice Hall India Learning Private Limited; 2nd Edition.
2. Data Structures, Schaum's Outlines Series, by Seymour Lipschutz
3. Fundamentals of Data Structures in C, by Sahni Horowitz, Publisher: Universities Press; 2nd Edition.

Reference Book

1. Data Structures and Algorithms Made Easy, CareerMonk Publications; 2nd Edition
2. Data Structures and Algorithms in C++, by Adam Drozdek, Publisher: Course Technology; 3rd Edition.
3. Data Structures & Algorithm Analysis in C++, by Mark A. Weiss , Publisher: Pearson; 4th Edition.

Year and Semester: First Year, Second Semester.
Subject Name: Analog IC and Fabrication

Course Code:	ECL107	**Course Title:**	Analog IC and Fabrication			
Category:	Core (DC)	**Credit Assigned**	L	T	P	C
			3	0	2	4
Pre-Requisite (if Any)	Electronic Devices and Applications	**Type of Course**	Electronics and Communication Engineering			

Course Outcomes:

1. Through the course, students are able to understand the Basics of analog IC design.
2. To understand the Frequency response, stability and noise issues in amplifiers.
3. To understand the implementation of linear and non – linear analog block implementation and their testing.
4. Demonstrate the use of analog circuit analysis to analyze the operation and behavior of various modern analog integrated circuits.

Course Contents:

Module – I
: Differential amplifier, configurations, DC & AC analysis, constant current bias, current mirror, cascaded differential amplifier stages, level translator.

Module – II

OPAMP: Basics, inverting, non-inverting, differential amplifier configurations, negative feedback, voltage gain, input & output impedance, Bandwidth. Input offset voltage, input bias and offset current, Thermal drift, CMRR, PSRR, Frequency response.

Module – III

: Linear applications, DC, ac amplifiers, summing differential amplifier, instrumentation amplifier, V to I and I to V converters, Integrator, Differentiator. Nonlinear applications, Comparators, Schmitt Trigger, Clipping and Clamping circuits, Absolute value circuits, Peak detectors, Sample and hold circuits, Log and antilog amplifiers.

Module – IV: First / Second order low/ high/ bandpass, band reject active filters, All pass filter, phase shift oscillator, Wein bridge oscillator, Square wave and triangular waveform generators.

Module – V :: Study of ICs LM-741, LM-555, LM-566, LM-565, LM-339, LM-723.

Text:

1. Operational amplifiers, Design and applications, "Tobey, Graeme, Huelsman", McGraw Hills, Edition
2. Operational Amplifiers and Linear Integrated Circuits, Gaikwad R.A, Pearson 2015 Fourth Edition
3. Design of Analog CMOS Integrated Circuits, “Behzad Razavi”, Second Edition, TMH

Reference:

1. Design with OPAMPS and Analog ICs, FransisS.,"McGraw Hills, 1998.",Second Edition
2. OPAMPS and Linear ICs, "Fiore J.M., delmer-Thomson", USA 2001.

List of Lab Assignments / Experiments OR List of Tools on which the lab assignment should be based (If Any)

1. Introduction to Operational Amplifier (op-amp) and measure various op amp parameters.
2. To design an Inverting Amplifier for the given specifications using Op-Amp IC 741
3. To design a Non-Inverting Amplifier for the given specifications using Op-Amp IC 741.
4. To design an Integrator circuit for the given specifications using Op-Amp IC 741.
5. To design and setup a zero crossing detector circuit with OP AMP 741C and plot the waveforms.
6. To design and setup a summing amplifier circuit with OP-AMP 741C for a gain of 2 and verify the output.
7. To construct and study the behavior of logarithmic and antilogarithmic amplifier.
8. To design and setup a Schmitt trigger, plot the input output waveforms and measure VUT and VLT.
9. To design and obtain the frequency response of second order Low Pass Filter (LPF).
10. To design and setup symmetrical and asymmetrical astable multivibrators using op-amp 741, plot the waveforms and measure the frequency of oscillation.
11. To design and setup a monostable multivibrator using Op-amp 741 and (i) Plot the waveforms (ii) Measure the time delay.
12. To Design and setup a RC phase shift oscillator using Op-Amp 741 and (i) Plot the output waveform (ii) Measure the frequency of oscillation.
13. To Design and setup a square wave and triangular wave generators using Op-Amp 741 and plot the output waveforms.
14. To design and setup symmetrical and asymmetrical astable multivibrators using IC 555 and (i) Plot the output waveform (ii) Measure the frequency of oscillation.

Simulations of linear and non-linear applications of op-amp on ORCAD simulator.

Year and Semester: First Year, Second Semester.
Subject Name: IoT Workshop-I

Course Code:	ECL108	**Course Title:**	IoT Workshop-I			
Category:	Core (DC)	**Credit Assigned**	L	T	P	C
			0	0	4	2
Pre-Requisite (if Any)	Electronic Devices and Applications	**Type of Course**	Electronics and Communication Engineering			

Course Outcomes:

1. Examine the working principle of basic electronic systems.
2. To conceptualize simulation of IoT systems.
3. Model a physical component for the IoT system.
4. Design an IoT system using components for the IoT.
5. Troubleshoot the connectivity among the components of IoT.

Curriculum:

Hands-on with major components of Internet-of-Things:

(1) Low-power embedded systems: Less battery consumption, high-performance electronic systems.

(2) Cloud computing: Storage and processing of the data collected through IoT devices.

(3) Availability of big data: Introduction and ways to handle huge data.

(4) Networking connection: Networking and communication of IoT devices

Year and Semester: First Year, Second Semester.

Subject Name: NMPT

Course Code:	MAL 201	Course Title:	NMPT			
Category:	Core (DC)	Credit Assigned	L	T	P	C
			3	1	0	4
Pre-Requisite (if Any)	MATHEMATICS	Type of Course	Basic Science			

Course Outcomes:

1. To understand common numerical methods and how they are used to obtain approximate solutions of mathematical problems.
2. To analyze and evaluate the error and accuracy of common numerical methods.
3. To apply numerical methods to obtain approximate solutions to mathematical problems.
4. To understand concepts of probability, conditional probability and independence, random variables and probability distributions.
5. Application of random processes, autocorrelation and cross-correlation in the field of electronics and communication engineering

Course Contents:

Numerical Analysis: Solutions of algebraic and transcendental equations by Iteration method, method of false position, Newton-Raphson method and their convergence. Solutions of system of linear equations by Gauss elimination method, Gauss Seidal method, LU decomposition method. Newton-Raphson method for system of nonlinear equations. Eigen values and eigen vectors: Power and Jacobi methods. Numerical solution of ordinary differential equations: Taylor's series method, Euler's modified method, Runge-Kutta method, Adam's Bashforth and Adam's Moulton, Milne's predictor corrector method. Boundary value problems: Shooting method, finite difference methods.

Probability theory: Random variables, discrete and continuous random variable, probability density function; probability distribution function for discrete and continuous random variable joint distributions. Definition of mathematical expectation, functions of random variables, The variance and standard deviations, moment generating function other measures of central tendency and dispersion, Skewness and Kurtosis. Binomial, Geometric distribution, Poisson distribution, Relation between Binomial and Poisson's distribution, Normal distribution, Relation between Binomial and Normal distribution.

Random processes, continuous and discrete, determinism, stationarity, ergodicity etc. correlation functions, autocorrelation and cross-correlation, properties and applications of correlation functions.

Text:

Jain, Iyengar and Jain : Numerical Methods for Engineers and Scientists, Wiley Eastern

Reference:

1. V.K. Rohatgi and A.K.M. Ehsanes Sateh: An Introduction to Probabability and Statistics, John Wiley & Sons.
2. S. D. Cante and C. de Boor, Elementary Numerical Analysis, an algorithmic approach, McGraw-Hill.
3. Gerald and Wheatley: Applied Numerical Analysis, Addison-Wesley.

4. Spiegel, M.R.; Theory and problems of Probability and statistics; McGraw-Hill Book Company; 1980.
5. K.S. Trivedi: Probability Statistics with Reliability, Queuing and Computer Science applications, Prentice Hall of India Pvt. Ltd.

Year and Semester: First Year, Second Semester.
Subject Name: Instrumentation Techniques

Course Code:	ECL109	**Course Title:**	Instrumentation Techniques			
Category:	Core (DC)	**Credit Assigned**	L	T	P	C
			3	0	0	3
Pre-Requisite (if Any)	Electrical Systems	**Type of Course**	Electronics and Communication Engineering			

Course Outcomes:

1. Examine the working principle of basic electronic instruments.
2. Measure various electrical quantities with desired accuracy, precision and resolution
3. Mathematically model and analyse an electronic instrument.
4. Design an instrument as per the requirements of measurand.
5. Demonstrate ability to select suitable instruments for measurement of physical quantity

Module 1: Accuracy and precision, Significant figures, Types of errors, statistical, Probability of errors, Limiting errors. Functional elements of an instrument, Active and Passive transducers, Analog and Digital mode of operation, Null deflection methods, Input and output configuration of measuring instrument and instrument system.

Module 2: Electromechanical Indicating Instruments: PMMC galvanometer, DC ammeters, DC voltmeter, series & shunt type ohmmeters, multi-meter, electrodynamometer for power measurement, power factor meter, instrumentation transformer.

Module 3: Bridge Measurements: Wheat stone bridge: Basic operation, measurement errors, Thevenin's equivalent circuit, Guarded Wheat-stone bridge, Kelvin bridge: Effects of connecting leads, Kelvin double Bridge. AC Bridges and their application: Condition and application of the balance equation. Maxwell's bridge, Hay Bridge, Schering Bridge, Wein Bridge unbalanced condition. Electronic Instruments: Amplified DC meter, AC voltmeter, electronic multimeter, digital voltmeter, Q meter

Module 4: Transducers as input elements to the instrumentation system. Basic methods of force measurement, torque measurement, pressure and sound measurement. Temperature measurement: Standards and calibration, thermal expansion methods, thermocouples, resistance thermometers junction semiconductors sensors, digital thermometers. Strain Measurement: Bonded and un-bonded electrical strain gauges, gauge factor, temperature compensation methods. Biomedical sensors used for measurement of biological, chemical and physical process of human body.

Module 5: Oscilloscope: Introduction, Oscilloscope block Diagram, Cathode Ray tube (CRT), CRT circuits, Deflection systems, Delay line. Multiple trace, Simple frequency counters. Strip XY recorder, CRO. LED display, LCD display, DSO. Signal conditioning Techniques used in

various transducers, Gain clipping, filtering, amplification, data logger. IEEE 488 Bus: Principles of operation, protocols.

Text books:

1. Electronic instrumentation & Measurement techniques, Cooper, Helfric, Prentice Hall India
2. Measurement System : Application &design, Doelbin E.D, McGraw Hill ,Edition

Reference Books:

1.Electronic Instrumentation, Kogalsusha. Terman, Petil Edition
2.Electronic Instrumentation, Kalsi, Tata Mc-Grawhill Edition
3.Electronic Measurement &Instrumentation, oliver, Tata Mc-Grawhill Edition
4.Electronic Measurement and Measuring Instruments, Sawhney A.

Year and Semester: First Year, Second Semester.
Subject Name: Communication Skills

Course Code:	HUL 101	**Course Title:**	Communication Skills			
Category:	Core	**Credit Assigned**	L	T	P	C
			2	0	2	3
Pre-Requisite (if Any)	Nil	**Type of Course**	Humanities			

Course Outcomes:

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

1. Understand the importance of effective interpersonal and workplace communication.
2. Have better reading comprehension and pronunciation
3. Write letters and resumes
4. Organize their thoughts for better pre and post placement communication through effective presentations, writing, personal interviews and group discussions.
5. Utilize functional English grammar for accurate and enhanced language skills.

Course Contents:

Importance of Effective Communication; Reading, Writing and oral communication Skills; Methods/ Modes of Communication , Choice of Media;
Barriers to Communication, Role of Communication in Society, Reading Skills, Professional Speaking, Orientation in Literary and Scholarly Article, Business Correspondence

Text:

1. Orient Longman, A Textbook of English for Engineers and Technologists
2. M. Ashraf Rizvi, Effective Technical Communication. Tata Mc Grwa-Hill Publishing Company Limited,2009

Reference:

1. Quirk R. and Greenbaum S., A University Grammar of English.
2. Krishnaswamy N., English Grammar (Longman Publication) (Macmillan India Ltd)
3. Sanjay Kumar and Pushp Lata. Communication Skills. Oxford Publication
4. Meenakshi Raman and Sangita Sharma. Technical Communication. Second Edition. Oxford Publication,2011.

List of Lab Assignments / Experiments OR List of Tools on which the lab assignment should be based (If Any)

1. Presenting a Book Chapter using PowerPoint slides
2. Speaking Skills
3. Presentation Skills
4. Group Discussion
5. Personal Interview/ SWOT Analysis
6. Comprehending a Technical Report/News Paper Article.