LNCT University B.TECH-AIML

Syllabus Batch 2025-26

First Year

I Semester Syllabus

Advanced Physics & Sustainable Environment (AL-201)

COURSE OUTCOMES:
After Completing the course student should be able to:

CO1	Apply physical significance of gradient, divergence and curl on various surfaces in engineering physics
CO2	Determine various parameters related to laser, fibre optics and optics
CO3	Find position and momentum of free particle by Schrodinger wave equation
CO4	Analyse and compare energy storage technologies
CO5	Study and analyse social issues and environmental ethics

COURSE CONTENTS:

Unit I Electrodynamics & Solid State Physics: Gradient, divergence and curl, Gauss divergence and Stoke's theorem, Equation of Continuity, Maxwell;s equations ,Maxwell;s equations in vacuum. Qualitative discussion of Kronig Penny model (no derivation), Fermi-Dirac statistical distribution function, Fermi level for Intrinsic and Extrinsic Semiconductors, PN junction diode, Zener diode, photodiode, Hall effect.

Unit II Quantum Physics & LASER: Group and particle velocities & their relationship, Heisenberg's uncertainty principle, Wave function and its properties, energy and momentum operators, time dependent and time independent Schrödinger wave equation. Application of time independent Schrödinger wave equation. Stimulated and spontaneous processes, Einstein's A & B Coefficients, active medium, population inversion, pumping, Optical resonators, Characteristics of laser beam, Coherence length, Principles and working of Ruby, He-Ne lasers with energy level diagram, Applications of laser.

Unit III -- Optical Fiber and wave optics: Fundamental idea about optical fiber, acceptance angle & cone, numerical aperture, V-number, Types of optical fiber, Number of modes.Applications of optical fibers. Interference of light, Division of amplitude, Interference in thin films (due to reflected and transmitted light), interference from a wedge shaped thin film, Newton's rings experiment. Diffraction of light, Diffraction at single slit and N-slits or grating.

UNIT IV: Physics of Renewable Energy Systems &Sustainable Energy: Basics of nano-materials and nanotechnology, Renewable energy sources and classifications. Unsustainable to Sustainable developments (Goals). Energy storage Technology: Introduction to energy storage for power systems and applications, solar energy (Photo voltaic cell), fuel cells, Mobile storage system: electric vehicle.

UNIT V: Social Issues and Environment : Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust.

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Reference /Books: -
1. Engineering Physics by R K Gaur & S L Gupta, Dhanpat Rai Publications
2. A Text Book of Engineering Physics – M N Avadhanulu,P G Kshirsagar, S Chand & Company Ltd (VI revised Edition)
3. A Text Book of Engineering Physics – N. Gupta & S.K. Tiwari , Dhanpat Rai & Co. , Delhi
 4. Advanced renewable Energy Systems, S C Bhatia
5. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
6. Online MOOCS/SWAYAM NPTEL Courses

 List of suggestive core experiments: - (Any ten)
   1. Measurement of energy band gap of semiconductor.
   2. V-I Characteristics of PN Junction diode
   3. V-I Characteristics of Zener diode
   4. V-I Characteristics of Photo diode
   5. V-I Characteristics of Solar cell (Photo-Voltaic Cell)
  6. Measurements by LASER- To find the width of s single slit by He-Ne Laser..
  7. Measurements by Fibre optics - To determine various parameters by Optical Fibre.
  8. Newton's Rings Experiment
  9. Spectrometers- Wavelength, using grating
  10. Spectrometers-R.I, using prism
  11. To study Hall effect.
  12. To determine plank's constant.
  13. Uses of Potentiometers and Bridges (Electrical) & CRO.
  14. Other conceptual experiments other than theory syllabus

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Advanced Calculus(AL-102)

COURSE OUTCOMES:
After Completing the course student should be able to:

CO12.1	Analyze the Rolle's theorem that is fundamental to application of differentiation in Engineering problem.
CO12.2	Evaluate the idea of applying differential and integral calculus of curvature and to improve integral apart from some application it gives a basic introduction on Beta and Gamma function.
CO12.3	Apply effective mathematical tools for the solution of Ordinary Differential Equations.
CO12.4	Develop the Fuzzy logics MATLAB concept in most branches of engineering.
CO12.5	Create the essential tool of matrices in a comprehensive manners.

Course Contents:

Module 1: Calculus: (10 hours): Rolle's theorem, Mean Value theorems, Expansion of functions by Mc. Laurin's and Taylor's for one variable; Taylor's theorem for function of two variables, Partial Differentiation, Maxima & Minima (two and three variables).

Module 2: Calculus: (8 hours): Definite Integral as a limit of a sum and Its application in summation of series; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions. Multiple Integral, Change the order of the integration, Applications of multiple integral for calculating area and volumes of the curves.

Module 3: Ordinary Differential Equations I :(6 hours) : Differential Equations of First Order and First Degree (Leibnitz linear, Bernoulli's, Exact), Differential Equations of First Order and Higher Degree, Higher order differential equations with constants coefficients, Homogeneous Linear Differential equations, Simultaneous Differential Equations.

Module 4: Fuzzy (8hours): Operation of fuzzy sets, Fuzzy arithmetic and relation, Fuzzy relation equations, Fuzzy logics. MATLAB introduction, Programming in MATLAB scripts, Functions and their application.

Module 5: Matrices (8 hours): Rank of a Matrix, Solution of Simultaneous Linear Equations by Elementary Transformation, Consistency of Equation, Eigen Values and Eigen Vectors, Diagonalization of Matrices, Cayley-Hamilton theorem and its applications to find inverse.

REFERENCE BOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43rd Edition, New Delhi,2015.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition,Pearson, Reprint, 2002.
3. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
4. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
5. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11thReprint, 2010.

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Decoding Data: Learn AI, ML, DS & Analytics (AL-103)

COURSE OUTCOMES:
After Completing the course student should be able to:

CO1	Analyse role of data scientist and applications of data science in various domains.
CO2	Apply data preprocessing techniques to sample matrix and dataset
CO3	Perform descriptive statistics method on numerical data
CO4	Develop regression model for prediction and decision making
CO5	Evaluate and test data science models for multiple performance parameters.

Course Contents

Objectives: to teach students the concepts of current main conceptual frameworks at use in

AI Business Intelligence and Data Analytics.

Unit I: Introduction to Data Science: Defining Data Science and Big Data, Benefits and Uses of Data Science and Big Data, Facets of Data, Structured Data, Unstructured Data, Natural Language, Machine generated Data, Graph based or Network Data, Audio, Image, Video, Streaming data, Data Science Process, Big data ecosystem and data science, distributed file systems, Distributed programming framework, data integration framework, machine learning framework, No SQL Databases, scheduling tools, benchmarking tools, system deployments

Unit II: Introduction to Machine Learning: What is Machine Learning, Learning from Data, History of Machine Learning, Big Data for Machine Learning, Leveraging Machine Learning, Descriptive vs Predictive Analytics, Machine Learning and Statistics, Artificial Intelligence and Machine Learning, Types of Machine Learning – Supervised, Unsupervised, Semi-supervised, Reinforcement Learning,

Unit III:More About ML Types of Machine Learning Algorithms, Classification vs Regression Problem, Bayesian, Clustering, Decision Tree, Dimensionality Reduction, Neural Network and Deep Learning, Training machine learning systems

Unit IV: Introduction to AI: What is AI, Turing Test, cognitive modeling approach, law of thoughts, the relational agent approach, the underlying assumptions about intelligence, techniques required to solve AI problems, level of details required to model human intelligence, successfully building an intelligent problem, history of AI

Unit V: Introduction to Data Analytics: Working with Formula and Functions, Introduction to Power BI & Charts, logical functions using Excel, Analysing Data with Excel.

Reference Books:-

- Stuart J. Russell & Peter Norvig, Artificial Intelligence : A Modern Approach, 3e ed. Pearson.
- Kevin Knight &Eliane Rich, B. Nair, Artificial Intelligence. 3rd ed. McGrawHill.
- Patrick Henry Winston, Artificial Intelligence. 3rd ed. Addison –Wesley Publishing company.

Suggested List of Experiments :

Python basics Overview of Data Analytics tools

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Programming and Problem solving with C++(AL-104)

COURSE OUTCOMES:
After Completing the course student should be able to:

CO1	Understand the basics of Computer system organization and number system.
CO2	Write and Understand algorithms to solve various computational problems.
CO3	Use of data types, operators, control statements and type conversions in C.
CO4	Write programs using arrays, functions, structures, and use of dynamic memory allocation and file handling concept in C programming language.
CO5	Understand the basic of data types, operators, functions, list, tuple and dictionaries in python programming.

Course Contents:

Unit- 1 Introduction: C and C++ language tokens, Data types. Type Conversion, Control Statement, Loops, Arrays and string. Object oriented programming Introduction, Application, characteristics, difference between object oriented and procedure programming, Comparison of C and C++, Cout, Cin, Operators , Function, returning values from functions, Reference arguments, Inline function, Default arguments, Returning by reference.

Unit-2 Object and Classes: Implementation of class and object in C++, access modifiers, object as data type, constructor, destructor, Object as function arguments, default copy constructor, parameterized constructor, returning object from function, Structures and classes, Classes objects and memory, static class data, Arrays of object, Arrays as class Member Data, the standard C++ String class, Run time and Compile time polymorphism.

Unit-3 Operator overloading and Inheritance: Overloading unary operators, Overloading binary operators, data conversion, pitfalls of operators overloading, Concept of inheritance, Derived class and base class, access modifiers, types of inheritance, Derived class constructors, member function, public and private inheritance.

Unit- 4 Pointer and Virtual Function: Addresses and pointers, the address-of operator & pointer and arrays, Pointer and Function pointer, Memory management: New and Delete, pointers to objects, debugging pointers, Virtual Function, friend function, Static function, friend class, Assignment and copy initialization, this pointer, dynamic type information.

Unit- 5 Streams and Files: Streams classes, Stream Errors, Disk File I/O with streams, file pointers, error handling in file I/O with member function, overloading the extraction and insertion operators, memory as a stream object, command line arguments, printer output, Function templates, Class templates Exceptions, Containers, exception handling.

Reference Books:-

1. Object Oriented Analysis and Design with Applications. by Grady Booch Pearson/PHI.
2. Harold Abelson and Gerald, Structure and Interpretation of Computer Programs,1985,MIT Press.
3. Y Kanetkar.Let us C.,5thedition.BPB.
4. Byron Gotfried, Schaum"s outline of programming with C.1st edition Schaum"s series
5. Y Kanetkar.Let us C++.,5thedition.BPB

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- **Suggested List of Experiments**

- Formulate simple algorithms for arithmetic and logical problems
- Translate the algorithms to programs (in C language)
- Test and execute the programs and correct syntax and logical errors
- Implement conditional branching, iteration and recursion
- Decompose a problem into functions and synthesize a complete program using divide and conquer approach
- WAP to illustrate various arithmetic functions using functions like add(),sub(),multi(), div() etc.

- WAP to take 10 numbers in any array and print sum of that numbers.

- WAP to add two numbers using function.

- WAP using class to illustrate concept of Constructor and Destructor. Also try to use scope resolution program.

- WAP to implement operator overloading like "+" operator.

- WAP to implement runtime polymorphism

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Digital Circuits &Embedded Systems (AL-203)

COURSE OUTCOMES:
After Completing the course student should be able to:

CO1	Design of various Combinational logic circuit
CO2	Understand the concept of synchronous sequential logic circuit.
CO3	Apply the concept of Asynchronous logic circuit for designing transition and flow table.
CO4	To differentiate the various requirements for general purpose computing systems and embedded systems.
CO5	Apply the programming using assembly level language in microcontroller for simple arithmetic, logical operation.

COURSE CONTENTS:
UNIT I - COMBINATIONAL LOGIC CIRCUIT Introduction to number system, Karnaugh map Minimization, Don't care conditions, Half Adder, Full Adder, Half Subtractor, Full Subtractor, Serial Adder, Parallel Adder, Carry Look Ahead Adder, Code Converters, Encoders, Decoders, Multiplexers and De-multiplexers, Design of combinational circuits.

UNIT II - SYNCHRONOUS SEQUENTIAL LOGIC CIRCUIT Latches ,Flip flops – SR, D, JK, T and Master Slave Flip Flop, Characteristics Equation , State Table ,Excitation Table, Analysis of synchronous sequential circuits, Design of synchronous sequential circuits , Counters, Serial Counter, Up down Counter ,Modulo n Counter, Decade Counter ,Registers ,Types of Shift Registers, Universal Shift Registers ,Shift Register Counter, Ring Counter

UNIT III - ASYNCHRONOUS SEQUENTIAL LOGIC CIRCUIT Design of Asynchronous sequential circuits, Algorithmic State Machines, ASM Charts, Transition table ,Flow table, State Reduction, State assignments in asynchronous sequential machine, races and hazards.

UNIT IV-OVERVIEW OF EMBEDDED SYSTEMS Embedded Systems and general purpose computing systems,classification, major application areas,general purpose processor, application specific processor, single purpose processor.Micro-controller architecture -8051 registers, Instruction set, addressing modes,PIC Micro Controller –CPU architecture, ARM processor – Architecture.

UNIT V- EMBEDDED SYSTEMS-ASSEMBLY LANGUAGE Structure of Assembly Language, Basic Assembly LanguageProgramming,Programming Tools and Techniques, Programming the 8051

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Reference Books: -

1. Malvino & Leach, "Digital Principles and Applications", TMH.
2. M. Morris Mano, "Digital Logic Design", PHI
3. Kohavi: Switching & Finite Automata Theory, TMH.
4. S. Salivahanan & S. Arivazhagan, "Digital Circuits and Design", Vikas Publishing
5. Ronald J Tocci , "Digital Systems, Principles and Applications", PHI.
6. Taub & Schilling, "Digital Integrated Electronics", TMH.
7. Lee: Digital Circuits and Logic Design, PHI Learning.
8. Shibu K.V, Introduction to Embedded Systems - McGraw Hill, 2009.
9. Muhammad Ali Mazidi and Janice Gillespie Mazidi, The 8051 Microcontroller and Embedded Systems, Pearson education, 2005
10. Raj Kamal, Embedded Systems Architecture, Programming and Design, TMH, 2011

List of suggestive core experiments: -

1. Verify the operation of all Logic Gates for various IC's (IC7400, IC 7402, IC 7404, IC 7408, IC 7486, IC 7432) on breadboard.
2. Design and verify the operation of Half Adder and Full Adder circuit.
3. Design and verify the operation of Half Subtractor and Full Subtractor circuit.
4. Implement 4:1/16:1 Multiplexer and verify its operation.
5. Implement 1:4 / 1:8 Demultiplexer and verify its operation.
6. Design &Verification of state tables of RS, JK, T and D flip flops using NAND gates.
7. Design of Decade Counter.
8. To study developmenttools/environment for ATMEL/PIC microcontroller program and Architecture.
9. Write a program for data transfer/exchange between specified memories locations in 8051.
10. Write a program for addition / subtraction / multiplication / division of 8/16 bit data in 8051.
11. Write a program for implementing logical bit and byte operation in 8051.

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Civil Engineering & Mechanics (AL-105)

COURSE OUTCOMES:
After Completing the course student should be able to:

CO1	Student should get general idea of selection of building materials for the components of building construction as per requirement of site.
CO2	Students should be able to get the concepts of surveying methods, results and surveying instruments in field.
CO3	Students should be able to do plotting of area traversed in field survey using conventional and modern techniques.
CO4	Students should be able to understand the use of principle of static and dynamics in civil engineering structures.
CO5	Students should be able to use centre of gravity and moment of inertia for finding complex cross sections.

Course Contents

Unit I : Stones, Bricks, Cement, Lime, Timber-Types, Properties, Test & uses, laboratory tests. Concrete and mortar Materials: Workability, Strength properties of Concrete, Nominal proportion of Concrete preparation of concrete, Compaction, Curing.
Elements of Building Construction, Foundations conventional spread footings, RCC footings, Brick masonry walls, Plastering and Pointing, Floors, Roofs, Doors, Windows, Lintels, Staircases – Types and their suitability

Unit II: Introduction to surveying Instruments – Levels, Theodolites, Plane tables and related devices. Electronic surveying instruments etc. Measurement of distances – conventional and EDM methods, measurement of directions by different methods, measurement of elevations by different methods.Reciprocal leveling.

Unit III : Data Analysis of Surveying using Total Station, Theodolite and Electronic surveying instruments. Overview of IOT sensors and devices for Structural health Monitoring, Smart cities, Intelligent Transportation System, Smart Irrigation, Smart Parking Syatem, real Time Contruction management and Project safety platforms., Introduction of remote sensing and its applications.

Unit IV: Forces and Equilibrium: Graphical and Analytical Treatment of Concurrent and non-concurrent Co- planner forces, Free Body Diagram, Force Diagram and Bow's notations, Application of Equilibrium Concepts: Analysis of plane Trusses: Method of joints, Method of Sections. Frictional force in equilibrium problems.

Unit V: Centre of Gravity and moment of Inertia: Centroid and Centre of Gravity, Moment Inertia of Area and Mass, Introduction to product of Inertia and Principle Axes. Support Reactions, Shear force and bending moment Diagram for Cantilever & simply supported beam with concentrated, distributed load and Couple.

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Rationale

1. Structural Health Monitoring-Structural health monitoring (SHM) involves monitoring and assessing the condition of astructure under working conditions by tracking parameters like stress, strain, vibrationsetc. The emergence of IoT have simplified the manual, laborious task of manual datacollection which is inefficient and slow. The collection of real time data of structures can be easily done by installing sensors and actuators in the structures in order to improve theoverall performance

2. Smart cities-Smart cities use IoT devices such as connected sensors, lights, and meters to collect andanalyze data. The cities then use this data to improve infrastructure, public utilities andservices, and more.

3. Intelligent transportation system-"Intelligent Transportation Systems (ITS) apply a variety of technologies to monitor,evaluate, and manage transportation systems to enhance efficiency and safety." Theinstallation of smart sensors, GPS based tracking systems can improve the overallperformance of the transportation systems. With the help of IoT enabled devices, real timedata of the exact locations, expected time of arrivals, delays etc can be obtained therebyimproving the traffic efficiency and reduces the traffic problems.

4. Smart irrigation facilities-Smart irrigation system makes use of IoT based sensors in an extensive way to determinethe frequency and depth of irrigation. Sensors of soil moisture content, temperature,piezometers, weather sensors etc are widely used for obtaining data which is thenprocessed and appropriate action (such as turning on/off the water pumps) can be takenwithout human efforts from a remote web or mobile application.

5. Smart parking systems-The parking system can be improved by installing sensors, that can alert the user aboutoccupied or vacant spot via web or mobile applications. This IoT based parking systemenables the user for a hassle free parking in less time thereby reducing the traffic volume.

6. Real-Time Construction Management Solution IoT provides solutionslike remote operative equipment in the construction industry to ensure safetyof the workforce. In addition to that, the project costs can also be reducedby employing IoT applications like Building Information Modelling whichwill help to improve the resource efficiency.

7. Project Safety Platform-Use of IoT enabled sensors and wearable in the construction site will improvesafety and efficiency of the workforce thereby increasing the productivity. IoTcan be used to obtain real time data of the construction sites regarding the harsh working environments, diagnosing and prediction of failures, accidents andmishaps etc. In case of threats or any such incidents, emergency evacuationprocedures, preventive measures or rescue activities can be performedimmediately .

Reference Books:

1. S. Ramamrutam&R.Narayanan. Basic Civil Engineering,3rd.Dhanpat Rai Publication.
2. Prasad I.B., Applied Mechanics,3rd.Khanna Publication
3. Shesha Prakash and Mogaveer. Elements of Civil Engg&Engg. Mechanics.1st.PHI
4. S.P,Timoshenko, Mechanics of structure.1st.East West press Pvt.Ltd.
5. Duggal, Surveying, 1st.Tata McGraw Hill New Delhi
6. S.C. Rangwala, Building Construction,3nd.Charotar publications House, Anand

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List of suggestive core experiments:

Practical work will be based on surveying and field work and material of Applied Mechanics

 SAMPLE FIELD WORK:

1. Linear measurements: Chain and Tape Surveying, Errors, Obstacles, Booking and Plotting, Calculation of Areas.
2. Angular Measurements: Bearing, Prismatic Compass, Local Attraction, Bowditch's Rule of correction, traverse open and closed, plotting of traverse, accuracy and precision.
3. Levelling : Types of Levels, Levelling Staff, Measurements, recording, curvature and refraction correction, reciprocal levelling, sensitivity of level.
4. Contours: Properties, uses, plotting of contours, measurement of drainage and volume of reservoir.
5. Measurement of area by planimeter.

Mini Project (AL-107)

Student has to take up some project work , prototype development and report writing with fundamental computing techniques such as C prog, MS Office etc for mini project and with C++ as micro project

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Technical Communication & Seminar (AL-208)(P)

COURSE OUTCOMES:
After Completing the course student should be able to:

CO1	Analyse relevance and importance of communication in a globalized worlds.
CO2	Compare types of communication to overcome barriers to communicate
CO3	Develop writing and speaking skills with different tools
CO4	Prepare for Job interviews with the help of self assessment techniques
CO5	Apply advanced grammar to develop linguistic abilities.

Course Contents

Unit I: Vocabulary building and Comprehension: Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives, Synonyms, Antonyms, Reading Skills.

Unit II: Communication: Introduction, Meaning and Importance of Communication, Process of Communication, 7 C's of Communication, Verbal Communication, NonverbalCommunication, Barriers to Communication and Ways to overcome them, Importance of Communication for Technical students

Unit III: Developing Writing Skills:
Technical Writing Skills : Letter Writing[Letter To Editor, Invitation Letter, Acceptance Letter, Declining Letter, Permission Letter], Job Application[CV, Resume and Cover Letter], Report Writing[Types, Structure, characteristics], Proposal.

Unit IV: Creative Writing
Creative Writing Skills : Precis Writing, Note-Making, Content Writing,Blogs and Tweets.

Unit V: Technical skill Practice
1. Group Discussion
2. Professional Presentation
3. Interview Preparation

Experiments: Practice work and activities are based on the contents included in course

Reference Books:-

1. Bansal, R.K. and J.B. Harrison, Spoken English. Orient Longman: Mumbai.
2. Rizvi, M. Asraf, Effective Technical Communication. Tata McGraw- Hill: New Delhi.
3. V. Sasikumar and P. V. Dhamija, A Self-Learning Guide to English Conversation. TMH

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