

Bachelor of Technology (Computer Science and Engineering)
Credit Based Scheme of Studies/Examination
Semester III (w.e.f Session 2019-2020)

S. No.	Course No.	Subject	L:T:P	Hours/Week	Credits	Examination Schedule (Marks)				Duration of Exam (Hrs)
						Major Test	Minor Test	Practical	Total	
1	ES-205	Principles of Programming Languages	3:0:0	3	3	75	25	0	100	3
2	PC-CS-201	Data Structure and Algorithms	3:0:0	3	3	75	25	0	100	3
3	ES-207	Digital Electronics	3:0:0	3	3	75	25	0	100	3
4	PC-CS-203	Object Oriented Programming	3:0:0	3	3	75	25	0	100	3
5	BS-205	Mathematics-III	3:0:0	3	3	75	25	0	100	3
6	HM-902	Business Intelligence and Entrepreneurship	3:0:0	3	3	75	25	0	100	3
7	PC-CS-205L	Data Structure and Algorithms Lab	0:0:4	4	2	0	40	60	100	3
8	ES-209L	Digital Electronics Lab	0:0:4	4	2	0	40	60	100	3
9	PC-CS-205 L	Object Oriented Programming Lab	0:0:4	4	2	0	40	60	100	3
		Total		30	24	450	270	180	900	
10	SIM-201*	Seminar on Summer Internship	2:0:0	2		0	50	0	50	

***Note: SIM-201* is a mandatory credit-less course in which the students will be evaluated for the Summer Internship (training) undergone after 2nd semester and students will be required to get passing marks to qualify.**

ES-205	Principles of Programming Languages						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3.0	75	25	100	3 Hour
Purpose	To introduce the principles and paradigms of programming languages for design and implement the software intensive systems.						
Course Outcomes (CO)							
CO 1	To introduce the basic concepts of programming language, the general problems and methods related to syntax and semantics.						
CO 2	To introduce the structured data objects, subprograms and programmer defined data types.						
CO 3	To outline the sequence control and data control.						
CO 4	To introduce the concepts of storage management using programming languages.						

Unit-I: Introduction, Syntax and Semantics

Introduction: A brief history, Characteristics of a good programming language, Programming language translators-compiler and interpreters, Elementary data types – data objects, variable and constants, data types. Specification and implementation of elementary data types, Declarations, type checking and type conversions, Assignment and initialization, Numeric data types, enumerations, Booleans and characters.

Syntax and Semantics: Introduction, general problem of describing syntax, Formal method of describing Syntax, attribute grammar dynamic semantic.

Unit-II: Structured data objects, Subprograms and Programmer Defined Data Types

Structured data objects: Structured data objects and data types, specification and implementation of structured data types, Declaration and type checking of data structure, vector and arrays, records Character strings, variable size data structures, Union, pointer and programmer defined data objects, sets, files.

Subprograms and Programmer Defined Data Types: Evolution of data type concept abstraction, encapsulation and information hiding, Subprograms, type definitions, abstract data types, over loaded subprograms, generic subprograms.

Unit-III: Sequence Control and Data Control

Sequence Control: Implicit and explicit sequence control, sequence control within expressions, sequence control within statement, Subprogram sequence control: simple call return, recursive subprograms, Exception and exception handlers, co routines, sequence control. Concurrency – subprogram level concurrency, synchronization through semaphores, monitors and message passing

Data Control: Names and referencing environment, static and dynamic scope, block structure, Local data and local referencing environment, Shared data: dynamic and static scope, Parameter and parameter transmission schemes.

Unit-IV: Storage Management and Programming Languages

Storage Management: Major run time elements requiring storage, programmer and system controlled storage management and phases, Static storage management, Stack based storage management, Heap storage management, variable and fixed size elements.

Programming Languages: Introduction to procedural, non-procedural, structured, logical, functional and object oriented programming language, Comparison of C and C++ programming languages.

Suggested Books:

- Terrence W. Pratt, Marvin V. Zelkowitz, Programming Languages Design and Implementation, Pearson.
- Allen Tucker and Robert Noonan, Programming Languages–Principles and Paradigms, Tata McGraw-Hill, 2009.
- Ellis Horowitz, Fundamentals of Programming Languages, Galgotia Publications, 2010.
- C. Ghezzi, Programming Languages Concepts, Wiley Publications, 2010.

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PC-CS201	Data Structure and Algorithms						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3.0	75	25	100	3 Hour
Purpose	To introduce the principles and paradigms of Data Structures for design and implement the software systems logically and physically.						
Course Outcomes (CO)							
CO 1	To introduce the basic concepts of Data structure , basic data types ,searching and sorting based on array data types.						
CO 2	To introduce the structured data types like Stacks and Queue and its basic operations's implementation.						
CO 3	To introduce dynamic implementation of linked list.						
CO 4	To introduce the concepts of Tree and graph and implementation of traversal algorithms.						

Unit-1

Introduction to Data Structures, Data Types, Built in and User Defined Data Structures, Applications of Data Structure, Algorithm Analysis, Worst, Best and Average Case Analysis, Notations of Space and Time Complexity, Basics of Recursion.

Arrays, One Dimensional Arrays, Two Dimensional Arrays and Multi-Dimensional Arrays, Sparse Matrices, Searching from array using Linear and Binary Searching Algorithm, Sorting of array using Selection, Insertion, Bubble, Radix Algorithm

Unit-2

Stacks: Definition, Implementation of Stacks and Its Operations, Evaluation of Infix, prefix and Postfix Expression, Inter-conversion of Infix, Prefix and Post-Fix Expression, Implementation of Merge Sort and Quick Sort Algorithm.

Queues: Definition, Sequential Implementation of Linear Queues and Its Operations, Circular Queue and Its Implementation, Priority Queues and Its Implementation, Applications of queues.

Unit-3

Linked Lists: Need of Dynamic Data Structures, Single Link List and Its Dynamic Implementation, Traversing, Insertion, Deletion Operations on Single Link Lists. Comparison between Static and Dynamic, Implementation of Linked List.

Circular Link Lists and Doubly Link List, Dynamic Implementation of Primitive Operations on Doubly Linked Lists and Circular Link List. Dynamic Implementation of Stacks and Queues.

Unit-4

Trees: Definition, Basic Terminology, Binary Tree, External and Internal Nodes, Static and Dynamic Implementation of a Binary Tree, Primitive Operations on Binary Trees, Binary Tree Traversals: Pre-Order, In-Order and Post-Order Traversals. Representation of Infix, Post-Fix and Prefix Expressions using Trees.

Introduction to Binary Search Trees: B+ trees, AVL Trees, Threaded Binary trees, Balanced Multi-way search trees, Implementation of Heap Sort Algorithm.

Graphs: Basic Terminology, Definition of Undirected and Directed Graphs, Memory Representation of Graphs, Minimum-Spanning Trees, Warshal Algorithm, Graph Traversals Algorithms: Breadth First and Depth First.

Suggested Books:

- Theory and Problems of Data Structures by Jr. Seymour Lipschetz, Schaum's outline, TMH.
- Data Structures and Algorithms by PAI, TMH.
- Fundamentals of Data structures by Ellis Horowitz and Sartaj Sahni, Pub, 1983, AW.
- Data Structures and Algorithms by A.V. Aho, J.E. Hopcroft and T.D. Ullman, Original edition, Addison-Wesley, 1999, Low Priced Edition.
- Data Structures and Program Design in C by Robert Kruse, PHI,
- Shukla, Data Structures using C++, Wiley India
- Introduction to Computers Science -An Algorithms Approach , Jean Paul Tremblay, Richard B. Bunt, 2002, T.M.H.
- Data Structure and the Standard Template library – Willam J. Collins, 2003, T.M.H.

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ES-207	Digital Electronics						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3.0	75	25	100	3 Hour
Purpose	To learn the basic methods for the design of digital circuits and provide the fundamental concepts used in the design of digital systems.						
Course Outcomes (CO)							
CO1	To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions						
CO2	To introduce the methods for simplifying Boolean expressions						
CO3	To outline the formal procedures for the analysis and design of combinational circuits and sequential circuits						
CO4	To introduce the concept of memories and programmable logic devices.						

UNIT I MINIMIZATION TECHNIQUES AND LOGIC GATES

Binary Digits, Logic Levels, and Digital Waveforms, Logic Systems-Positive and negative, Logic Operations, Logical Operators, Logic Gates-AND, OR, NOT, NAND, NOR, Exclusive-OR and Exclusive-NOR, Active high and Active low concepts, Universal Gates and realization of other gates using universal gates, Gate Performance Characteristics and Parameters. Boolean Algebra: Rules and laws of Boolean algebra, Demorgan's Theorems, Boolean Expressions and Truth Tables, Standard SOP and POS forms; Minterm and Maxterms, Canonical representation of Boolean expressions, Duality Theorem, Simplification of Boolean Expressions, Minimization Techniques for Boolean Expressions using Karnaugh Map and Quine McCluskey Tabular method. Introduction of TTL and CMOS Logic and their characteristics, Tristate gates.

UNIT II COMBINATIONAL CIRCUITS

Introduction to combinational Circuits, Adders-Half-Adder and Full-Adder, Subtractors- Half and Full Subtractor; Parallel adder and Subtractor; Look-Ahead Carry Adders. BCD adder, BCD subtractor, Parity Checker/Generator, Multiplexer, Demultiplexer, Encoder, Priority Encoder; Decoder, BCD to Seven segment Display Decoder/Driver, LCD Display, and Comparators.

UNIT III SEQUENTIAL CIRCUITS

Introduction to Sequential Circuits, Flip-Flops: Types of Flip Flops -RS, T, D, JK; Edge triggering, Level Triggering; Flip Flop conversions; Master-Slave JK.

Introduction to shift registers, Basic Shift Register Operations, types of shift registers, Bidirectional Shift Registers, Shift Register Counters. Introduction to counters, Types of Counters-Asynchronous and synchronous counters, Up/Down Synchronous Counters, Modulo-n Counter, State table, excitation table concepts, Design of asynchronous and synchronous counters, Ring Counter, Applications of counters.

UNIT IV CONVERTER and MEMORY DEVICES

Digital to Analog Converter, Weighted Register: R-2R Ladder Network: Analog to Digital Conversion, Successive Approximation Type, Dual Slope Type.

Classification of memories - ROM: ROM organization, PROM, EPROM, EEPROM, EAPROM, RAM: - RAM organization - Write operation, Read operation, Memory cycle, Timing wave forms, memory expansion, Static RAM Cell, MOSFET RAM cell structure, Dynamic RAM cell structure, Programmable Logic Devices - Programmable Logic Array (PLA), Programmable Array Logic (PAL), Implementation of PLA, PAL using ROM.

Suggested Books:

- Donald P. Leach and Albert Paul Malvino, Digital Principles and Applications, 8th Edition, TMH, 2003.M.
- Morris Mano, Digital Design, 3rd Edition, Prentice Hall of India Pvt. Ltd., 2003 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.
- ALI, Digital Switching Systems, , TMH
- A.K. Maini, Digital Electronics, Wiley India
- John F. Wakerly, Digital Design, Fourth Edition, Pearson/PHI, 2006
- John. M Yarbrough, Digital Logic Applications and Design, Thomson Learning, 2002.
- S. Salivahanan and S. Arivazhagan, Digital Circuits and Design, 3rd Edition., Vikas Publishing House Pvt. Ltd, New Delhi, 2006
- William H. Gothmann, Digital Electronics, 2nd Edition, PHI, 1982.
- Thomas L. Floyd, Digital Fundamentals, 8th Edition, Pearson Education Inc, New Delhi, 2003
- Donald D. Givone, Digital Principles and Design, TMH, 2003.

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PC-CS203	Object Oriented Programming						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3.0	75	25	100	3 Hour
Purpose	To introduce the principles and paradigms of Object Oriented Programming Language for design and implement the Object Oriented System.						
Course Outcomes (CO)							
CO1	To introduce the basic concepts of object oriented programming language and the its representation.						
CO2	To allocate dynamic memory, access private members of class and the behavior of inheritance and its implementation.						
CO3	To introduce polymorphism, interface design and overloading of operator.						
CO4	To handle backup system using file, general purpose template and handling of raised exception during programming.						

Unit-1

Introduction to C++, C++ Standard Library, Illustrative Simple C++ Programs. Header Files, Namespaces, Application of object oriented programming.

Object Oriented Concepts, Introduction to Objects and Object Oriented Programming, Encapsulation, Polymorphism, Overloading, Inheritance, Abstract Classes, Accessifier (public/ protected/ private), Class Scope and Accessing Class Members, Controlling Access Function, Constant, Class Member, Structure and Class

Unit-2

Friend Function and Friend Classes, This Pointer, Dynamic Memory Allocation and Deallocation (New and Delete), Static Class Members, Constructors, parameter Constructors and Copy Constructors, Deconstructors, Introduction of inheritance, Types of Inheritance, Overriding Base Class Members in a Derived Class, Public, Protected and Private Inheritance, Effect of Constructors and Deconstructors of Base Class in Derived Classes.

Unit-3

Polymorphism, Pointer to Derived class, Virtual Functions, Pure Virtual Function, Abstract Base Classes, Static and Dynamic Binding, Virtual Deconstructors.

Fundamentals of Operator Overloading, Rules for Operators Overloading, Implementation of Operator Overloading Like <<, >> Unary Operators, Binary Operators.

Unit-4

Text Streams and binary stream, Sequential and Random Access File, Stream Input/ Output Classes, Stream Manipulators.

Basics of C++ Exception Handling, Try, Throw, Catch, multiple catch, Re-throwing an Exception, Exception specifications.

Templates: Function Templates, Overloading Template Functions, Class Template, Class Templates and Non- Type Template arguments.

Suggested Books:

- The complete reference C ++ by Herbert shieldt Tata McGraw Hill.
- Object Oriented Programming in Turbo C++ by Robert Lafore, 1994, The WAITE Group Press.
- Shukla, Object Oriented Programming in c++, Wiley India.
- C++ How to Program by H M Deitel and P J Deitel, 1998, Prentice Hall.
- Programming with C++ By D Ravichandran, 2003, T.M.H.

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BS-205	Mathematics-III						
Lecture	Tutorial	Practical	Credit	Theory	Sessional	Total	Time
3	0	0	3	75	25	100	3 Hour
Purpose	To familiarize the prospective engineers with techniques in sequence and series, multivariable calculus, and ordinary differential equations.						
Course Outcomes (CO)							
CO1	To develop the tool of sequence, series and Fourier series for learning advanced Engineering Mathematics.						
CO2	To introduce effective mathematical tools for the solutions of differential equations that model physical processes.						
CO3	To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.						
CO4	To familiarize the student with calculus of vector functions that is essential in most branches of engineering.						

UNIT-I

Sequence and Series: Convergence of sequence and series, tests for convergence (Comparison test, D'Alembert's Ratio test, Logarithmic test, Cauchy root test, Raabe's test).

Fourier series: Introduction, Fourier-Euler Formula, Dirichlet's conditions, Change of intervals, Fourier series for even and odd functions, Half range sine and cosine series.

UNIT-II

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

Differential equations of higher orders:

Second order linear differential equations with constant coefficients, method of variation of parameters, Cauchy and Legendre's linear differential equations.

UNIT-III

Multivariable Calculus (Integration): Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar) Applications: areas and volumes; Triple integrals (Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds.

UNIT-IV

Vector Calculus: Introduction, Scalar and Vector point functions, Gradient, divergence and Curl and their properties, Directional derivative. Line integrals, surface integrals, volume integrals, Theorems of Green, Gauss and Stokes (without proof).

Suggested Books:

- G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
- Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
- Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
- N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
- B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
- Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley and Sons, 2006.
- W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edition, Wiley India, 2009.
- S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
- E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
- E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
- G.F. Simmons and S.G. Krantz, Differential Equations, Tata McGraw Hill, 2007.
- Erwin Kreyszig and Sanjeev Ahuja, Applied Mathematics-I, reprint 2015, Wiley India Publication.

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HM-902	Business Intelligence and Entrepreneurship						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3.0	75	25	100	3
Purpose	To make the students conversant with the basics concepts in management thereby leading to nurturing their managerial skills.						
Course Outcomes (CO)							
CO1	Students will be able understand who the entrepreneurs are and what competences needed to become an Entrepreneur.						
CO2	Students will be able understand insights into the management, opportunity search, identification of a Product; market feasibility studies; project finalization etc. required for small business enterprises.						
CO3	Students can be able to write a report and do oral presentation on the topics such as product identification, business idea, export marketing etc.						
CO4	Students will be able to know the different financial and other assistance available for the small industrial units.						

Unit –I

Entrepreneurship : Concept and Definitions; Entrepreneurship and Economic Development; Classification and Types of Entrepreneurs; Entrepreneurial Competencies; Factor Affecting Entrepreneurial Growth – Economic, Non-Economic Factors; EDP Programmes; Entrepreneurial Training; Traits/Qualities of an Entrepreneurs; Manager Vs. Entrepreneur, Entrepreneurial challenges.

Unit -II

Opportunity / Identification and Product Selection: Entrepreneurial Opportunity Search and Identification; Criteria to Select a Product; Conducting Feasibility Studies; Sources of business ideas, Marketing Plan : Conducting of Marketing Research, Industry Analysis, Competitor analysis, market segmentation and positioning, building a marketing plan, marketing mix, launching a new product; export marketing, Methods of Project Appraisal, Project Report Preparation; Specimen of Project Report; Project Planning and Scheduling using Networking Techniques of PERT / CPM.

Unit –III

Small Enterprises and Enterprise Launching Formalities : Definition of Small Scale; Rationale; Objective; Scope; SSI; Registration; NOC from Pollution Board; Machinery and Equipment Selection , Role of SSI in Economic Development of India; major problem faced by SSI,MSMEs – Definition and Significance in Indian Economy; MSME Schemes, Challenges and Difficulties in availing MSME Schemes.

Unit –IV

Role of Support Institutions and Management of Small Business : DIC; SIDO; SIDBI; Small Industries Development Corporation (SIDC); SISI; NSIC; NISBUD; State Financial Corporation SIC; Venture Capital : Concept, venture capital financing schemes offered by various financial institutions in India.

Special Issues for Entrepreneurs: Legal issues – Forming business entity, requirements for formation of a Private/Public Limited Company, Entrepreneurship and Intellectual Property Rights: IPR and their importance. (Patent, Copy Right, Trademarks) , Case Studies-At least one in whole course.

Note:

- Case studies of Entrepreneurs – successful, failed, turnaround ventures should be discussed in the class.
- Exercises / activities should be conducted on ‘generating business ideas’ and identifying problems and opportunities.
- Interactive sessions with Entrepreneurs, authorities of financial institutions, Government officials should be organized

Suggested Readings:

- “Entrepreneurship development small business enterprises”, Pearson, Poornima M Charantimath,2013.
- Roy Rajiv, “Entrepreneurship”, Oxford University Press, 2011.
- “Innovation and Entrepreneurship”,Harper business- Drucker.F, Peter, 2006.
- “Entrepreneurship”, Tata Mc-graw Hill Publishing Co.ltd new Delhi- Robert D. Hisrich, Mathew J. Manimala, Michael P Peters and Dean A. Shepherd, 8th Edition, 2012
- Entrepreneurship Development- S.Chand and Co.,Delhi- S.S.Khanka 1999
- Small-Scale Industries and Entrepreneurship. Himalaya Publishing House, Delhi –Vasant Desai 2003.
- Entrepreneurship Management -Cynthia, Kaulgud, Aruna, Vikas Publishing House, Delhi, 2003.

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PC-CS205L	Data Structure and Algorithms Lab						
Lecture	Tutorial	Practical	Credit	Minor Test	Practical	Total	Time
0	0	4	2.0	40	60	100	3
Purpose	To introduce the principles and paradigms of Data Structures for design and implement the software systems logically and physically.						
Course Outcomes (CO)							
CO1	To introduce the basic concepts of Data structure, basic data types, searching and sorting based on array data types.						
CO2	To introduce the structured data types like Stacks and Queue and its basic operation's implementation.						
CO3	To introduce dynamic implementation of linked list.						
CO4	To introduce the concepts of Tree and graph and implementation of traversal algorithms.						

1. Write a program for Binary search methods.
2. Write a program for insertion sort, selection sort and bubble sort.
3. Write a program to implement Stack and its operation.
4. Write a program for quick sort.
5. Write a program for merge sort.
6. Write a program to implement Queue and its operation.
7. Write a program to implement Circular Queue and its operation.
8. Write a program to implement singly linked list for the following operations: Create, Display, searching, traversing and deletion.
9. Write a program to implement doubly linked list for the following operations: Create, Display, inserting, counting, searching, traversing and deletion.
10. Write a program to implement circular linked list for the following operations: Create, Display, inserting, counting, searching, traversing and deletion.
11. Write a program to implement insertion, deletion and traversing in B tree

NOTE:

At least seven experiments are to be performed from above list and the concerned institution as per the scope of the syllabus may set remaining eight.

ES-209L	Digital Electronics Lab						
Lecture	Tutorial	Practical	Credit	Minor Test	Practical	Total	Time
0	0	4	2.0	40	60	100	3
Purpose	To learn the basic methods for the design of digital circuits and systems.						
Course Outcomes (CO)							
CO1	To Familiarization with Digital Trainer Kit and associated equipment.						
CO2	To Study and design of TTL gates						
CO3	To learn the formal procedures for the analysis and design of combinational circuits.						
CO4	To learn the formal procedures for the analysis and design of sequential circuits						

LIST OF EXPERIMENTS:

1. Familiarization with Digital Trainer Kit and associated equipment.
2. Study of TTL gates AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR.
3. Design and realize a given function using K-Maps and verify its performance.
4. To verify the operation of Multiplexer and De-multiplexer.
5. To verify the operation of Comparator.
6. To verify the truth table of S-R, J-K, T, D Flip-flops.
7. To verify the operation of Bi-directional shift register.
8. To design and verify the operation of 3-bit asynchronous counter.
9. To design and verify the operation of asynchronous Up/down counter using J-K FFs.
10. To design and verify the operation of asynchronous Decade counter.
11. Study of TTL logic family characteristics.
12. Study of Encoder and Decoder.
13. Study of BCD to 7 segment Decoder.

NOTE:

At least ten experiments are to be performed from above list and the concerned institution as per the scope of the syllabus may set remaining five.

PC-CS205 L	Object Oriented Programming Lab						
Lecture	Tutorial	Practical	Credit	Minor Test	Practical	Total	Time
0	0	4	2.0	40	60	100	3 Hour
Purpose	To introduce the principles and paradigms of Object Oriented Programming Language for design and implement the Object Oriented System.						
Course Outcomes (CO)							
CO1	To introduce the basic concepts of object oriented programming language and the its representation.						
CO2	To allocate dynamic memory, access private members of class and the behavior of inheritance and its implementation.						
CO3	To introduce polymorphism, interface design and overloading of operator.						
CO4	To handle backup system using file, general purpose template and handling of raised exception during programming.						

Q1. Raising a number n to a power p is the same as multiplying n by itself p times. Write a function called `power ()` that takes a double value for n and an int value for p , and returns the result as double value. Use a default argument of 2 for p , so that if this argument is omitted, the number will be squared. Write a main () function that gets values from the user to test this function.

Q2. A point on the two dimensional plane can be represented by two numbers: an X coordinate and a Y coordinate. For example, (4,5) represents a point 4 units to the right of the origin along the X axis and 5 units up the Y axis. The sum of two points can be defined as a new point whose X coordinate is the sum of the X coordinates of the points and whose Y coordinate is the sum of their Y coordinates. Write a program that uses a structure called `point` to model a point. Define three points, and have the user input values to two of them. Then set the third point equal to the sum of the other two, and display the value of the new point. Interaction with the program might look like this:

Enter coordinates for P1: 3 4

Enter coordinates for P2: 5 7

Coordinates of P1 + P2 are : 8, 11

Q3. Create the equivalent of a four function calculator. The program should request the user to enter a number, an operator, and another number. It should then carry out the specified arithmetical operation: adding, subtracting, multiplying, or dividing the two numbers. (It should use a switch statement to select the operation). Finally it should display the result. When it finishes the calculation, the program should ask if the user wants to do another calculation. The response can be 'Y' or 'N'. Some sample interaction with the program might look like this.

Enter first number, operator, and second number: 10/ 3

Answer = 3.333333

Do another (Y/N)? Y

Enter first number, operator, second number 12 + 100

Answer = 112

Do another (Y/N) ? N

Q4. A phone number, such as (212) 767-8900, can be thought of as having three parts: the area code (212), the exchange (767) and the number (8900). Write a program that uses a structure to store these three parts of a phone number separately. Call the structure `phone`. Create two structure variables of type `phone`. Initialize one, and have the user input a number for the other one. Then display both numbers. The interchange might look like this:

- Enter your area code, exchange, and number: 415 555 1212

- My number is (212) 767-8900

- Your number is (415) 555-1212

Q5. Create two classes `DM` and `DB` which store the value of distances. `DM` stores distances in metres and centimeters and `DB` in feet and inches. Write a program that can read values for the class objects and add one object of `DM` with another object of `DB`. Use a friend function to carry out the addition operation. The object that stores the results maybe a `DM` object or `DB` objects, depending on the units in which the results are required. The display should be in the format of feet and inches or metres and centimetres depending on the object on display.

Q6. Create a class `rational` which represents a numerical value by two double values- `NUMERATOR` and `DENOMINATOR`. Include the following public member Functions:

- constructor with no arguments (default).

- constructor with two arguments.

- void `reduce()` that reduces the rational number by eliminating the highest common factor between the numerator and denominator.

- Overload `+` operator to add two rational number.

- Overload `>>>` operator to enable input through `cin`.

- Overload << operator to enable output through cout.

Write a main () to test all the functions in the class.

Q7. Consider the following class definition

```
class father {
protected : int age;
public;
father (int x) {age = x;}
virtual void iam ( )
{ cout << "I AM THE FATHER, my age is : "<< age<< endl;}
};
```

Derive the two classes son and daughter from the above class and for each, define iam () to write our similar but appropriate messages. You should also define suitable constructors for these classes. Now, write a main () that creates objects of the three classes and then calls iam () for them. Declare pointer to father. Successively, assign addresses of objects of the two derived classes to this pointer and in each case, call iam () through the pointer to demonstrate polymorphism in action.

Q8. Write a program that creates a binary file by reading the data for the students from the terminal. The data of each student consist of roll no., name (a string of 30 or lesser no. of characters) and marks.

Q9. A hospital wants to create a database regarding its indoor patients. The information to store include

- a) Name of the patient
- b) Date of admission
- c) Disease
- d) Date of discharge

Create a structure to store the date (year, month and date as its members). Create a base class to store the above information. The member function should include functions to enter information and display a list of all the patients in the database. Create a derived class to store the age of the patients. List the information about all the to store the age of the patients. List the information about all the pediatric patients (less than twelve years in age).

Q10. Make a class **Employee** with a name and salary. Make a class **Manager** inherit from **Employee**. Add an instance variable, named department, of type string. Supply a method to **to String** that prints the manager's name, department and salary. Make a class **Executive** inherits from **Manager**. Supply a method **to String** that prints the string "**Executive**" followed by the information stored in the **Manager** superclass object. Supply a test program that tests these classes and methods.

Q11. Imagine a tollbooth with a class called toll Booth. The two data items are a type unsigned int to hold the total number of cars, and a type double to hold the total amount of money collected. A constructor initializes both these to 0. A member function called payingCar () increments the car total and adds 0.50 to the cash total. Another function, called nopayCar (), increments the car total but adds nothing to the cash total. Finally, a member function called displays the two totals. Include a program to test this class. This program should allow the user to push one key to count a paying car, and another to count a nonpaying car. Pushing the ESC key should cause the program to print out the total cars and total cash and then exit.

Q12. Write a function called reversit () that reverses a string (an array of char). Use a for loop that swaps the first and last characters, then the second and next to last characters and so on. The string should be passed to reversit () as an argument. Write a program to exercise reversit (). The program should get a string from the user, call reversit (), and print out the result. Use an input method that allows embedded blanks. Test the program with Napoleon's famous phrase, "Able was I ere I saw Elba".

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Q13. Create some objects of the string class, and put them in a Deque-some at the head of the Deque and some at the tail. Display the contents of the Deque using the forEach () function and a user written display function. Then search the Deque for a particular string, using the first That () function and display any strings that match. Finally remove all the items from the Deque using the getLeft () function and display each item. Notice the order in which the items are displayed: Using getLeft (), those inserted on the left (head) of the Deque are removed in "last in first out" order while those put on the right side are removed in "first in first out" order. The opposite would be true if getRight () were used.

Q14. Assume that a bank maintains two kinds of accounts for customers, one called as savings account and the other as current account. The savings account provides compound interest and withdrawal facilities but no cheque book facility. The current account provides cheque book facility but no interest. Current account holders should also maintain a minimum balance and if the balance falls below this level, a service charge is imposed.

Create a class account that stores customer name, account number and type of account. From this derive the classes

cur_acct and sav_acct to make them more specific to their requirements. Include necessary member functions in order to achieve the following tasks:

- a) Accept deposit from a customer and update the balance.

- b) Display the balance.
- c) Compute and deposit interest.
- d) Permit withdrawal and update the balance.
- e) Check for the minimum balance, impose penalty, necessary and update the balance.
- f) Do not use any constructors. Use member functions to initialize the class members.

Q15. Create a base class called shape. Use this class to store two double type values that could be used to compute the area of figures. Derive two specific classes called triangle and rectangle from the base shape. Add to the base class, a member function `get_data()` to initialize baseclass data members and another member function `display_area()` to compute and display the area of figures. Make `display_area()` as a virtual function and redefine this function in the derived classes to suit their requirements. Using these three classes, design a program that will accept dimensions of a triangle or a rectangle interactively and display the area.

Remember the two values given as input will be treated as lengths of two sides in the case of rectangles and as base and height in the case of triangles and used as follows:

Area of rectangle = $x * y$

Area of triangle = $\frac{1}{2} * x * y$

NOTE:

At least ten experiments are to be performed from above list and the concerned institution as per the scope of the syllabus may set remaining five.

Bachelor of Technology (Computer Science and Engineering)
Credit Based Scheme of Studies/Examination
Semester IV (w.e.f Session 2019-2020)

S. No.	Course No.	Subject	L:T:P	Hours/Week	Credits	Examination Schedule (Marks)				Duration of Exam (Hrs)
						Major Test	Minor Test	Practical	Total	
1	PC-CS-202	Discrete Mathematics	3:0:0	3	3	75	25	0	100	3
2	PC-CS-204	Internet Technology and Management	3:0:0	3	3	75	25	0	100	3
3	PC-CS-206	Operating Systems	3:0:0	3	3	75	25	0	100	3
4	PC-CS-208	Design and Analysis of Algorithms	3:0:0	3	3	75	25	0	100	3
5	HM-901	Organizational Behaviour	3:0:0	3	3	75	25	0	100	3
6	PC-CS-210L	Internet Technology and Management Lab	0:0:4	4	2	0	40	60	100	3
7	PC-CS-212L	Operating Systems Lab	0:0:4	4	2	0	40	60	100	3
8	PC-CS-214L	Design and Analysis of Algorithms Lab	0:0:4	4	2	0	40	60	100	3
		Total		27	21	375	245	180	800	
9	MC-901 *	Environmental Sciences	3:0:0	3	0	75	25	0	100	3

***MC-901 is a mandatory credit-less course and student has to get passing marks in order to qualify for the award of B.Tech. Degree.**

PC-CS202	Discrete Mathematics						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3.0	75	25	100	3
Purpose	To provide the conceptual knowledge of Discrete structure.						
Course Outcomes (CO)							
CO1	To study various fundamental concepts of Set Theory and Logics.						
CO2	To study and understand the Relations, diagraphs and lattices.						
CO3	To study the Functions and Combinatorics.						
CO4	To study the Algebraic Structures.						

Unit 1 Set Theory and Logic

Fundamentals - Sets and subsets, Venn Diagrams, Operations on sets, Laws of Set Theory, Power Sets and Products, Partition of sets, The Principle of Inclusion- Exclusion.

Logic : Propositions and Logical operations, Truth tables, Equivalence, Implications, Laws of Logic, Normal forms, Predicates and quantifiers, Mathematical Induction.

Unit 2: Relations, diagraphs and lattices

Product sets and partitions, relations and diagraphs, paths in relations and diagraphs, properties of relations, equivalence and partially ordered relations, computer representation of relations and diagraphs, manipulation of relations, Transitive closure and Warshall's algorithm, Posets and Hasse Diagrams, Lattice.

Unit 3 Functions and Combinatorics

Definitions and types of functions: injective, subjective and bijective, Composition, identity and inverse, Review of Permutation and combination-Mathematical Induction, Pigeon hole principle, Principle of inclusion and exclusion, Generating function-Recurrence relations.

Unit 4: Algebraic Structures

Algebraic structures with one binary operation - semi groups, monoids and groups, Product and quotient of algebraic structures, Isomorphism, homomorphism, automorphism, Cyclic groups, Normal sub group, codes and group codes, Ring homomorphism and Isomorphism.

Suggested Books:

- Elements of Discrete Mathematics C.L Liu, 1985, Reprinted 2000, McGraw Hill
- Discrete Mathematics - Revised (SIE) (Schaum's Outline Series), LIPSCHUTZ , TMH
- Discrete mathematical structures by B Kolman RC Busby, S Ross PHI Pvt. Ltd.
- Discrete Mathematical Structures with Applications to Computer Science , by Tremblay J.P, and Manohar R., McGraw Hill Book Company, 1975, International Edition, 1987.
- Discrete and Combinatorial mathematics ", Ralph P., Grimaldi, Addison-Wesley Publishing Company, Reprinted in 1985.
- Discrete Mathematics and its Applications ", Kenneth H.Rosen, McGraw Hill Book Company, 1999. Sections: 7.1 to 7.5.
- Discrete Mathematics for computer scientists and Mathematicians, Joe L. Mott, Abraham

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

PC-CS204	Internet Technology and Management						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3.0	75	25	100	3
Purpose	To provide the conceptual knowledge of Internet and methodologies used in web and secure internet communication and networking.						
Course Outcomes (CO)							
CO1	To study various fundamental concepts of Internetworking techniques with their characteristics.						
CO2	To study and understand the requirements for world-wide-web formats and techniques.						
CO3	To study the E-mail functioning and basics of HTML, XML and DHTML languages.						
CO4	To study the functioning of Servers and Privacy and Security related mechanisms.						

UNIT-1 : THE INTERNET

Introduction to networks and internet, history, Internet, Intranet and Extranet, Working of Internet, Internet Congestion, internet culture, business culture on internet. Collaborative computing and the internet. Modes of Connecting to Internet, Internet Service Providers(ISPs), Internet address, standard address, domain name, DNS, IP.v6.Modems, Speed and time continuum, communications software; internet tools.

UNIT-II : WORLD WIDW WEB

Introduction, Miscellaneous Web Browser details, searching the www: Directories search engines and meta search engines, search fundamentals, search strategies, working of the search engines, Telnet and FTP, HTTP, Gopher Commands, TCP/IP. Introduction to Browser, Coast-to-coast surfing, hypertext markup language, Web page installation, Web page setup, Basics of HTML and formatting and hyperlink creation.Using FrontPage Express, Plug-ins.

UNIT-III : INTERNET PLATEFORM AND MAILING SYSTEMS

Introduction, advantages and disadvantages, User Ids, Pass words, e-mail addresses, message components, message composition, mailer features, E-mail inner workings, E-mail management, MIME types, Newsgroups, mailing lists, chat rooms, secure-mails, SMTP, PICO, Pine, Library cards catalog, online ref. works.

Languages: Basic and advanced HTML, Basics of scripting languages – XML, DHTML, Java Script.

UNIT-IV : SERVERS

Introduction to Web Servers: PWS, IIS, Apache; Microsoft Personal Web Server. Accessing and using these servers.

Privacy and security topics: Introduction, Software Complexity, Attacks, security and privacy levels, security policy, accessibility and risk analysis, Encryption schemes, Secure Web document, Digital Signatures, Firewalls, Intrusion detection systems

Suggested Books:

- Internet and World Wide Programming, Deitel,Deitel and Nieto, 2012, Pearson Education
- Fundamentals of the Internet and the World Wide Web, Raymond Greenlaw and Ellen Hepp, TMH- 2012
- Inline/Online: Fundamentals of The Internet And The World Wide Web, GREENLAW, TMH
- Complete idiots guide to java script,. Aron Weiss, QUE, 2013
- Network firewalls, Kironjeet syan -New Rider Pub.2014
- Networking Essentials – Firewall Media.Latest-2015
- www.secnf.com
- www.hackers.com
- Alfred Gikossbrenner-Internet 101 Computing MGH, 2013

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

PC-CS-206	OPERATING SYSTEMS						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3.0	75	25	100	3
Purpose	To familiarize the students with the basics of Operating Systems.						
Course Outcomes (CO)							
CO1	To understand the structure and functions of Operating system.						
CO2	To learn about processes, threads and scheduling algorithms.						
CO3	To understand the principle of concurrency.						
CO4	To understand the concept of deadlocks.						
CO5	To learn various memory management schemes.						
CO6	To study I/O management and file systems.						
CO7	To study the concept of protection and security.						

UNIT 1

Introduction: Introduction to OS. Operating system functions, Different types of O.S.: batch process, multi-programmed, time-sharing, real-time, distributed, parallel.

System Structure: Computer system operation, I/O structure, storage structure, storage hierarchy, different types of protections, operating system structure (simple, layered, virtual machine), O/S services, system calls.

UNIT II

CPU scheduling: scheduling criteria, preemptive and non-preemptive scheduling, scheduling algorithms, algorithm evaluation, multi-processor scheduling.

Threads: overview, benefits of threads, user and kernel threads.

Process Management: Concept of processes, process states, process control, co-operating processes, inter-process communication.

Process Synchronization: background, critical section problem, critical region, synchronization hardware, Classical problems of synchronization, semaphores.

UNIT III

Deadlocks: Concept of deadlock, deadlock characterization, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock.

Memory Management: background, logical vs. physical address space, contiguous memory allocation, paging, segmentation, segmentation with paging. Concept of fragmentation.

Virtual Memory: background, demand paging, concept of page replacement, page replacement algorithms , allocation of frames, thrashing.

UNIT IV

File Systems: file concept, file organization and access methods, allocation methods, directory structure, free-space management

I/O Management: I/O hardware, polling, interrupts, DMA, kernel I/O subsystem (scheduling, buffering, caching, spooling and device reservation)

Disk Management: disk structure, disk scheduling (FCFS, SSTF, SCAN,C-SCAN) , disk reliability, disk Performance parameters

Protection and Security:

Goals of protection and security, security attacks, authentication, program threats, system threats, threat monitoring.

Case studies: UNIX file system, Windows file system

Suggested Books:

- Operating System Concepts”, Abraham Silberschatz, Peter Baer Galvin, and Greg Gagne, Wiley
- Operating systems: a concept based approach”, Dhananjay M. Dhamdhare, McGraw Hill .
- Operating Systems : Internals and Design Principles, William Stallings, Pearson
- Operating Systems Design and Implementation” ,(Prentice Hall Software Series) Andrew S Tanenbaum and Albert S Woodhull
- Taub and Schilling, Principles of Communication Systems, TMH.
- Mithal G K, Radio Engineering, Khanna Pub.
- Sirnon Haykin, Communication Systems, John Wiley

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

PC-CS208	Design and Analysis of Algorithms						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3.0	75	25	100	3 Hrs.
Purpose	To introduce advanced data structures and algorithms concepts involving their implementation for solving complex applications.						
Course Outcomes (CO)							
CO1	To introduce the basic concepts of Data Structures and their analysis.						
CO2	To study the concept of Dynamic Programming and various advanced Data Structures.						
CO3	To introduce various Graph algorithms and concepts of Computational complexities.						
CO4	To study various Flow and Sorting Networks						

Unit 1: Introduction

Review:- Elementary Data Structures, Algorithms and its complexity(Time and Space), Analysing Algorithms, Asymptotic Notations, Priority Queue, Quick Sort.

Recurrence relation:- Methods for solving recurrence(Substitution , Recursion tree, Master theorem), Strassen multiplication.

Unit 2: Advanced Design and analysis Techniques

Dynamic programming:- Elements, Matrix-chain multiplication, longest common subsequence,

Greedy algorithms:- Elements , Activity- Selection problem, Huffman codes, Task scheduling problem, Travelling Salesman Problem.

Advanced data Structures:- Binomial heaps, Fibonacci heaps, Splay Trees, Red-Black Trees.

Unit 3: Graph Algorithms

Review of graph algorithms:-Traversal Methods(Depth first and Breadth first search),Topological sort, Strongly connected components, Minimum spanning trees- Kruskal and Prims, Single source shortest paths, Relaxation, Dijkstras Algorithm, Bellman- Ford algorithm, Single source shortest paths for directed acyclic graphs, All pairs shortest paths- shortest paths and matrix multiplication, Floyd- Warshall algorithm.

Computational Complexity:-Basic Concepts, Polynomial Vs Non-Polynomial Complexity, NP- hard and NP-complete classes.

Unit 4: Network and Sorting Algorithms

Flow and Sorting Networks Flow networks, Ford- Fulkerson method, Maximum Bipartite matching, Sorting Networks, Comparison network, The zero- One principle, Bitonic sorting network, Merging networks

Suggested Books :

- Corman, Leiserson and Rivest : Introduction to Algorithms, 2/e, PHI
- Das Gupta :Algorithms, TMH.
- Horowitz, Ellis and Sahni, Sartaj: Fundamentals of Computer Algorithms. Galgotia Publications
- Aho, Hopcroft and Ullman: The Design and Analyses of Computer Algorithms. Addison Wesley.
- R.B.Patel: Expert Data Structures with C, Khanna Publications , Delhi, India, 2nd Edition 2004, ISBN 81-87325-07-0.
- R.B.Patel and M.M.S Rauthan: Expert Data Structures with C++, Khana Publications, Delhi , India, 2nd Edition 2004,ISBN 87522-03-8

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

HM-901	Organizational Behavior						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3.0	75	25	100	3
Purpose	To make the students conversant with the basics concepts of organizational culture and behavior for nurturing their managerial skills.						
Course Outcomes (CO)							
CO1	An overview about organizational behavior as a discipline and understanding the concept of individual behavior.						
CO2	Understand the concept and importance of personality ,emotions and its importance in decision making and effective leadership.						
CO3	Enabling the students to know about the importance of effective motivation and its contribution in group dynamics and resolving conflicts.						
CO4	Understand how to overcome organizational stress by maintaining proper organizational culture and effective communication.						

Unit 1

Introduction to Organizational Behavior: Concept and importance of Organizational Behavior, Role of Managers in OB, Foundations or Approaches to Organizational Behavior, Challenges and Opportunities for OB.

Foundation of individual behavior: Biographical characteristics, concept of Abilities and Learning , Learning and Learning Cycle, Components of Learning, concept of values and attitude, types of attitude, attitude and workforce diversity.

Unit 2

Introduction to Personality and Emotions: Definition and Meaning of Personality, Determinants of Personality, Personality Traits Influencing OB, Nature and Meaning of Emotions, Emotions dimensions, concept of Emotional intelligence

Perception and individual decision making: Meaning of perception, factors influencing perception, Rational decision making process, concept of bounded rationality. Leadership- Trait approaches, Behavioral approaches, Situational approaches, and emerging approaches to leadership.

Unit-3

Motivation: concept and theories of Motivation, theories of motivation-Maslow, Two Factor theory, Theory X and Y,ERG Theory, McClelland's Theory of needs, goal setting theory, Application of theories in Organizational Scenario, linkage between MBO and goal setting theory, employee recognition and involvement program.

Foundations of Group Behavior and conflict management :Defining and classifying of Groups, stages of group development, Informal and Formal Groups – Group Dynamics, Managing Conflict and Negotiation , a contemporary perspective of intergroup conflict, causes of group conflicts, Managing intergroup conflict through Resolution.

Unit-4:

Introduction to Organizational Communication: Meaning and Importance of Communication process, importance of Organizational Communication, Effective Communication, Organizational Stress: Definition and Meaning , Sources and Types of Stress, Impact of Stress on Organizations, Stress Management Techniques.

Introduction to Organization Culture- Meaning and Nature of Organization Culture, Types of Culture, Managing Cultural Diversity, Managing Change and Innovation – Change at work, Resistance to change, A model for managing organizational change.

Suggested Books

- Colquitt, Jason A., Jeffery A. LePine, and Michael Wesson. Organizational Behavior: Improving Performance and Commitment in the Workplace. 5th ed. New York: McGraw-Hill Education, 2017.
- Hitt, Michael A., C. Chet Miller, and Adrienne Colella. Organizational Behavior. 4th ed. Hoboken, NJ: John Wiley, 2015.
- Robbins, Stephen P., and Timothy Judge. Organizational Behavior. 17th ed. Harlow, UK: Pearson Education, 2017.
- Stephen P. Robins, Organisational Behavior, PHI Learning / Pearson Education, 11th edition, 2008.
- Schermerhorn, Hunt and Osborn, Organisational behavior, John Wiley.
- UdaiPareek, Understanding OrganisationalBehaviour, Oxford Higher Education.
- Mc Shane and Von Glinov, OrganisationalBehaviour, Tata Mc Graw Hill.
- Aswathappa, K., OrganisationalBehaviour– Text and Problem, Himalaya Publication

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

PC-CS210L	Internet Technology and Management Lab						
Lecture	Tutorial	Practical	Credit	Minor Test	Practical	Total	Time
0	0	4	2.0	40	60	100	3 Hour
Purpose	Learn the internet and design different web pages using HTML .						
Course Outcomes (CO)							
CO1	Understanding different PC software and their applications.						
CO2	To be able to learn HTML.						
CO3	To be able to write Web pages using HTML.						
CO4	To be able to install modems and understand the e-mail systems.						

PC Software: Application of basics of MS Word 2000, MS Excel 2000, MS Power Point 2000, MS Access 2000, HTML

1. To prepare the Your Bio Data using MS Word
2. To prepare the list of marks obtained by students in different subjects and show with the help of chart/graph the average, min and max marks in each subject.
3. Prepare a presentation explaining the facilities/infrastructure available in your college/institute.
4. Design Web pages containing information of the Deptt.

HTML Lists:

1. Create a new document that takes the format of a business letter. Combine <P> and
 tags to properly separate the different parts of the documents. Such as the address, greeting, content and signature. What works best for each?
2. Create a document that uses multiple
 and <P> tags, and put returns between <PRE> tags to add blank lines to your document see if your browser renders them differently.
3. Create a document using the <PRE>tags to work as an invoice or bill of sale, complete with aligned dollar values and a total. Remember not to use the Tab key, and avoid using emphasis tags like or within your list.
4. Create a seven-item ordered list using Roman numerals. After the fifth item, increase the next list value by 5.
5. Beginning with an ordered list, create a list that nests both an unordered list and a definition list.
6. Use the ALIGN attribute of an tags to align another image to the top of the first image.. play with this feature, aligning images to TOP, MIDDLE and BOTTOM.
7. Create a 'table of contents' style page (using regular and section links) that loads a different document for each chapter or section of the document.

Internet:

1. Instilling internet and external modems, NIC and assign IP address.
2. Study of E-mail system.
3. Create your own mail-id in yahoo and indiatimes.com.
4. Add names (mail-id's) in your address book, compose and search an element.

NOTE:

At least ten experiments are to be performed from above list and the concerned institution as per the scope of the syllabus may set remaining five.

PC-CS212L	Operating Systems Lab						
Lecture	Tutorial	Practical	Credit	Sessional	Practical	Total	Time
0	0	4	2.0	40	60	100	3
Purpose	To familiarize the students with the basics of Operating Systems.						
Course Outcomes (CO)							
CO1	To understand the CPU scheduling.						
CO2	To learn about memory management.						
CO3	To understand system calls.						
CO4	To understand the concept of file operations.						
CO5	To learn various classical problems.						

1. Simulation of the CPU scheduling algorithms a) Round Robin b) SJF c) FCFS d) Priority
2. Program for paging techniques of memory management.
3. Program for page replacement algorithms
4. Simulation of Bankers Deadlock Avoidance and Prevention algorithms.
5. Program for Implementation of System Calls.
6. Program for File Permissions
7. Program for File Operations.
8. Program for File Copy and Move.
9. Program for Dining Philosophers Problem.
10. Program For Producer – Consumer Problem concept.
11. Program for disk scheduling algorithms.

NOTE:

At least ten experiments are to be performed from above list and the concerned institution as per the scope of the syllabus may set remaining five.

PC-CS214L	Design and Analysis of algorithms Lab						
Lecture	Tutorial	Practical	Credit	Minor Test	Practical	Total	Time
0	0	4	2.0	40	60	100	3
Purpose	The student should be made to Learn the algorithm analysis techniques, become familiar with the different algorithm design techniques and Understand the limitations of Algorithm power.						
Course Outcomes (CO)							
CO1	The student should be able to Design algorithms for various computing problems.						
CO2	The student should be able to Analyze the time and space complexity of algorithms.						
CO3	The student should be able to Critically analyze the different algorithm design techniques for a given problem.						
CO4	The student should be able to Modify existing algorithms to improve efficiency.						

- Sort a given set of elements using the Quick sort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
- Using Open, implement a parallelized Merge Sort algorithm to sort a given set of elements and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
- Obtain the Topological ordering of vertices in a given digraph.
 - Compute the transitive closure of a given directed graph using Warshall's algorithm.
- Implement 0/1 Knapsack problem using Dynamic Programming.
- From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.
- Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm.
- Print all the nodes reachable from a given starting node in a digraph using BFS method.
 - Check whether a given graph is connected or not using DFS method.
- Find a subset of a given set $S = \{s_1, s_2, \dots, s_n\}$ of n positive integers whose sum is equal to a given positive integer d. For example, if $S = \{1, 2, 5, 6, 8\}$ and $d = 9$ there are two solutions $\{1, 2, 6\}$ and $\{1, 8\}$. A suitable message is to be displayed if the given problem instance doesn't have a solution.
- Implement any scheme to find the optimal solution for the Traveling Salesperson problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation.
- Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm.
- Implement All-Pairs Shortest Paths Problem using Floyd's algorithm. Parallelize this algorithm, implement it using Open and determine the speed-up achieved.
- Implement N Queen's problem using Back Tracking.
- Use divide and conquer method to recursively implement Binary Search

NOTE:

At least ten experiments are to be performed from above list and the concerned institution as per the scope of the syllabus may set remaining five.

MC-901	Environmental Sciences						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	0	75	25	100	3 Hrs.
Purpose	To learn the multidisciplinary nature, scope and importance of Environmental sciences.						
Course Outcomes (CO)							
CO1	The students will be able to learn the importance of natural resources.						
CO2	To learn the theoretical and practical aspects of eco system.						
CO3	Will be able to learn the basic concepts of conservation of biodiversity.						
CO4	The students will be able to understand the basic concept of sustainable development.						

UNIT 1

The multidisciplinary nature of environmental studies, Definition, Scope and Importance, Need for public awareness, Natural Resources: Renewable and Non-Renewable Resources: Natural resources and associated problems.

- 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 over-utilization of surface and ground water, floods, drought, conflicts over 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, fertilizer-pesticide problems, water logging, salinity, case studies.
- Energy Resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. 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, Equitable use of resources for sustainable lifestyle.

UNIT II

Ecosystem-Concept of an ecosystem. Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological Succession, Food Chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: (a) Forest Ecosystem, (b) Grassland Ecosystem, (c) Desert Ecosystem and (d) Aquatic Ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Field Work: Visit to a local area to document Environment assets-river/forest/grassland/hill/mountain, Visit to a local polluted site-Urban /Rural Industrial/Agricultural, Study of common plants, insects and birds, Study of simple ecosystems-pond, river, hill, slopes etc. (Field work equal to 5 lecture hours).

UNIT III

Biodiversity and its conservation: Introduction, Definition: genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity of global, National and local levels. India as a mega-diversity nation Hot spots of Biodiversity, Threats to biodiversity: Habitat loss, poaching of wild life, man-wildlife conflicts, Endangered and endemic species of India, Conservation of Biodiversity- In situ and Ex-Situ conservation of biodiversity.

Environmental Pollution Definition: Cause, effects and control measures of (a) Air Pollution (b) Water Pollution (c) Soil Pollution (d) Marine Pollution (e) Noise Pollution (f) Thermal Pollution (g) Nuclear Hazards

Solid waste management- cause, effects and control measures of urban and industrial wastes, Role of an individual in prevention of pollution, Pollution case studies, Disaster management: floods, earthquake, cyclone and landslides

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: Environmental ethics-issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies: Wasteland Reclamation, Consumerism and waste products, Environment Protection Act, Air (Prevention and

Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public Awareness, Human population and the Environment, Population growth, variation among nations, Population explosion-Family Welfare Programme, Environment and human health. Human rights, Value Education, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and Human Health, Case Studies, Drugs and their effects; Useful and harmful drugs, Use and abuse of drugs, Stimulant and depressant drugs, Concept of drug addiction, Legal position on drugs and laws related to drugs.

Suggested Books

- Environmental Studies- Deswal and Deswal. Dhanpat Rai and Co.
- Environmental Science and Engineering Anandan, P. and Kumaravelan, R. 2009. Scitech Publications (India) Pvt. Ltd., India
- Environmental Studies. Daniels Ranjit R. J. and Krishnaswamy. 2013. Wiley India.
- Environmental Science- Botkin and Keller. 2012. Wiley , India

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

Bachelor of Technology (Electronics Communication Engineering) (Credit Based)
KURUKSHETRA UNIVERSITY KURUKSHETRA
Scheme of Studies/Examination

LIST OF OPEN ELECTIVES (B.TECH. ECE)		
SEM	CODE	SUBJECT
V	ECO-1	Computer Networks
	ECO-2	Mechatronics
	ECO-3	Electronic Measurement and Instruments
	ECO-4	Renewable Energy Resources
MOOC 1		
VI	ECO-5	Data Structures
	ECO-6	Multimedia Communication
	ECO-7	Consumer Electronics
	ECO-8	Transducers and Their Applications
MOOC 2		
VII	ECO-9	Bio-informatics
	ECO-10	Electromechanical Energy Conversion
	ECO-11	Operating Systems
	ECO-12	Robotics
MOOC 3		
VIII	ECO-13	Machine Learning
	ECO-14	Soft Computing
	ECO-15	Neural Networks and Fuzzy Logic
	ECO-16	Software Defined Radio
	ECO-17	Statistics and Operational Research
	ECO-18	Biomedical Signal Processing
	ECO-19	Internet of Things
	ECO-20	Wireless Sensor Networks
MOOC 4		
MOOC 5		

LIST OF PROGRAM ELECTIVES (B.TECH. ECE)		
SEM	CODE	SUBJECT
V	ECP-1	Probability Theory & Stochastic Processes
	ECP-2	Speech and Audio Processing
	ECP-3	Introduction to MEMS
	ECP-4	Power Electronics
	ECP-5	VLSI
VI	ECP-6	Antennas and Propagation
	ECP-7	CMOS Design
	ECP-8	Bio-Medical Electronics
	ECP-9	Scientific Computing
VII	ECP-10	Fiber Optic Communications
	ECP-11	Nano electronics
	ECP-12	Microwave Theory and Techniques
	ECP-13	Adaptive Signal Processing
VIII	ECP-14	Wireless Sensor Networks
	ECP-15	Satellite Communication
	ECP-16	High Speed Electronics
	ECP-17	Wavelets
	ECP-18	Embedded systems
	ECP-19	Mixed Signal Design
	ECP-20	Error correcting codes
	ECP-21	Digital Image & Video Processing
	ECP-22	Mobile Communication and Networks

Bachelor of Technology (Electronics & Communication Engineering) (Credit Based)
KURUKSHETRA UNIVERSITY KURUKSHETRA
Scheme of Studies/Examination
Semester III (w.e.f. session 2019-2020)

Sr. No.	Course No.	Subject	L:T:P	Hours/Week	Credits	Examination Schedule (Marks)				Duration of Exam (Hrs)
						Major Test	Minor Test	Practical	Total	
1	BS-201	Optics & Waves	3:0:0	3	3	75	25	0	100	3
2	EC-201	Electronic Devices	3:0:0	3	3	75	25	0	100	3
3	EC-203L	Electronic Devices Lab	0:0:2	2	1	-	40	60	100	3
4	EC-205	Digital Electronics	3:0:0	3	3	75	25	0	100	3
5	EC-207L	Digital Electronics Lab	0:0:2	2	1	-	40	60	100	3
6	EC-209	Signals & Systems	3:0:0	3	3	75	25	0	100	3
7	EC-211L	Signals & Systems Lab	0:0:2	2	1	-	40	60	100	3
8	EC-213	Network Theory	3:0:0	3	3	75	25	0	100	3
9	ES-201	Essentials of Information Technology	3:0:0	3	3	75	25	0	100	3
10	*EC-215	Industrial Training-I	2:0:0	2	-	-	100	-	100	3
11	**MC-901	Environmental Sciences	3:0:0	3	-	75	25	0	100	3
		Total		26	21	450	270	180	900	

*EC-215 is a mandatory credit-less course in which the students will be evaluated for the industrial training undergone after 2nd semester and students will be required to get passing marks to qualify.

**MC-901 is a mandatory credit-less course in which the students will be required to get passing grade.

Bachelor of Technology (Electronics & Communication Engineering) (Credit Based)
KURUKSHETRA UNIVERSITY KURUKSHETRA
Scheme of Studies/Examination
Semester IV (w.e.f. session 2019-2020)

S. No.	Course No.	Subject	L:T:P	Hours/Week	Credits	Examination Schedule (Marks)				Duration of Exam (Hrs)
						Major Test	Minor Test	Practical	Total	
1	BS-204	Higher Engineering Mathematics	3:0:0	3	3	75	25	0	100	3
2	HM-903	Soft Skills & Interpersonal Communication	3:0:0	3	3	75	25	0	100	3
3	EC- 202	Digital Communication	3:0:0	3	3	75	25	0	100	3
4	EC-204L	Communication Lab	0:0:2	2	1	-	40	60	100	3
5	EC-206	Analog Circuits	3:0:0	3	3	75	25	0	100	3
6	EC-208L	Analog Circuits Lab	0:0:2	2	1	-	40	60	100	3
7	EC-210	Microprocessors & Microcontrollers	3:0:0	3	3	75	25	0	100	3
8	EC-212L	Microprocessors & Microcontrollers Lab	0:0:2	2	1	0	40	60	100	3
9	ES-202	Basics of Analog Communication	3:0:0	3	3	75	25	0	100	3
10	*MC-902	Constitution of India	3:0:0	3	-	75	25	0	100	3
		Total		27	21	450	270	180	900	

*MC-902 is a mandatory credit-less course in which the students will be required to get passing grade.

Note: All the students have to undergo 4 to 6 weeks Industrial Training after 4th semester which will be evaluated in 5th semester

Syllabus
B.Tech ECE IIIrd Semester
Credit Based
(2019-20)

BS - 201	Optics and Waves						
L	T	P	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	75	25	100	3h
Purpose	To introduce the fundamentals of wave and optics for the applications in Engineering field.						
Course Outcomes							
CO 1	Familiarize with basic phenomenon used in propagation of waves.						
CO 2	Introduce the fundamentals of interference, diffraction, polarization and their applications.						
CO 3	To make the students aware to the importance of Laser in technology.						

Unit - I

Waves: Travelling waves, Characteristics of waves, Mathematical representation of travelling waves, General wave equation, Phase velocity, Light source emit wave packets, Wave packet and Bandwidth, Group velocity and real light waves.

Propagation of light waves: Maxwell's equations, Electromagnetic waves and constitutive relations, Wave equation for free-space, Uniform plane waves, Wave polarization, Energy density, the pointing vector and intensity, Radiation pressure and momentum, Light waves at boundaries, Wave incident normally on boundary, Wave incident obliquely on boundary: law of reflection, Snell's law and reflection coefficients.

Unit - II

Interference: Principle of Superposition, Conditions for Sustained interference, Young's double slit experiment, Division of wave-front: Fresnel's Biprism and its applications, Division of amplitude: Interference due to reflected and transmitted light, Wedge-shaped thin film, Newton's rings and its applications, Michelson Interferometer and its applications.

Unit – III

Diffraction: Types of diffraction, Fraunhofer diffraction at a single slit, Plane transmission diffraction grating: theory, secondary maxima and secondary minima, width of principal maxima, absent spectra, overlapping of spectral lines, determination of wavelength; Dispersive power and resolving power of diffraction grating.

Polarization: Polarization of transverse waves, Plane of polarization, Polarization by reflection, Double refraction, Nicol Prism, Quarter and half wave plate, Specific Rotation, Laurent 's half shade polarimeter, Biquartz polarimeter.

Unit – IV

Laser: Stimulated Absorption, Spontaneous and Stimulated Emission; Einstein's Coefficients and its derivation, Population Inversion, Direct and Indirect pumping, Pumping schemes, Main components of Laser, Gas lasers (He-Ne, CO₂), Solid state lasers (Ruby, Neodymium, semiconductor), Dye laser, Characteristics of Laser, Applications of Laser.

Text/Reference Books:

1. P.K. Diwan, Applied Physics for Engineers, *Wiley India Pvt. Ltd., India*
2. N. Subrahmanyam, B. Lal, M.N. Avadhanulu, A Textbook of Optics, *S. Chand & Company Ltd., India.*
3. A. Ghatak, Optics, *McGraw Hill Education (India) Pvt. Ltd., India.*
4. E. Hecht, A.R. Ganesan, Optics, *Pearson India Education Services Pvt. Lt., India.*

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EC-201 Electronic Devices							
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	75	25	100	3 Hrs.
Course Outcomes (CO)							
CO1	To understand the concept of carrier transport phenomena in semiconductors and diodes such as p-n junction diode and tunnel diode.						
CO2	To understand the detailed operation of BJT and calculation of its parameters using transistor models.						
CO3	To understand the operation, characteristics & parameters of FET and MOSFET.						
CO4	To understand the concept of different types of regulated power supplies and Op-Amp based voltage regulators						

UNIT-I

Charge Carriers Transport : Energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility and resistivity; Generation and recombination of carriers; Continuity equation, PN Junction: Basic Structure, small signal equivalent circuit of p-n diode, derivation of barrier potential and diode current equation, Simple diode circuits: clipping, clamping and rectifiers, Zener diode and its application as voltage regulator.

UNIT-II

Bipolar Junction Transistor: Basic principle of operation, Current gains : derivation of α, β, γ and their relationship. Various modes of operation of BJT, Base Width Modulation, Transistor hybrid model, h-parameter equivalent circuit of transistor, Analysis of transistor amplifier using h-parameters, calculation of input impedance, output impedance and voltage gain.

UNIT-III

Field Effect Devices: JFET : basic Operation and characteristics, drain and transfer characteristics, pinch off voltage, parameters of JFET: Transconductance (g_m), ac drain resistance (r_d), amplification factor (μ), Small Signal Model & Frequency Limitations. MOSFET: basic operation, depletion and enhancement type, pinch-off voltage, Shockley equation and Small Signal Model of MOSFET, MOS capacitor.

UNIT-IV

Regulated Power Supplies: Voltage Regulation, block diagram of DC regulated power supply, Zener diode voltage regulators: transistor series voltage regulator, Transistor shunt voltage regulator, Controlled Transistor Voltage Regulator, Op-Amp Series and shunt voltage regulator.

Text Books:

1. Millman & Halkias: Integrated Electronics, TMH.
2. Boylestad & Nashelsky: Electronic Devices & Circuit Theory, PHI.

Reference Books:

1. B.G. Streetman, Solid State Electronic Devices, Prentice Hall of India, New Delhi, 1995.
2. E S. Yang, Microelectronic Devices, McGraw Hill, Singapore, 1988.
3. A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College Publishing, 1991.
4. S Salivahanan and N Naresh Kumar, Electronics devices and circuits, McGraw Hill, 1998.

Note: Separate paper template will be provided to the paper setter for setting the question paper of end term semester examinations.

EC-203L	Electronic Devices Lab						
Lecture	Tutorial	Practical	Credit	Practical	Minor Test	Total	Time
-	-	2	1	60	40	100	3 Hrs.
Course Outcomes (CO)							
CO1	To teach the students how to experimentally plot the VI characteristics of various diodes such as p-n diode, zener diode etc. find the threshold voltage and zener breakdown voltage from the VI curve.						
CO2	To teach the students how to experimentally find the values of various parameters of Transistor such as voltage gain, current gain etc.						
CO3	To teach the students how to plot the input and output characteristics of FET and MOSFET by experimental method.						
CO4	To experimentally teach the students the concept of different configurations of regulated power supplies using Zener diodes and Op-Amp.						

List of experiments:

1. To study the VI characteristics of p-n diode in forward and reverse bias and find the threshold voltage from the VI curve.
2. To study the operation of Zener diode as a voltage regulator.
3. To study the operation of half-wave and full wave rectifiers and calculate their ripple factor values.
4. To study the operation of series and parallel Clippers using P-N junction diodes.
5. To study the operation of clampers using P-N junction diodes.
6. To experimentally plot the input and output characteristics of a given BJT transistor in CE configuration and calculate its various parameters.
7. To experimentally plot the input and output characteristics of a given BJT transistor in CB configuration and calculate its various parameters.
8. To study the transfer and drain characteristics of JFET and calculate its various parameters.
9. To study the transfer and drain characteristics of MOSFET and calculate its various parameters.
10. To study the different types of negative feedback in two stage amplifier and to observe its effects upon the amplifier parameters.
11. To study the Zener diode as a transistor series voltage regulator.
12. To study the Zener diode as a transistor shunt voltage regulator.

Reference Books:

1. Millman & Halkias: Integrated Electronics, TMH.
2. Boylestad & Nashelsky: Electronic Devices & Circuit Theory, PHI.

Note: Atleast ten (10) experiments from the above list are mandatory to perform for the students.

EC-205	Digital Electronics						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	75	25	100	3 Hrs.
Course Outcomes (CO)							
CO1	Students will be able to understand the basic logic gates and will be able to apply minimization techniques for reducing a function upto six variables.						
CO2	Students will be able to design combinational circuits and applications related to them.						
CO3	Students will be able to write the truth table, excitation table, characteristic equations of various flip flops and to design the sequential circuits using Flip flops.						
CO4	Students will be able to familiarize with varied memory types and various A/D, D/A Converters and their characteristics.						

UNIT-I

Fundamentals of Digital Systems and Techniques: Digital signals, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, number systems: binary, signed binary, octal, hexadecimal number, binary arithmetic, one's and two's complements arithmetic, Codes: BCD codes, Excess-3, Gray codes, Error detecting and correcting codes: parity check codes and Hamming code

Minimization Techniques: Basic postulates and fundamental theorems of Boolean algebra: Standard representation of logic functions: SOP and POS forms, Simplification of switching functions using K-map and Quine-McCluskey tabular methods, Don't care conditions, Digital logic families: TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-state logic.

UNIT-II

Combinational Digital Circuits: Design procedure: Half adder, Full Adder, Half subtractor, Full subtractor, Parallel binary adder, parallel binary Subtractor, Carry Look Ahead adder, Serial Adder/Subtractor, BCD adder, Binary Multiplier, Binary Divider, Multiplexer/ De-multiplexer, decoder, encoder, parity checker, parity generators, code converters, Magnitude Comparator.

UNIT-III

Sequential circuits: A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J- K, T and D types flip flops, applications of flip flops: shift registers, serial to parallel converter, parallel to serial converter, Synchronous and Asynchronous mod counter, FSM, sequence generator and detector.

UNIT-IV

A/D and D/A Converters: Digital to analog converters: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, specifications for A/D converters

Semiconductor Memories and Programmable Logic Devices: Characteristics of memories, read only memory (ROM), read and write memory (RAM), Programmable logic array, Programmable array logic, Introduction to Field Programmable Gate Array (FPGA)

Text Books:

1. M. M. Mano, "Digital design", Pearson Education India, 2016.
2. Donald P. Leach and Albert Paul Malvino, Digital Principles and Applications, 8th Edition, TMH, 2003.
3. Taub Schilling, Digital Integrated Electronics, TMH

Reference Books:

1. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
2. A.K. Maini, Digital Electronics, Wiley India
3. R P Jain, Modern digital electronics, TMH

Note: Separate paper template will be provided to the paper setter for setting the question paper of end term semester examinations.

EC-207L	Digital Electronics Lab						
Lecture	Tutorial	Practical	Credit	Practical	Minor Test	Total	Time
-	-	2	1	60	40	100	3 Hrs.
Course Outcomes (CO)							
CO1	Students will be able to verify truth tables of basic logic gates and design various gates using universal gates.						
CO2	Students will be able to design various combinational circuits and verify their operation.						
CO3	Students will be able to design different sequential circuits by using flip flops and verify their operation.						
CO4	Students will be to study and design various encoders and decoders.						

List of experiments:

1. Familiarization with Digital Trainer Kit and associated equipment.
2. Study of TTL gates AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR.
3. Design and realize a given function using K-Maps and verify its performance.
4. To verify the operation of Multiplexer and De-multiplexer.
5. To verify the operation of Comparator.
6. To verify the truth table of S-R, J-K, T, D Flip-flops.
7. To verify the operation of Bi-directional shift register.
8. To design and verify the operation of 3-bit asynchronous counter.
9. To design and verify the operation of asynchronous Up/down counter.
10. To design and verify the operation of asynchronous Decade counter.
11. Study of Encoder and Decoder.
12. Study of BCD to 7 segment Decoder

Text Books:

1. M. M. Mano, "Digital design", Pearson Education India, 2016.
2. Donald P. Leach and Albert Paul Malvino, Digital Principles and Applications, 8th Edition, TMH, 2003.

Note: At least ten (10) experiments from the above list are mandatory to perform for the students.

ECE-209	Signals and Systems						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	75	25	100	3 Hrs.
Course Outcomes (CO)							
At the end of this course, students will demonstrate the ability to							
CO1	Analyze different types of signals.						
CO2	Represent continuous and discrete systems in time and frequency domain using different transforms.						
CO3	Understand sampling theorem and its implications.						

UNIT-I

Introduction to Signals: Continuous and discrete time signals, deterministic and stochastic signals, periodic and a periodic signals, even and odd signals, energy and power signals, exponential and sinusoidal signals and singular functions. Signal representation in terms of singular functions, orthogonal functions and their use in signal representation

Introduction to Systems: Linear and non-linear systems, time invariant and time varying systems, lumped and distributed systems, deterministic and stochastic systems, casual and non-causal systems, analog and discrete/digital memory and memory less systems.

UNIT-II

Random Variables: Introduction to Random Variables, pdf, cdf, moments, distributions, correlation functions.

Linear Time Invariant Systems: Introduction to linear time invariant (LTI) systems, properties of LTI systems, convolution integral, convolution sum, causal LTI systems described by differential and difference equations, Concept of impulse response.

UNIT-III

Discretization of Analog Signals: Introduction to sampling, sampling theorem and its proof, effect of undersampling, reconstruction of a signal from sampled signal.

Fourier Series : Continuous time Fourier series (CTFS), Properties of CTFS, Convergence of Fourier series, Discrete time Fourier Series (DTFS), Properties of DTFS , Fourier series and LTI system, Filtering.

UNIT-IV

Fourier Transform: Continuous Time Fourier Transform (CTFT), Properties of CTFT, Systems characterized by linear constant- coefficient differential equations, Discrete time fourier transform (DTFT), Properties of DTFT, Duality, Systems characterized by Linear constant coefficient difference equations.

Laplace Transform: Introduction to Laplace transform, Region of convergence for laplace transform, Inverse laplace transform, Properties of laplace transform, Analysis and characterization of LTI systems using laplace transform, System function algebra and block diagram representations, Unilateral laplace transform.

Text Books:

1. Alan V. Oppenheim, Alan S. Willsky, S. Hamid Nawab, Signals and Systems, Prentice Hall India, 2nd Edition, 2009

Reference Books:

1. Simon Haykins – “Signal & Systems”, Wiley Eastern
2. Tarun Kumar Rawat , Signals and Systems , Oxford University Press.
3. H. P. Hsu, “Signals and systems”, Schaum’s series, McGraw Hill Education, 2010.
4. M. J. Robert “Fundamentals of Signals and Systems”, McGraw Hill Education, 2007.
5. B. P. Lathi, “Linear Systems and Signals”, Oxford University Press, 2009.

Note: Question paper template will be provided to the paper setter.

ECE-211L	Signals & Systems Lab						
Lecture	Tutorial	Practical	Credit	Practical	Minor Test	Total	Time
-	-	2	1	60	40	100	3 Hrs.
Course Outcomes (CO)							
CO1	To understand the basic concepts of software.						
CO2	To explore properties of various types of signals and systems.						
CO3	To explore different properties of signals and systems.						
CO4	To understand the concept of sampling in time and frequency domain.						

List of experiments:

1. Introduction of the MATLAB/SciLab/Octave software.
2. To demonstrate some simple signal.
3. To explore the effect of transformation of signal parameters (amplitude-scaling, time-scaling and time- shifting).
4. To visualize the complex exponential signal and real sinusoids.
5. To identify a given system as linear or non-linear.
6. To explore the time variance and time invariance property of a given system.
7. To explore causality and non-causality property of a system.
8. To determine Fourier transform of a signal.
9. To determine Laplace transform of a signal.
10. To demonstrate the time domain sampling of bandlimited signals (Nyquist theorem).
11. To demonstrate the sampling in frequency domain (Discrete Fourier Transform).
12. To demonstrate the convolution and correlation of two continuous-time signals.
13. To demonstrate the convolution and correlation of two discrete-time signals.

Reference Books:

1. B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2009.
2. Signals and Systems using Scilab, www.scilab.in.
3. Signals and Systems using Octave, www.octave.org

Note: Atleast ten (10) experiments from the above list are mandatory to perform for the students.

EC-213	Network Theory						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	75	25	100	3 Hrs.
Course Outcomes (CO)							
CO1	To understand the concept of network topologies and the network analysis in the time domain for solving simple and complex circuits.						
CO2	Describe the circuit element models, network analysis using Laplace transform and time domain behavior from the pole-zero plots.						
CO3	Describe the characteristics & parameters of two port networks.						
CO4	To understand the concept of filters and synthesis of one port networks.						

UNIT I

INTRODUCTION: - Principles of network topology, graph matrices, Network Analysis (Time-Domain): Singularity Functions, Source-Free RC, RL, Series RLC, Parallel RLC circuits, Initial & Final Conditions, Impulse & Step Response of RC, RL, Series RLC, Parallel RLC circuits.

UNIT 2

NETWORK ANALYSIS (using Laplace Transform): - Circuit Element Models, Transient Response of RC, RL, RLC Circuits to various excitation signals such as step, ramp, impulse and sinusoidal excitations using Laplace transform.

NETWORK FUNCTIONS: - Terminal pairs or Ports, Network functions for one-port and two-port networks, poles and zeros of Network functions, Restrictions on pole and zero Locations for driving point functions and transfer functions.

UNIT 3

CHARACTERISTICS AND PARAMETERS OF TWO PORT NETWORKS: - Relationship of two-port variables, short-circuit admittance parameters, open circuit impedance parameters, transmission parameters, hybrid parameters, relationships between parameter sets, Inter-connection of two port networks.

UNIT 4

TYPES OF FILTERS AND THEIR CHARACTERISTICS: - Filter fundamentals, constant-k and m-derived low-pass and high-pass filters.

NETWORK SYNTHESIS: - Causality & Stability, Hurwitz Polynomials, Positive real functions, Synthesis of one port networks with two kind of elements.

TEXT BOOKS:

1. Fundamentals of Electric Circuits: Charles K. Alexander, Matthew N. O. Sadiku, McGraw Hill Education
2. Network Analysis: M.E. Van Valkenburg, PHI

REFERENCE BOOKS:

1. Network Analysis & Synthesis: F. F. Kuo, John Wiley.
2. Circuits & Networks: Sukhija & Nagsarkar, Oxford Higher Education.
3. Basic Circuit Theory: DasoerKuh, McGraw Hill Education.
4. Circuit Analysis: G.K. Mithal, Khanna Publication.

Note: Separate paper template will be provided to the paper setter for setting the question paper of end term semester examinations.

ES-201	Essentials of Information Technology						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	75	25	100	3 Hrs.
Course Outcomes (CO)							
CO1	Develop basic computational thinking. Learn how to reason with variables, state transitions, conditionals, and iteration						
CO2	Understand the notion of data types, and higher order data structures such as lists, tuples, and dictionaries.						
CO3	Develop a basic understanding of computer systems -architecture, OS, mobile and cloud computing.						
CO4	Learn basic SQL programming						

UNIT-I

Python Programming: Familiarization with the basics of Python programming, process of writing a program, running it, and print statements; simple data-types: integer, float, string. The notion of a variable, and methods to manipulate it, Knowledge of data types and operators: accepting input from the console, assignment statement, expressions, operators and their precedence. Conditional statements: if, if-else, if-elif-else; Notion of iterative computation and control flow: for, while, flowcharts, decision trees and pseudo code

UNIT-II

Idea of debugging: errors and exceptions; debugging: pdb, break points. Sequence datatype: Lists, tuples and dictionary, Introduce the notion of accessing elements in a collection using numbers and names. Sorting algorithm: bubble and insertion sort; count the number of operations while sorting. Strings: Strings in Python : compare, concat, substring. **Data visualization using Pyplot:** line chart, pie chart, and bar chart.

UNIT-III

Computer Systems and Organisation: description of a computer system and mobile system, CPU, memory, hard disk, I/O, battery, power. Types of software:Types of Software – System Software, Utility Software and Application Software, how an operating system runs a program, operating system as a resource manager. **Cloud Computing:** Concept of cloud computers, cloud storage (public/private),and brief introduction to parallel computing.

UNIT-IV

Relational databases: idea of a database and the need for it, relations, keys, primary key, foreign key; use SQL commands to create a table, foreign keys; insert/delete an entry, delete a table. SQL commands: select, project, and join; indexes. Basics of NoSQL databases: Mongo DB

Text Books:

1. Python Programming: A modular approach by Sheetal Taneja and Naveen Kumar Pearson

Reference Books:

1. Python Programming - Using Problem Solving Approach by Reema Thareja Oxford Publication.

2. Database Management System a Practical Approach by Rajiv Chopra by S. Chand

Note: Separate paper template will be provided to the paper setter for setting the question paper of end term semester examinations.

MC-901	ENVIRONMENTAL SCIENCES						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	-	-	-	75	25	100	3 Hrs.
Purpose	To learn the multidisciplinary nature, scope and importance of Environmental sciences.						
Course Outcomes							
CO1	The students will be able to learn the importance of natural resources.						
CO2	To learn the theoretical and practical aspects of eco system.						
CO3	Will be able to learn the basic concepts of conservation of biodiversity.						
CO4	The students will be able to understand the basic concept of sustainable development.						

UNIT 1

The multidisciplinary nature of environmental studies. Definition, Scope and Importance. Need for public awareness. Natural Resources: Renewable and Non-Renewable Resources: Natural resources and associated problems.

- (a) Forest Resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
- (b) Water Resources- Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
- (c) Mineral Resources- Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
- (d) Food Resources- World Food Problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- (e) Energy Resources- Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.
- (f) Land Resources- Land as a resource, land, degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyle.

UNIT II

Ecosystem-Concept of an ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological Succession. Food Chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem-

- a. Forest Ecosystem
- b. Grassland Ecosystem
- c. Desert Ecosystem
- d. Aquatic Ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Field Work. Visit to a local area to document Environment assets- river/forest/grassland/hill/mountain. Visit to a local polluted site- Urban /Rural Industrial/Agricultural. Study of common plants, insects and birds. Study of simple ecosystems-pond, river, hill, slopes etc. (Field work equal to 5 lecture hours).

UNIT III

Biodiversity and its conservation. Introduction, Definition: genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity of global, National and local levels. India as a mega-diversity nation Hot spots of Biodiversity. Threats to biodiversity: Habitat loss, poaching of wild life, man-wildlife conflicts. Endangered and endemic species of India. Conservation of Biodiversity- In situ and Ex-Situ conservation of biodiversity.

Environmental Pollution Definition. Cause, effects and control measures of- (a) Air Pollution (b) Water Pollution (c) Soil Pollution (d) Marine Pollution (e) Noise Pollution (f) Thermal Pollution (g) Nuclear Hazards
Solid waste management- cause, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides

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. Environmental ethics-issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. Wasteland Reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and Control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public Awareness. Human population and the Environment. Population growth, variation among nations. Population explosion-Family Welfare Programme. Environment and human health. Human rights. Value Education. HIV/AIDS, Women and Child Welfare. Role of Information Technology in Environment and Human Health. Case Studies. Drugs and their effects; Useful and harmful drugs; Use and abuse of drugs; Stimulant and depressant drugs. Concept of drug de-addiction. Legal position on drugs and laws related to drugs.

Text Books

1. Environmental Studies- Deswal and Deswal. Dhanpat Rai & Co.
2. Environmental Science & Engineering Anandan, P. and Kumaravelan, R. 2009. Scitech Publications (India) Pvt. Ltd., India
3. Environmental Studies. Daniels Ranjit R. J. and Krishnaswamy. 2013. Wiley India.
4. Environmental Science- Botkin and Keller. 2012. Wiley , India

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus

Syllabus
B.Tech ECE IVth Semester
(Credit Based)
(2019-20)

BS-204	HIGHER ENGINEERING MATHEMATICS						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	75	25	100	3 h
Purpose	The objective of this course is to familiarize the prospective Engineers with Laplace Transform, partial differential equations which allow deterministic mathematical formulations of phenomena in engineering processes and to study numerical methods for the approximation of their solution. More precisely, the objectives are as under:						
Course Outcomes							
CO 1	Introduction about the concept of Laplace transform and how it is useful in solving the definite integrals and initial value problems.						
CO 2	To introduce the Partial Differential Equations, its formation and solutions for multivariable differential equations originated from real world problems.						
CO 3	To introduce the tools of numerical methods in a comprehensive manner those are used in approximating the solutions of various engineering problems.						
CO 4	To familiar with essential tool of Numerical differentiation and Integration needed in approximate solutions for the ordinary differential equations.						

UNIT-1

Laplace Transform

Laplace Transform, Laplace Transform of Elementary Functions, Basic properties of Laplace Transform, Laplace transform of periodic functions, finding inverse Laplace transform by different methods, Convolution theorem, solving ODEs by Laplace Transform method.

UNIT-2

Partial Differential Equations

Formation of Partial Differential Equations, Solutions of first order linear and non-linear PDEs, Charpit's method, Solution to homogenous linear partial differential equations (with constant coefficients) by complimentary function and particular integral method.

UNIT-3

Numerical Methods-1

Solution of polynomial and transcendental equations: Bisection method, Newton-Raphson method and Regula-Falsi method, Finite differences, Relation between operators, Interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae.

UNIT-4

Numerical Methods-2

Numerical Differentiation using Newton's forward and backward difference formulae, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules, Ordinary differential equations: Taylor's series, Euler and modified Euler's methods. Runge-Kutta method of fourth order for solving first and second order equations.

Textbooks/References:

1. S. J. Farlow, Partial Differential Equations for Scientists and Engineers, Dover Publications, 1993. AICTE Model Curriculum in Mathematics.
2. R. Haberman, Elementary Applied Partial Differential equations with Fourier Series and Boundary Value Problem, 4th Ed., Prentice Hall, 1998.

3. Ian Sneddon, Elements of Partial Differential Equations, McGraw Hill, 1964.
4. Manish Goyal and N.P. Bali, Transforms and Partial Differential Equations, University Science Press, Second Edition, 2010.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
7. Veerarajan T., Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2008.
8. P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company, 2nd Edition, Reprint 2012.
9. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.
10. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
11. Erwin Kreyszig and Sanjeev Ahuja, Applied Mathematics-II, Wiley India Publication, Reprint, 2015.

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

HM- 903		Soft Skills & Interpersonal Communication					
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	75	25	100	3 Hrs.
Course Outcomes (CO)							
CO1	Develop basic understanding of Communication						
CO2	Understand the process of communication and speaking						
CO3	Develop the Personality concepts and its implementation						
CO4	Develop the basic of Group Discussion and interviews						

UNIT-I

Communication: Introduction Verbal, Non-Verbal, kinesics, proxemics, chronemics, Types of communication, extrapersonal communication, intrapersonal communication, intrapersonal communication, mass communication, Creativity in communication, Role of communication, flow of Communication and its need, Persuasive communication and negotiation; Time management in Persuasive communication, Importance of Persuasive Communication

UNIT-II

Barriers in the way of communication, noise, intrapersonal barriers, interpersonal barriers, organizational barriers, Extrapersonal barriers, Basics of communication: importance of communication, process of communication, objectives and characteristics of communication, Communication skills: Accent, Intonation, Phonetics, Speaking skills, Confidence, clarity, Fluency, Quality, pronunciation

UNIT-III

Personality Development; what is personality? Role of personality, Heredity, Environment, situation, Basics of personality, Soft skills; Needs and training, Activity in soft skills, Organizational skill; introduction and its need, basics principles for Organization skills, Stress management; Introduction, Stress at home and office, Stress prevention, analyze the model of stress.

UNIT-IV

Group discussion, form of Group discussion, strategy for Group discussion, discussing problems and solution, Oral presentation, introduction, planning, Occasion, Purpose, Modes of delivery, Resume making; Purpose of Resume, Resume design and structure, contents in Resume, types of resume, Job interview, introduction, objective of Interview, types of interview, stages of interview, Face to face interview and campus interview

Text Books:

1. Technical Communication Principles and Practice by Meenakshi Raman and Sangeeta Sharma by Oxford Publication

Reference Books:

1. Personality Development and soft skills by Barun K. Mitra, Oxford Publication

2. Communication Skills For Engineers by C. Muralikrishna and Sunita Mishra, Pearson Pub.

Note: Separate paper **template** will be provided to the paper setter for setting the question paper of end term semester examinations.

EC-202	Digital Communication						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	75	25	100	3 Hrs.
Course Outcomes (CO)							
CO1	To learn digitization of analog signal by pulse modulation system and analyze their system performance						
CO2	To analyze different baseband transmission schemes and their performance						
CO3	To learn and understand different digital modulation schemes and compute the bit error performance						
CO4	To analyze different modulation tradeoffs and different equalization techniques.						

UNIT-I

Pulse modulation. Sampling process. Pulse Amplitude and Pulse code modulation (PCM), Differential pulse code modulation. Delta modulation, Noise considerations in PCM, Time Division multiplexing. Quantization noise in delta modulation, The O/P signal to quantization noise ratio in delta modulation, O/P signal to noise ratio in delta modulation, variants of DM.

UNIT-II

Base Band Pulse Transmission: Matched filter and its properties, average probability of symbol error in binary enclosed PCM receiver, Intersymbol interference, Nyquist criterion for distortionless base band binary transmission, ideal Nyquist channel raised cosine spectrum, correlative level coding Duo binary signalling, tapped delay line equalization, adaptive equalization, LMS algorithm, Eye pattern.

UNIT-III

Elements of Detection Theory, Optimum detection of signals in noise, Coherent communication with waveforms- Probability of Error evaluations.

Pass band Digital Modulation schemes- ASK, Phase Shift Keying, Frequency Shift Keying, Quadrature Amplitude Modulation, Continuous Phase Modulation and Minimum Shift Keying. Signal space diagram and spectra of the above systems, effect of intersymbol interference, bit symbol error probabilities, synchronization.

UNIT-IV

Digital Modulation tradeoffs. Optimum demodulation of digital signals over band-limited channels- Maximum likelihood sequence detection (Viterbi receiver). Equalization Techniques. Synchronization and Carrier Recovery for Digital modulation.

Text Books:

1. Haykin S., "Communications Systems", John Wiley and Sons, 2001.
2. Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002.
3. Taub H. and Schilling D.L., "Principles of Communication Systems", Tata McGraw Hill, 2001.

Reference Books:

1. Proakis J.G., "Digital Communications", 4th Edition, McGraw Hill, 2000.
2. Lathi B.P., "Modern Digital and Analog Communication", 4th edition, Oxford university Press, 2010

EC-204L	COMMUNICATION LAB						
Lecture	Tutorial	Practical	Credit	Practical	Minor Test	Total	Time
-	-	2	1	60	40	100	2 Hrs.
Course Outcomes (CO)							
Upon completion of the course, students will be able to							
CO1	Generate and analyze Analog Modulated and demodulated Signals.						
CO2	Test & observe the outputs of different types of analog detectors.						
CO3	Generate and analyze digital Modulated and demodulated Signals.						
CO4	Test & observe the outputs of different types of digital detectors.						

List of experiments:

- 1: To study and Perform Amplitude Modulation & Demodulation.
- 2: To study and Perform Frequency Modulation and Demodulation.
- 3: To study and Perform Pulse Amplitude Modulation and Demodulation.
- 4: To study and Perform Pulse Width Modulation and Demodulation.
- 5: To study and Perform Pulse Position Modulation and Demodulation.
- 6: To study and Perform Pulse Code Modulation and Demodulation.
- 7: To study and Perform Time Division Multiplexing (TDM) system.
- 8: To study and Perform Amplitude Shift Keying (ASK) Modulation and De- Modulation.
- 9: To study and Perform Frequency Shift Keying (FSK) Modulation and De-Modulation.
- 10: To study and Perform Phase Shift Keying (PSK) Modulation and De-Modulation.
- 11: To study and Perform Quadrature Phase Shift Keying (QPSK) Modulation and De-Modulation.
- 12: To study and perform Adaptive Delta Modulation and demodulation.
13. To study Base Band Transmission and calculate bit error rate.

Note: At least ten (10) experiments from the above list are mandatory to perform for the students.

Reference Books:

1. Taub & Schilling, Principles of Communication Systems, McGraw Hill Publications, (1998) 2nd ed.
2. Simon Haykin, Communication Systems, John Wiley Publication, 3rd ed.
3. Sklar, Digital Communications, Prentice Hall-PTR, (2001) 2nd ed.
4. Lathi B. P., Modern Analog and Digital Communication, , Oxford University Press, (1998) 3rd

EC-206	Analog Circuits						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	75	25	100	3 Hrs.
Course Outcomes (CO)							
CO1	To make the students understand the analysis of various BJT and FET amplifiers using small signal models.						
CO2	To teach the students the concept of describe the frequency response of multistage amplifiers and the detailed concept of feedback topologies.						
CO3	To make the students learn various oscillator circuits using both Op-Amp and BJT.						
CO4	To teach the students the various application circuits of Op-Amp and designing for a given specification.						

UNIT-I

Amplifier Models: Amplifier types: Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier, comparison based on input impedance and output impedance. Small signal analysis of BJT amplifiers: CE, CB and CC amplifiers using r_e model, small signal analysis of the CS JFET amplifiers, estimation of voltage gain, input resistance, output resistance etc, design procedure for particular specifications of amplifiers.

UNIT-II

Transistor Frequency Response: Class A, class B, class C amplifiers: calculation of maximum efficiency. Frequency response of the amplifiers: low frequency, mid-frequency and high frequency region. Effect of cascading of amplifiers on the frequency response, cut-off frequencies, Bandwidth and voltage gain. Miller effect, Feedback in amplifiers: Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth, input impedance, output impedance.

UNIT-III

Oscillators: Barkhausen criterion for oscillators, types of Oscillators: RC phase shift oscillator, Wien bridge oscillator, LC oscillators : Hartley oscillator, Collpit oscillator, derivation of frequency of oscillation for BJT and Op-amp configurations, 555 timer: operation as astable and monostable multivibrator.

UNIT-IV

Op-Amp Applications: Simple op-amp circuits: adder, subtractor, Schmitt trigger, Differential amplifier: calculation of differential gain, common mode gain, CMRR, OP-AMP design: design of differential amplifier for a given specification, design of gain stages and output stages.

Text Books:

1. Millman & Halkias: Integrated Electronics, TMH.
2. Boylestad & Nashelsky: Electronic Devices & Circuit Theory, PHI.

Reference Books:

1. B.G. Streetman, Solid State Electronic Devices, Prentice Hall of India, New Delhi, 1995.
2. E S. Yang, Microelectronic Devices, McGraw Hill, Singapore, 1988.
3. A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College Publishing, 1991.
4. S Salivahanan and N Naresh Kumar, Electronics devices and circuits, McGraw Hill, 1998.

Note: Separate paper template will be provided to the paper setter for setting the question paper of end term semester examinations.

EC-208L	Analog Circuits Lab						
Lecture	Tutorial	Practical	Credit	Practical	Minor Test	Total	Time
-	-	2	1	60	40	100	3 Hrs.
Course Outcomes (CO)							
CO1	To design and calculate the gain , frequency response etc. of the various configuration of transistor amplifier.						
CO2	To make students Design various RC oscillators using Op-Amp 741 for a given frequency of oscillation.						
CO3	To make students Design various RC oscillators using BJT for a given frequency of oscillation.						
CO4	To teach the students the design of various Op-Amp circuits such as adder, subtractor etc.						

List of experiments:

1. To design a simple common emitter (CE) amplifier circuit using BJT and find its gain and frequency response. To design a differential amplifier using BJT and calculate its gain and frequency response.
2. To design a BJT emitter follower and determine its gain, input and output impedances.
3. To design and test the performance of Phase shift Oscillator using Op-Amp 741.
4. To design and test the performance of Wien bridge oscillator using Op-Amp 741.
5. To design and test the performance of BJT - RC Phase shift Oscillator for $f_0 \leq 10$ KHz.
6. To design and test the performance of BJT – Hartley Oscillators for RF range $f_0 \geq 100$ KHz.
7. To design and test the performance of BJT – Colpitt Oscillators for RF range $f_0 \geq 100$ KHz.
8. To design an astable multivibrator using 555 timer.
9. To design a monostable multivibrator using 555 timer.
10. To design Schmitt trigger using Op-amp and verify its operational characteristics.
11. To design an adder circuit using Op-Amp to add three dc voltages.
12. To design a subtractor using Op-Amp to subtract DC voltages v_1 and v_2 .

Reference Books:

1. Millman & Halkias: Integrated Electronics, TMH.
 2. Boylestad & Nashelsky: Electronic Devices & Circuit Theory, PHI.
 3. S Salivahanan and N Naresh Kumar, Electronics devices and circuits, McGraw Hill, 1998.
- Note:** Atleast ten (10) experiments from the above list are mandatory to perform for the students.

EC-210		MICROPROCESSORS AND MICROCONTROLLER					
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	75	25	100	3 Hrs.
Course Outcomes (CO)							
CO1	Acquired knowledge about the architecture of Microprocessors and Microcontrollers.						
CO2	Acquired knowledge about instruction set and programming concept of Microprocessors and Microcontrollers in assembly and C language.						
CO3	To understand peripheral interfacing with Microprocessors and Microcontrollers.						
CO4	To design the systems /models based on Microprocessors and Microcontrollers						

UNIT-I

Evolution of Microprocessor, Introduction to 8-bit Microprocessor 8085 architecture, Pin Details 8085 Microprocessor, 8086 Architecture description of data registers, address registers; pointer and index registers, PSW, Queue, BIU and EU, 8086 Pin diagram descriptions. Generating 8086 CLK and reset signals using 8284. WAIT state generation. Microprocessor BUS types and buffering techniques, 8086 minimum mode and maximum mode CPU module, 8086 CPU Read/Write timing diagrams in minimum mode and maximum mode.

UNIT-II

8051 Architecture, On-chip memory organization – general purpose registers, SFR registers, Internal RAM and ROM, Oscillator and Clock circuits. Pin Diagram of 8051, I/O Pins, Port, Connecting external memory, Counters and Timers, Purpose of TCON & TMOD registers, Serial data transmission/reception and transmission modes, Purpose of SCON & PCON registers, Different Types of Interrupts, Purpose of Time Delays, 8051 addressing modes.

UNIT-III

8086 Instruction format, addressing modes, Data transfer instructions, string instructions, logical instructions, arithmetic instructions, transfer of control instructions; process control instructions. 8051 Data transfer instructions, arithmetic and logical instructions, Jump and Call instructions, I/O port, Timer and Counter programming, Serial port and Interrupt programming, Assembly language programs.

UNIT-IV

Memory devices, Address decoding techniques, Interfacing SRAMS; ROMS/PROMS, 8086 Interrupt mechanism; interrupt types and interrupt vector table. Intel's 8255 - description and interfacing with 8086, ADCs and DACs, - types operation and interfacing with 8086.

Interfacing of Matrix Keyboards, ADC, DAC, Temperature Sensor, Stepper Motor with 8051.

Text Books:

1. D.V. Hall, Microprocessors and Interfacing, McGraw Hill 2nd ed.
2. Kenneth Ayala," The 8051 Microcontroller" 3rd ed. CENGAGE Learning.

3. M.A. Mazidi, J.G. Mazidi, R. D. McKinlay, "The 8051 Microcontroller and Embedded systems using assembly and C" -2nd Ed, Pearson Education.
4. Liu, Gibson, "Microcomputer Systems: The 8086/88 Family", 2nd Edition, PHI,2005.
5. Barry B. Brey, "The Intel Microprocessor8086/8088, 80186", Pearson Education, Eighth Edition, 2009.
6. Uffenback, "The 8086 Family Design" PHI, 2nd Edition.

Reference Books:

1. Mke Predko, "Programming and Customizing the 8051 Microcontroller", TMH.
2. Manish K Patel,"Microcontroller based embedded system", McGraw Hill Education.

Note: Separate paper template will be provided to the paper setter for setting the question paper of end term semester examinations.

EC-212L	MICROPROCESSORS AND MICROCONTROLLER LAB						
Lecture	Tutorial	Practical	Credit	Practical	Minor Test	Total	Time
-	-	2	1	60	40	100	3 Hrs.
Course Outcomes (CO)							
CO1	To familiarization with 8085, 8086 Microprocessors and 8051 Microcontrollers.						
CO2	Ability to write an assembly language program for 8086 Microprocessors as well as C language program for 8051 Microcontroller.						
CO3	Ability to interfacing the various Peripheral to 8086 Microprocessors and 8051 Microcontrollers.						
CO4	Ability to design the systems based on 8051 Microcontrollers.						

List of experiments to be performed using 8086 and 8051 Microcontrollers

For 8086 Microprocessor write an Assembly Language Program to

- 1 Add / Sub two 16 bit numbers.
- 2 Multiply two 16 bit unsigned/ signed numbers.
- 3 Divide two unsigned/ signed numbers (32/16 , 16/8, 16/16, 8/8)
- 4 Find smallest/ largest number from array of n numbers.
- 5 Arrange numbers in array in ascending/ descending order.
- 6 Convert Hex to Decimal, Decimal to Hex.
- 7 Compare two strings using string instructions / without using string instructions.
- 8 Display string in reverse order, string length, Concatenation of two strings.
- 9 To find 1's and 2's complement of a number.
- 10 To find the Fibonacci Series.
- 11 To find Log of a given number using look up table.
- 12 To find Factorial of a number.
- 13 To write an ALP using 8051 Microcontrollers to perform addition, subtraction, multiplication and division of two eight bit numbers.
- 14 To write an ALP using 8051 Microcontrollers to perform logical operation i.e., AND, OR, XOR and Complement of two eight bit numbers.
- 15 To write an ALP using 8051 Microcontrollers to perform multi byte addition and subtraction of unsigned number.
- 16 To write an embedded C program using 8051 Microcontrollers for interfacing LCD to display message "LCD Display" on LCD screen.
- 17 To write an embedded C program using 8051 Microcontrollers for interfacing keypad to port P0 .Whenever a key is pressed; it should be displayed on LCD.
- 18 To write an embedded C program using 8051 Microcontrollers for interfacing a switch and a buzzer to two different pins of a Port such that the buzzer should sound as long as the switch is pressed.
- 19 To write an embedded C program using 8051 Microcontrollers for interfacing stepper motor to rotate clockwise and anticlockwise directions.
- 20 To write an embedded C program using 8051 Microcontrollers for interfacing relay and buzzer.

Reference Books:

1. Kenneth Ayala," The 8051 Microcontroller" 3rd ed. CENGAGE Learning.
2. M.A. Mazidi, J.G. Mazidi, R. D. McKinlay," The 8051 Microcontroller and Embedded systems using assembly and C" -2nd Ed, Pearson Education.

Note: Atleast ten (10) experiments from the above list are mandatory to perform for the students.

ES -202	BASICS OF ANALOG COMMUNICATION						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	75	25	100	3 Hrs.
Course Outcomes (CO)							
Upon completion of the course, students will be able to							
CO1	Describe different types of noise and predict its effect on various analog communication systems.						
CO2	Understand and analyze various Amplitude modulation and demodulation methods.						
CO3	Understand and analyze Angle modulation and demodulation methods.						
CO4	Understand the concepts of Transmitters and Receivers and their circuits.						

Unit-I

Communication system and Noise: Constituents of communication system, Modulation, Bandwidth requirement, Noise, Classification of noise, Resistor noise, Multiple resistor noise sources, Noise Temperature, Noise bandwidth, Noise figure, its calculation and measurement, Bandpass noise representation, Noise calculation in Communication Systems: Noise in Amplitude Modulated System, Noise in angle modulated systems.

Analog Modulation Techniques: Theory of amplitude modulation, AM power calculations, AM modulation with a complex wave, Concepts of angle modulation, Theory of frequency modulation, Mathematical analysis of FM, Spectra of FM signals, Narrow band FM, Wide band FM, Phase modulation, Phase modulation obtained from frequency modulation, Comparison of AM, FM & PM.

Unit-II

AM Transmission: Generation of Amplitude Modulation, Low level and high level modulation, Basic principle of AM generation, Square law modulation, Vander bijl modulation, Suppressed carrier AM generation (Balanced Modulator) ring Modulator.

AM Reception: Tuned Ratio Frequency (TRF) Receiver, Super heterodyne Receiver, RF Amplifier, Image Frequency Rejection, Cascade RF Amplifier, Frequency Conversion and Mixers, Tracking & Alignment, IF Amplifier, AM detectors, Distortion in diode detectors, AM receiver characteristics.

Unit-III

FM Transmission: FM allocation standards, Generation of FM by direct method, Varactor diode Modulator, Indirect generation of FM, The Armstrong method RC phase shift method, Frequency stabilized reactance FM transmitter, FM stereo transmitter, Noise triangle.

FM Reception: Direct methods of Frequency demodulation, Frequency discrimination (Balanced slope detector), Foster seelay of phase discriminator, Ratio detector, Indirect method of FM demodulation, FM detector using PLL, Pre-emphasis / de-emphasis, FM receiver, FM stereo receiver.

Unit-IV

SSB Transmission: Introduction, Advantages of SSB Transmission, Generation of SSB, The Filter method The Phase Shift Method, The Third Method, Pilot Carrier SSB, Vestigial Side-band Modulation (VSB), VSB-SC, Application of AM and FM in TV transmission.

SSB Reception: SSB Product Demodulator, Balanced Modulator as SSB Demodulator, Pilot Carrier SSB Receiver, Modern Communication Receiver.

Analog Pulse Modulation: Introduction, Pulse amplitude modulation (PAM), PAM Modulator Circuit, Demodulation of PAM Signals, Pulse Time Modulation (PTM): Pulse Width Modulation (PWM), Pulse Position Modulation (PPM), PWM and PPM Demodulator,

Text Books

1. Kennedy, G., Electronic Communication Systems, McGraw-Hill (2008) 4th ed.
2. Lathi.B.P., Modern Digital and Analog Communications Systems 3rd ed.

Reference Books:

1. Taub, H., Principles of Communication Systems, McGraw-Hill (2008) 3rd ed.
2. Haykin, S., Communication Systems, John Willey (2009) 4th ed.
3. Proakis, J. G. and Salehi, M., Fundamentals of Communication Systems, Dorling Kindersley (2008) 2nd ed.
4. Mithal G K, Radio Engineering, Khanna Pub.
5. Singh & Sapre—Communication Systems: 2/e, TMH

Note: Separate paper template will be provided to the paper setter for setting the question paper of end term semester examinations.

MC-902	Constitution of India					
Lecture	Tutorial	Practical	Major Test	Minor Test	Total	Time
3	-	-	75	25	100	3 Hrs.
Purpose	To know the basic features of Constitution of India					
Course Outcomes						
CO1	The students will be able to know about salient features of the Constitution of India.					
CO2	To know about fundamental duties and federal structure of Constitution of India.					
CO3	To know about emergency provisions in Constitution of India.					
CO4	To know about fundamental rights under constitution of India.					

UNIT-I

1. Meaning of the constitution law and constitutionalism, Historical perspective of the Constitution of India. Salient features and characteristics of the Constitution of India.
2. Scheme of the fundamental rights

UNIT - II

3. The scheme of the Fundamental Duties and its legal status. The Directive Principles of State Policy – Its importance and implementation. Federal structure and distribution of legislative and financial powers between the Union and the States.
4. Parliamentary Form of Government in India – The constitution powers and status of the President of India

UNIT - III

5. Amendment of the Constitutional Powers and Procedure. The historical perspectives of the constitutional amendments in India.
6. Emergency Provisions: National Emergency, President Rule, Financial Emergency. Local Self Government – Constitutional Scheme in India.

UNIT-IV

7. Scheme of the Fundamental Right to Equality. Scheme of the Fundamental Right to certain Freedom under Article 19.
8. Scope of the Right to Life and Personal Liberty under Article 21.

Text Books

1. Constitution of India. Prof.Narender Kumar (2008) 8th edition. Allahabad Law Agency.

Reference Books:

1. The constitution of India. P.M. Bakshi (2016) 15th edition. Universal law Publishing.

Bachelor of Technology (Biotechnology)
Credit-Based
 SCHEME OF STUDIES/EXAMINATIONS
Semester – III (w.e.f. the session 2019-20)

S. No.	Course No.	Course Title	Teaching Schedule				Credits	Allotment of Marks				Duration of Exam (Hrs.)
			L	T	P	Hours/Week		Major Test	Minor Test	Practical	Total	
1	BTE-201	Cell Biology & Genetics	3	0	0	3	3.0	75	25	0	100	3
2	BTE-203	Microbiology	3	0	0	3	3.0	75	25	0	100	3
3	BTE-205	Biochemistry	3	0	0	3	3.0	75	25	0	100	3
4	BTE-207	Principles of Biostatistics	3	0	0	3	3.0	75	25	0	100	3
5	HM-901	Organizational Behavior	3	0	0	3	3.0	75	25	0	100	3
6	BTE-209L	Cell Biology & Genetics Lab	0	0	3	3	1.5	0	40	60	100	3
7	BTE-211L	Microbiology Lab	0	0	3	3	1.5	0	40	60	100	3
8	BTE-213L	Biochemistry Lab	0	0	3	3	1.5	0	40	60	100	3
		Total	15	0	9	24	19.5	375	245	180	800	
9	BTE-215	Industrial Training-I	2	0	0	2	-	-	100	-	100	-
10	*MC-902	Constitution of India	3	0	0	3		75	25	0	100	3

Note: BTE-215 is a mandatory credit less course in which the students to be evaluated for the industrial training undergone after 2nd semester and students will be required to get passing marks to qualify.

***MC-902** is a mandatory credit less course in which the student will be required to get passing marks in the major test

Bachelor of Technology (Biotechnology)
Credit-Based
SCHEME OF STUDIES/EXAMINATIONS
Semester – IV (w.e.f. the session 2019-20)

S. No	Course No.	Course Title	Teaching Schedule				Credits	Allotment of Marks				Duration of Exam (Hrs.)
			L	T	P	Hours /Week		Major Test	Minor Test	Practical	Total	
1	BTE-202	Molecular Biology	3	0	0	3	3.0	75	25	0	100	3
2	BTE-204	Bio-analytical Techniques	3	0	0	3	3.0	75	25	0	100	3
3	BTE-206	Immunology	3	0	0	3	3.0	75	25	0	100	3
4	BTE-208	Industrial Biotechnology	3	0	0	3	3.0	75	25	0	100	3
5	BS-202	Basics of Thermodynamics and Organic Chemistry	3	0	0	3	3.0	75	25	0	100	3
6	BTE-212L	Molecular Biology Lab	0	0	3	3	1.5	0	40	60	100	3
7	BTE-214L	Bio-analytical Techniques Lab	0	0	3	3	1.5	0	40	60	100	3
8	BTE-216L	Industrial Microbiology Lab	0	0	3	3	1.5	0	40	60	100	3
9	BTE-218L	Immunology Lab	0	0	3	3	1.5	0	40	60	100	3
		Total	15	0	12	27	21	375	285	240	900	
10	MC-901*	Environmental Sciences*	3	0	0	3		75	25	0	100	3

*MC-901 is a mandatory credit less course in which the student will be required to get passing marks in the major test
Note: All the students have to undergo 4-6 weeks industrial training after IV semester and to be evaluated in V semester.

BTE-201 Cell Biology and Genetics (B.Tech. Biotechnology) Semester-III							
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	75	25	100	3hrs
Purpose	To familiarize the students with the basic of cell biology and genetics.						
Course outcome							
CO1	Student to learn the fluidity and structural organization of bio membrane and cytoskeleton						
CO2	To learn the fundamentals of inheritance via both qualitative and quantitative patterns.						
CO3	Able to understand the basic concept of evolution and genetic basis of variations.						
CO4	Student will learn about the genome mapping by different techniques ranging from bacteria to human beings.						

UNIT-I

Bio membrane-Physical and chemical properties, Structural organization, Cell signaling (Different Pathways), cell recognition and membrane transport, Membrane receptor for macromolecules and regulation of receptor expression and function. Receptors for neurotransmitters

Structural organization and functions -Microtubule, Microfilament and Intermediary filaments.

UNIT-II

Mendelism – History of Mendel, Monohybrid, Di- hybrid and Tri-hybrid cross, Gene interaction, Concept of dominance - incomplete ,complete and co-dominance(Blood group system in human beings),Multiple alleles(Skin color in rabbit),Concept of lethality and pedigree analysis. Sex linked, sex influenced and sex limited inheritance.

Quantitative inheritance-History, Yule experiment, Nelsson-Ehle experiment, skin color in human beings, Basis of genetic variation. Numerical problems on quantitative inheritance.

UNIT-III

Population Genetics- Concept of Random Mating and controlled mating and Inbreeding. Hardy Weinberg Law-Allele frequency, Genotype frequency, Causes of variations (Mutation, Migration, Random genetic drift, and Natural selection).

Mutation-Classification, application, detection, site directed mutagenesis and DNA repair Mechanism-(Mismatch repair, Photo-reactivation, tolerance, retrieval system.

UNIT-IV

Genome mapping-Difference between cytological, physical and molecular mapping. Recombination, Linkage, Gene mapping based on Two point cross in Neurospora and Three point test cross in wheat. History and development of human genome project.

Muscle contraction-Types of muscles, Structural proteins of muscles , regulation and energetic of muscle contraction.

Nerve Transmission- structure and function of neurons. Action and resting potential, Mechanism of nerve transmission, Neuromuscular junction.

Text /ReferenceBooks

1. Cell Biology: Organelle structure and function, Sadava, D.E.(2004) Panima Pub., New Delhi.
2. Fundamentals of Genetics, Singh, B.D., Kalyani Publishers, New Delhi.
3. Basic Genetics. (2000) Miglani, G.S., Narosa Publishing House, New Delhi.

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

BTE-203 Microbiology (B.Tech. Biotechnology) Semester- III							
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	-	-	3.0	75	25	100	3hrs
Purpose	To familiarize the students with the basic of Microbiology						
Course outcome							
CO1	To learn the history and classification of microbiology						
CO2	To learn microbial nutrition and various microbiological techniques						
CO3	Able to understand microbial growth and genetics						
CO4	Student will learn about various microbial diseases and drugs						

UNIT - I

- 1. History and scope of Microbiology:** Development of Microbiology, various branches of microbiology and applications of microbiology.
- 2. Classification of Microorganisms: Microbial Taxonomy-** criteria used including molecular approaches. Microbial phylogeny and current classification of bacteria.

UNIT - II

- 3. Microbial Diversity:** Morphology and cell structure of major groups of microorganisms e.g. bacteria, fungi, algae, protozoa and viruses.
- 4. Cultivation and microbial nutrition of Microorganism:** Methods of isolation, purification and preservation. Pure culture technique and sterilization methods. Requirement for C, N, S and growth factors. Nutritional categories of microorganisms.

UNIT - III

- 5. Microbial Growth and Metabolism:** Growth curve (normal and biphasic) and generation time. Measurement of growth. Synchronous, batch and continuous cultures. Microbial fermentation and its types.
- 6. Microbial Genetics:** Bacterial plasmids. Bacterial recombination: transformation, transduction and conjugation. Formation of endospores and mechanism of sporulation.

UNIT - IV

- 7. Environmental Microbiology:** Normal and contaminating microflora of water, soil and air. Methods to study water and air pollution.
- 8. Medical Microbiology:** Antibacterial, Antiviral, Antifungal and Antiprotozoan drugs, Major water, air and soil borne microbial diseases.

Text Book:

1. Microbiology 5th Edition. Prescott, L.M.; Harley, J.P. and Klein, D.A.(2003) McGraw Hill, USA.
2. Microbiology. Pelczar Jr., M.J.; Chan, E.C.S. and Krieg, N.R. (1993) Tata McGraw Hill, New Delhi.

References Books:

3. Modern Food Microbiology. Jay, J.M. (1996) CBS Publishers and Distributors, New Delhi.
4. Food Microbiology 2nd ed, Adam, M. R. and Moss (2003) Panima Pub, New Delhi.

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

BTE-205	Biochemistry (B.Tech Biotechnology) Semester-III						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	75	25	100	3 Hrs.
Purpose	To introduce the students with basics of Biochemistry						
Course Outcomes							
CO1	The students will be able to learn the structure and functions of carbohydrates and proteins						
CO2	The students will be able to learn structure and functions of lipid and nucleic acids along with basic concepts of enzymes.						
CO3	The students will be able to write major pathways of carbohydrates and lipid metabolism						
CO4	To make the students learn synthesis and degradation of pyrimidine nucleotides						

UNIT-I

- 1. Amino acids & Proteins** –Structure and properties of amino acids. Peptide bonds.

Proteins classification based on their biological roles. Forces stabilizing protein structure and shape. Different levels of structural organization of proteins. Ramachandran plot, alpha helix, beta plated sheets, domain motif and fold.

- 2. Carbohydrates-Structure and functions:** Structures and properties of glucose and fructose, distinguishing features of different disaccharides. Ring structure and mutarotation. Structure and brief introduction of starch, glycogen and cellulose.

UNIT – II

- 3. Lipids-Structure and functions:** Classification of lipids based on their biological roles and their general functions. Membrane lipids and brief discussion on fatty acids.
- 4. Nucleic Acids-Structure and functions:** Structure and properties of purine and pyrimidine bases. A brief introduction of ATP, GTP, CTP AND UTP.
- 5. Enzymes:** Classification of Enzymes according to enzyme commission report. Activation energy and rate of reaction. Rate constant, reaction order. A brief introduction of mechanism of enzyme catalysis. Enzyme inhibition and concept of allostery. Michaelis-Menten equation.

UNIT-III

- 6 Carbohydrate Metabolism:** Glycolysis and TCA cycle. Pentose phosphate pathway and its significance. Gluconeogenesis pathway. Biosynthesis of lactose, sucrose and starch. Glycogenolysis, glycogenesis and control of glycogen metabolism.

- 7.Lipid Metabolism:** Beta -oxidation of saturated fatty acids, Degradation of triacylglycerols by lipases. Biosynthesis of saturated fatty acids. Biosynthesis of triacylglycerols, phospholipids.

UNIT -IV

- 8 Amino Acid Metabolism:** General reactions of amino acids metabolism- transamination, oxidative and non-oxidative deamination and decarboxylation. Urea cycle and its regulations.
- 9. Nucleic Acid Metabolism:** Catabolism, *de novo*-biosynthesis and salvage pathway.

10. Mitochondrial oxidative phosphorylation: Mitochondrial electron transport chain. Hypotheses of mitochondrial oxidative phosphorylation.

Text

1. Biochemistry, concepts and connections, 1st edition, by Dean R. Appling, Spencer J. Anthony-Cahill and Christopher K. Matthews (2015). Pearson Education, Inc.
2. Biochemistry, 4th edition, by L. Stryer (1995). W.H. Freeman & Co. NY
3. Lehninger: Principles of Biochemistry, 3rd edition, by David L. Nelson and M.M. Cox (2000) Maxmillan/ Worth publishers

References Books:

1. Biochemistry, 4th edition, by G. Zubay (1998). Wm.C. Brown Publishers.
2. Biochemistry, 2nd edition, by Laurence A. Moran, K.G. Scrimgeour, H. R. Horton, R.S. Ochs and J. David Rawn (1994), Neil Patterson Publishers Prentice Hall.
3. Biochemistry, 2nd edition, by R.H. Garrett and C.M. Grisham (1999) . Saunders college Publishing, NY. Sons, NY.
4. Fundamentals of Biochemistry by Donald Voet and Judith G Voet (1999) , John Wiley & Sons, NY
5. Harper's Biochemistry, 25th edition, by R.K. Murray, P.A. Hayes, D.K. Granner, P.A. Mayes and V.W. Rodwell (2000). Prentice Hall International.

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

BTE-207	Principles of Biostatistics (B.Tech Biotechnology) Semester-III						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	75	25	100	3
Purpose To Introduce statistical concept for biological data interpretation							
Course Outcomes							
CO1	To develop basic understanding about statistics						
CO2	To develop basic knowledge of probability and different tests.						
CO3	To derive numerical approach between data correlation and their variations.						
CO4	To understand the numbers and errors						

UNIT-1

Introduction: Basic concept of statistics, Difference between statistics and mathematics, Samples and variables, Frequency distribution curve and basic quantitative method: Mean median, mode, standard deviation and variance.

UNIT-II

Probability distribution: Basic concept of probability, binomial distribution, Poisson distribution and normal distribution.

Hypothesis testing: Students T-test, estimation of null hypothesis, confidence limit of variance and chi-square test.

UNIT-III

Analysis of Variance:F-test, Two way ANOVA and Three way ANOVA

Correlation and Regression: Analysis of correlation and their different types, analysis of covariance and multiple regressions.

UNIT-IV

Approximation and error: Introduction, Accuracy of numbers: approximate number, significant number, rounding off. Different types of error.

Role of computer in solving biostatistical problem: Genetic Algorithm, Application of statistical methods in biotechnology.

Text Books:

1. Statistical Methods. S.P.Gupta. Sultan chand and sons, New delhi

Reference Books:

1. Introduction to Biostatistics. Glover T. and Mitchell K. (2002). MacGraw Hill, New York.
2. Fundamentals of Biostatistics. Rosner Bernard. (1999), Duxbury Press.

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

HM-901	Organizational Behavior(B.Tech Biotechnology) Semester-III						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	75	25	100	3
Purpose	To make the students conversant with the basics concepts of organizational culture and behavior for nurturing their managerial skills						
COURSE OUTCOMES							
CO1	An overview about organizational behavior as a discipline and understanding the concept of individual behavior						
CO2	Understand the concept and importance of personality ,emotions and its importance in decision making and effective leadership						
CO3	Enabling the students to know about the importance of effective motivation and its contribution in group dynamics and resolving conflicts						
CO4	Understand how to overcome organizational stress by maintaining proper organizational culture and effective communication						

UNIT -I

Introduction to Organizational Behavior: Concept and importance of Organizational Behavior, Role of Managers in OB, Foundations or Approaches to Organizational Behavior, Challenges and Opportunities for OB

Foundation of individual behavior: Biographical characteristics, concept of Abilities and Learning , Learning and Learning Cycle, Components of Learning, concept of values and attitude, types of attitude, attitude and workforce diversity

UNIT-II

Introduction to Personality and Emotions: Definition and Meaning of Personality, Determinants of Personality, Personality Traits Influencing OB, Nature and Meaning of Emotions, Emotions dimensions, concept of Emotional intelligence

Perception and individual decision making: Meaning of perception, factors influencing perception, Rational decision making process, concept of bounded rationality. Leadership- Trait approaches, Behavioral approaches, Situational approaches, and emerging approaches to leadership.

UNIT-III

Motivation: concept and theories of Motivation, theories of motivation- Maslow, Two Factor theory, Theory X and Y,ERG Theory, McClelland's Theory of needs, goal setting theory, Application of theories in Organizational Scenario, linkage between MBO and goal setting theory, employee recognition and involvement program

Foundations of Group Behavior and conflict management: Defining and classifying of Groups, stages of group development, Informal and Formal Groups - Group Dynamics, Managing Conflict and Negotiation, a contemporary perspective of intergroup conflict, causes of group conflicts, Managing intergroup conflict through Resolution.

UNIT-IV

Introduction to Organizational Communication: Meaning and Importance of Communication process, importance of Organizational Communication, Effective Communication, Organizational Stress: Definition and Meaning Sources and Types of Stress, Impact of Stress on Organizations, Stress Management Techniques

Introduction to Organization Culture- Meaning and Nature of Organization Culture, Types of Culture, Managing Cultural Diversity, Managing Change and Innovation - Change at work, Resistance to change, A model for managing organizational change.

Text Books

Colquitt, Jason A., Jeffery A. LePine, and Michael Wesson. *Organizational Behavior: Improving Performance and Commitment in the Workplace*. 5th ed. New York: McGraw-Hill Education, 2017.

Hitt, Michael A., C. Chet Miller, and Adrienne Colella. *Organizational Behavior*. 4th ed. Hoboken, NJ: John Wiley, 2015.

Robbins, Stephen P., and Timothy Judge. *Organizational Behavior*. 17th ed. Harlow, UK: Pearson Education, 2017.

Stephen P. Robins, Organisational Behavior, PHI Learning / Pearson Education, 11th edition, 2008.

Reference Books

Schermerhorn, Hunt and Osborn, Organisational behavior, John Wiley.

Udai Pareek, Understanding Organisational Behaviour, Oxford Higher Education.

Mc Shane & Von Glinov, Organisational Behaviour, Tata Mc Graw Hill.

Aswathappa, K., Organisational Behaviour– Text and Problem, Himalaya Publication

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

BTE-209L	Cell Bio and Genetics Lab (B.Tech. Biotechnology) Semester –III						
Lecture	Tutorial	Practical	Credit	Minor Test	Practical	Total	Time
-	-	3	1.5	40	60	100	3 Hrs
Purpose	To learn working of instruments and their principles to study basic concepts.						
Course Outcomes							
CO1	Students will be able to learn basic instruments need to study all types of cellular structures.						
CO2	Preparation of permanent slides to study histology of different organ systems..						
CO3	Students will come to know about the procedure of division of cells in both somatic and gametic cells.						
CO4	Students will learn Techniques of DNA extraction and its application in fingerprinting.						

LABORATORY EXPERIMENTS

1. Study of different types of microscopes.
2. Microscopy: Structure of Prokaryotic and eukaryotic cell.
3. Microtomy. Histology of various organ systems (Nervous, digestion, reproductive, respiratory and circulatory system).
4. Cell division in onion root tip.
5. Cell division in insect gonads/flower bud.
6. Isolation of Chloroplasts/ Mitochondria from Plants.
7. Fluorescence labeling of cellular organelles.
8. Isolation of DNA and study of its denaturation spectrophotometrically & viscometrically.

Reference books:

1. Principles and techniques of Practical Biochemistry: K. Wilson and J. Walker (1994), Cambridge University Press, Cambridge.
2. Introductory practical Biochemistry by S.K. Sawhney and Randhir Singh (2000), Narosa Publishing House, New Delhi.
3. An introduction to Practical Biochemistry by David T. Plummer (1988), McGraw-Hill, Book Company, UK.

BTE-211 L		MICROBIOLOGY LAB (B.Tech. Biotechnology Semester III)					
Lecture	Tutorial	Practical	Credit	Minor Test	Practical	Total	Time
-	-	3	1.5	40	60	100	3 Hrs
Purpose	To learn the practical aspects of Microbiology						
Course Outcomes							
CO1	Students will be able to know about the instruments and their working principles.						
CO2	Learning of Culture Media Preparation for Microbial Growth.						
CO3	Students will learn Pure Culture Techniques for isolation and preservation of microbes.						
CO4	Students will learn about staining methods for identification of microbes and effect of different factors on growth of microbes.						

LABORATORY EXPERIMENTS

1. Rule and Regulations of working in the laboratory.
2. To know about the instruments and equipments used in the laboratory
3. Preparation of culture media for culturing microbes.
5. Collection of samples from different sources and serial dilution method.
6. Culture techniques- Pour plate and spread plate.
7. Isolation of pure colonies by streaking method.
8. Gram Staining method to differentiate between gram positive and gram negative bacteria.
8. To analyze the waste water samples for presence of microbes.
9. Measurements of growth and study of effect of various factors on growth of microorganisms-temperature, pH, salt concentration,
10. Milk Microbiology- Testing the quality of milk.

Text and References Books:

1. Experiments in Microbiology, Plant Pathology and Biotechnology. 4th Edition. Aneja, K.R. (2003) New Age International Publishers, New Delhi.
2. Microbiology- a laboratory manual. 4th edition. Cappuccino J. and Sheeman N. (2000) Addison Wesley, California.
3. Environmental Microbiology – A Laboratory Manual Pepper. I.L.; Gerba, C.P. and Brendecke, J.W.(1995) Academic Press, New York.

BTE-213L	BIOCHEMISTRY LAB (B.Tech. Biotechnology) Semester-III						
Lecture	Tutorial	Practical	Credit	Minor Test	Practical	Total	Time
-	-	3	1.5	40	60	100	3 Hrs
Purpose	To learn the practical aspects of Biochemistry						
Course Outcomes							
CO1	Students will be able to learn qualitative and quantitative estimation of biomolecules						
CO2	Students will be able to learn procedure to perform enzyme assay of any common enzyme.						
CO3	Students will learn effect of environmental factors on enzyme activity						
CO4	Students will be able to calculate Km and Vmax of any common enzyme						

LABORATORY EXPERIMENTS

1. Qualitative tests for amino acids, proteins, Lipids and carbohydrates.
2. Quantitative estimation of proteins by Lowry method.
3. Determination of reducing sugar by Nelson-Somogyi's method
4. Assay of any commonly occurring enzyme.
5. Effect of pH, temperature, enzyme concentration and protein denaturation on an enzyme activity.
6. Determination of Km and Vmax of any commonly occurring enzyme.

Text/ Reference Books:

1. Principles and techniques of Practical Biochemistry: K. Wilson and J. Walker (1994), Cambridge University Press, Cambridge.
2. Introductory practical Biochemistry by S.K. Sawhney and Randhir Singh (2000), Narosa Publishing House, New Delhi.
3. An introduction to Practical Biochemistry by David T. Plummer (1988), McGraw-Hill, Book Company, UK.

MC-902	Constitution of India (B.Tech. Biotechnology) Semester- III					
Lecture	Tutorial	Practical	Major Test	Minor Test	Total	Time
3	-	-	75	25	100	3 Hrs.
Purpose	To know the basic features of Constitution of India					
Course Outcomes						
CO1	The students will be able to know about salient features of the Constitution of India.					
CO2	To know about fundamental duties and federal structure of Constitution of India.					
CO3	To know about emergency provisions in Constitution of India.					
CO4	To know about fundamental rights under constitution of India.					

UNIT-I

1. Meaning of the constitution law and constitutionalism, Historical perspective of the Constitution of India. Salient features and characteristics of the Constitution of India.
2. Scheme of the fundamental rights

UNIT - II

3. The scheme of the Fundamental Duties and its legal status. The Directive Principles of State Policy – Its importance and implementation. Federal structure and distribution of legislative and financial powers between the Union and the States.
4. Parliamentary Form of Government in India – The constitution powers and status of the President of India

UNIT - III

5. Amendment of the Constitutional Powers and Procedure. The historical perspectives of the constitutional amendments in India.
6. Emergency Provisions: National Emergency, President Rule, Financial Emergency. Local Self Government – Constitutional Scheme in India.

UNIT-IV

7. Scheme of the Fundamental Right to Equality. Scheme of the Fundamental Right to certain Freedom under Article 19.
8. Scope of the Right to Life and Personal Liberty under Article 21.

Text Books

1. Constitution of India. Prof. Narender Kumar (2008) 8th edition. Allahabad Law Agency.

Reference Books:

1. The constitution of India. P.M. Bakshi (2016) 15th edition. Universal law Publishing.

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

BTE-202	Molecular Biology (B.Tech. Biotechnology) Semester -IV						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	75	25	100	3 Hrs.
Purpose	To familiarize the students with basic concepts of molecular biology.						
Course Outcomes							
CO1	The students will be able to learn the Basic structure of DNA RNA.						
CO2	To learn the process of DNA replication and regulation.						
CO3	The students will be able to understand the process of Transcription of DNA in Prokaryotes and Eukaryotes.						
CO4	The students will be able to explain the process of Translation.						

UNIT- I

1. Genes : DNA/RNA as the genetic material. Double helical structure of DNA. Types of DNA. Super coiling and periodicity of DNA. Linking number of DNA. Nature of multiple alleles, Cis- acting sites and Trans-acting molecules. Euchromatin and heterochromatin. Nucleosomes. Organelle DNA- Mitochondrial and chloroplast DNA.

2. From Genes to Genomes : exons and introns, repetitive and non-repetitive DNA, C-value paradox.

3. DNA Replication : Origin of DNA replication. Bacterial and eukaryotic replicons. DNA polymerases. Mechanism and regulation of DNA replication in prokaryotes and eukaryotes.

UNIT - II

4. Transcription: Various RNA species and their properties- tRNA as an adapter and turnover of mRNA.

a) **Transcription in Prokaryotes:** RNA polymerases. Mechanism of transcription- initiation, elongation and termination. Role of sigma factor in transcription.

b) **Transcription in Eukaryotes:** RNA Polymerases. Downstream and upstream promoters. Techniques to define promoters- foot printing experiment. Mechanism of transcription. Interaction of upstream factors with basal apparatus. Role of enhancers. Post-transcriptional modifications of various RNA species. Transcription in mitochondria and chloroplast.

c) **The Operon:** Positive and negative control of transcription, repressor-inducer complex, catabolite repression and attenuation.

d) **Regulation of Transcription:** DNA binding domains- zinc finger motif, helix loop helix, leucine zippers and homeodomains. Demethylation and gene regulation.

UNIT -III

5. Genetic Code: Evidence for triplet code. Properties of genetic code, Wobble hypothesis. Mitochondrial genetic code. Suppressor tRNAs.

6. Protein Synthesis :Structure of prokaryotic and eukaryotic ribosomes and their role in protein synthesis. Mechanism of initiation, elongation and termination of protein synthesis.Regulation of translation in prokaryotes and eukaryotes. Post translational modifications of proteins.

7. Protein folding :Role of molecular chaperones.

UNIT -IV

8. Nuclear Splicing :Lariat formation, Sn RNAs, cis-splicing and trans-splicing reactions. Catalytic RNA- Ribozymes- Ribonuclease P, small RNAs, group I &II introns.

Text/Reference Books :

1. Genes XI Lewin, Benjamin(2013)OUP, Oxford.
2. Genomes,2nded, Brown, T. A.(2002) John Wiley and sons ,Oxford
3. Molecular biology of cell 4thed Alberts, Bruce; Watson,J D(2002) Garland Science Publishing, New York.
4. Molecular cell biology 4thedLodish, Harvey and. Baltimore,D(2000) W.H. Freeman and Co., New York
5. Cell and Molecular Biology 8thed, Robertis, EDP De &Robertis, EMF De(2002) lippincott Williams & Wilkins international student edition, Philadelphia.
6. Essentials of Molecular Biology 4thed, Malacinski, G. M. (2003) Jones &Bartlet Publishers, Boston
7. Cell and Molecular Biology: concepts and experiments 3rded Karp, Gerald(2002) John Wiley and sons, New York.
8. The Cell-a molecular approach, 3rded Cooper, G M&Hausman, R E(2004) ASM Press, Washington D C

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

BTE-204		Bioanalytical Techniques (B.Tech. Biotechnology) Semester- IV					
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	75	25	100	3 Hrs.
Purpose	To acclimatize students about different bioanalytical techniques.						
Course Outcomes							
CO1	The students will be able to understand the principle of microscopy.						
CO2	The students will be able to understand the principle and applications chromatography techniques.						
CO3	The students will be able to learn underlying principle and applications of spectroscopy.						
CO4	The students will be able to learn process of detection and measurement of radioactivity.						

UNIT- I

- 1. Principles of Microscopy:** Light, electron (scanning and transmission), fluorescence microscopy, marker enzymes.
- 2. Centrifugation: Basic concepts and applications,** differential centrifugation, high speed and ultracentrifugation techniques.

UNIT- II

- 3. Electrophoresis:** basic principle and applications of Paper and gel electrophoresis, isoelectric focussing, two-dimensional electrophoresis.
- 4 Principles of Chromatography:** Ion-exchange, gel filtration, affinity, gas chromatography, High Pressure Liquid Chromatography (HPLC), FPLC and Hydrophobic Interaction Chromatography.

UNIT- III

- 5. Principle and applications of Spectroscopy:** UV/visible, IR, NMR, ESR, fluorescence, Raman.
- 6. Mass spectroscopy:** LC-MS, X-ray diffraction (molecular crystals), CD.

UNIT- IV

- 7. Radioisotope Techniques:** Nature of radioactivity, properties of α , β and γ -rays, detection and measurement of radioactivity, use of radioisotopes in research, autoradiography, radio-immunoassay.

Text/ References Books:

1. Physical Biochemistry, 2nd edition, by D Friefelder (1983). W.H. Freeman & Co., U.S.A.
2. 4. Analytical Chemistry for technicians: John Kenkel (1994), Lewis Publishers. Boca Raton.
3. Principles and techniques of Practical Biochemistry: K. Wilson and J. Walker (1994), Cambridge University Press, Cambridge.
4. Biophysical Chemistry: Principles and Techniques, 2nd edition by A. Upadhyay, K. Upadhyay and N. Nath. (1998). Himalaya Publishing House, Delhi.
5. Physical Biochemistry, 2nd edition, by K. E. VanHolde (1985), Prentice Hall Inc, New Jersey.

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

BTE-206 IMMUNOLOGY (B.Tech Biotechnology) semester-IV							
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	75	25	100	3 Hrs.
Purpose	To learn the role of various components of immune system and their response against various diseases						
Course Outcomes							
CO1	The students will be able to learn the basic concepts of cells and organs related to immune system.						
CO2	Able to learn the formation, maturation and functions of B cells and T cells.						
CO3	To learn the concepts of various Immunological techniques and understanding various effector responses of body against an infection.						
CO4	To learn the immunological reasons behind various diseases.						

UNIT – I

- 1. Introduction to immune system:** Innate and acquired immunity, cells and organs of immune System- B-Lymphocytes and T-Lymphocytes, primary and secondary lymphoid organs, humoral and cell mediated immune response.
- 2. Immune System: Antigens. Immunoglobulins-** structure and function, antigenic Determinants (isotype, allotype, idiotype).

UNIT –II

- 3. Generation of B-Cell and T-Cell Responses:** Major histocompatibility complex. Antigen Processing and presentation.
- 4. Cell mediated immunity:** T-cell receptor, T-cell maturation, activation and differentiation.

UNIT –III

- 5 Immunological techniques:** Immunoprecipitin reactions, agglutination reactions, ELISA, RIA, Immunofluorescence.
- 6. Immune effector responses:** Cytokines. Complement system.

UNIT – IV

- 7. Immune System in Health and Disease:** Hypersensitive reactions. Auto immunity and immune response to infectious diseases. Immune response to transplants. Vaccines.

Text Book:

- 1. Kuby's Immunology, 5th ed. Goldsby, R A. Kindt, T.J, Osborne, B.A.(2003) W. H. Freeman and company, New York**

Reference Books

1. Essential Immunology, 10th ed Roitt, Ivon; Delves, Peter (2001) Blackwell Scientific Publications Oxford.
2. Fundamentals of Immunology: Paul W.E. (Eds.) Raven Press, New York.
3. Immunology by Prescott.

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

BTE-208	INDUSTRIAL BIOTECHNOLOGY (B.Tech. Biotechnology) Semester -IV						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	75	25	100	3 Hrs.
Purpose	To learn the various aspects of Industrial Biotechnology						
Course Outcomes							
CO1	To learn basic concepts of Fermentation Bioechnology						
CO2	To learn the theoretical aspects of Process Technology for the production of various products						
CO3	To learn the concepts of biopesticides, biofuels and biofertilizers.						
CO4	To understand the concept of integrated strain improvement program.						

UNIT-I

- 1. Industrial Biotechnology:** Introduction, objectives and scope.
- 2. Fermentation Technology:** Biochemistry of fermentation. Traditional and modern biotechnology-A brief survey of organisms, processes and products. Basic concepts of upstream and downstream processing in fermentation technology

UNIT - II

- 3. Production of Primary metabolites and alcoholic beverages** Organic acids, dextran, amino acids (Glutamic acid, L-Lysine) and alcohols and alcoholic beverages (wine and beer).
- 4. Production of Industrial Enzymes-** Amylase, protease, lipase, xylanase, lignocellulase. production of acrylamide, adipic acid and 1,2-Propanediol.

UNIT-III

- 5. Production of Biopesticides and Biofertilizers:** Characteristics of biopesticides. Important biopesticides- Bt-toxin, Kasugamycin, Beauverin, Devine and Collogo. Beneficial Soil Microorganisms. Biofertilizers.
- 6. Production of Biofuels:** Basic concepts and important types of biofuels. Fuel from biomass, production and economics of biofuels, biogas, biorefineries, Microbial Enhanced Oil Recovery (MEOR).
- 7. Production of other industrial bioproducts-** Single Cell Protein & Mushroom Culture, Biopreservatives (Nisin), Cheese, Biopolymers (Xanthan gum, PHB). Biosynthetic Technology. Bioflavours and biopigments: microbial production of flavours and fragrances. Microbial pigments in textile and food industries.

UNIT-IV

8. Strain Improvement Strategies- Improvement of industrially important microorganisms, selection of mutants, use of rDNA technology. Integrated Strain Improvement Program (Precision Engineering Technology)

9. Microbial Production of Pharmaceuticals. Antibiotics (penicillin, streptomycin and tetracycline), Enzyme Inhibitors. Production of Vitamin E, K, B₂ and B₁₂, Genetic engineering of microorganisms for production of non-ribosomal peptides (NRPS) and polyketides (PKS), anticancer drugs.

Text

1. A Textbook of Basic and Applied Microbiology. Aneja, K. R., Jain, P. and Aneja, R. (2008). New Age International Publishers, New Delhi

Reference Books:

1. Industrial Microbiology. Casida Jr., L.E. (1968) New Age International (P)Ltd. New Delhi.
2. Prescott & Dunn's Industrial Microbiology. Ed. E.G. Reed (1987). CBS Publishers, New Delhi.
3. Biotechnology: A Textbook of Industrial Microbiology 2nd Edition. Crueger, W. and Crueger, A. (2000) Panima Publishing Corporation, New Delhi.
4. Enzymes: Biochemistry, Biotechnology, Clinical chemistry. Palmer, T. (2000) Horwood publishing Colphon.
5. Process engineering in biotechnology. Jackson, A.T. (1991) Prentice Hall.
6. Manual of Industrial Microbiology and Biotechnology 2nd Edition. Ed. Arnold L. Demain and Julian E. Davies (1999) ASM Press Washington D.C.

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

BS-202	Basics of Thermodynamic and Organic Chemistry (B.Tech. Biotechnology Semester IV)						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	75	25	100	3 Hrs
Purpose	To familiarize the students with basic concepts of thermodynamic and organic chemistry.						
Course Outcomes							
CO1	The students will be able to know the basic concepts of naming of organic compounds and general organic reactions.						
CO2	Able to know about spatial arrangement of molecules and their bonding.						
CO3	Able to know about basic concepts of thermodynamics.						
CO4	Able to know about concept of free energy in biomolecules and binding used in biochemical reactions.						

UNIT-I

IUPAC Nomenclature: Systematic IUPAC nomenclature of alkenes, alkynes, cycloalkanes, aromatics, bicyclic and polyfunctional organic compounds. Bond line notation. Types of Organic Reactions: Substitution, Addition, Elimination reactions. Wanger-Meerwin rearrangement reaction. Hyperconjugation : concept and consequences, mole concepts.

UNIT-II

Bonding: Hydrogen bonding- Nature, type, stability and its importance in organic compounds. Tautomerism-Concept, Ring-chain tautomerism, Ring-chain isomerism, properties and reactions of keto-enol tautomers.

Stereo Chemistry: Classification of stereomers, diastereomers, separation of enantiomers, absolute configuration (R & S), projection formulae, stereochemistry of compounds containing two asymmetric C- atoms, stereochemistry of biphenyls. Geometrical isomerism-concept, E & Z nomenclature and aldol condensation

UNIT -III

Thermodynamic parameters –internal energy, enthalpy; their relationship and their significance. First law of thermodynamics. Kirchoff's Equation. Heat capacity at constant pressure and volume and their relationship.

Concepts of Entropy, Second law of thermodynamics. Entropy changes for reversible and irreversible processes. Entropy of mixing.

Third Law of Thermodynamics. Numerical problems on Laws of Thermodynamics.

UNIT-IV

Basic concept of Equilibrium and steady state conditions, Free energy and its relation with equilibrium constant, Chemical potential, Gibbs-Duhem equation and their application, Standard biochemical state and standard free energy changes. Thermodynamic basis of Biochemical reactions, solvent extraction for purification of compounds. Binding – Non-cooperative binding, Co-operative binding and its biological significance

Text/Reference Books:

1. Organic Chemistry V1:6th ed. Finar,I L(2003) Pearson Education, Delhi
2. Organic Chemistry V2:5th ed. Finar,I L(2003) Pearson Education, Delhi.
3. Organic Chemistry 6th ed. Morrison,R & Boyd,T.(2003) Pearson Education, Delhi.
4. Organic Chemistry. Paula Yurkanis Bruice; Pearson Education, Delhi.
5. Principle of Organic Synthesis. Richard Norman and James M Coxon.
6. Organic Chemistry:Reactions & Reagents,37th ed. Aggarwal (2003) Goel Publishing House,Meerut.
7. Organic Analytical Chemistry. Jagmohan (2003) Narosa pub. New Delhi.
Kinetics and Thermodynamics in Biochemistry : Bray & White.
8. Biophysical chemistry Vol. I : Edsall and Wyman
9. Non Equilibrium Thermodynamics in Biophysics : Katchalasky and Curran; Harvard University Press.
10. Principles of Physical Biochemistry : Kensel. E.Van Holde, W. Curtis Johnson, P. Shing Ho (2005) 2 nd edition, Prentice Hall
11. Physical basis of biochemistry: Foundations of molecular biophysics, Bergethan, P.R.(2000) Springer.

BTE-212L		Molecular Biology Lab (B.Tech. Biotechnology Semester IV)					
Lecture	Tutorial	Practical	Credit	Practical	Minor Test	Total	Time
-	-	3	1.5	60	40	100	3 Hrs.
Purpose		To familiarize the students with basic concepts of molecu.					
Course Outcomes							
CO1		Students will be able to learn Isolation of DNA from Prokaryotic and Eukaryotic Cells					
CO2		Learning of Gel Electrophoresis for separation of DNA, RNA and Proteins					
CO3		Students will learn the technique of PCR Amplification of Nucleic Acids					
CO4		Students will learn Restriction Mapping of Plasmid DNA					

LABORATORY EXPERIMENTS

1. Isolation of genomic DNA from eukaryotic cells.
2. Isolation of RNA from eukaryotic cells.
3. Isolation of proteins from eukaryotic cells.
4. Isolation of genomic DNA from prokaryotic cells.
5. Isolation of plasmid DNA from Prokaryotic cells.
6. Restriction mapping of plasmid DNA: This experiment involves single and double digestion of the plasmid with restriction enzymes.
7. Gel electrophoretic separation of DNA and molecular wt. determination.
8. Gel electrophoretic separation of RNA.
9. Gel electrophoretic separation of proteins.
10. Transblot analysis of DNA.
11. Gel Extraction of DNA.
12. PCR amplification of DNA: Visualization by gel electrophoresis.

Reference Book:

Molecular Cloning – A laboratory manual: 3rd Edition Vol. 1-3. Sambrook J and Russell D.W. (2001). Cold Spring Harbor laboratory Press, New York.

BTE-214L Bioanalytical Techniques Lab (B.Tech. Biotechnology) Semester- IV							
Lecture	Tutorial	Practical	Credit	Practical	Minor Test	Total	Time
-	-	3	1.5	60	40	100	3 Hrs
Purpose	To learn the Bioanalytical Techniques used in the field of Biotechnology						
Course Outcomes							
CO1	Students will learn about working of spectrophotometer.						
CO2	Students will be able to learn about technique of paper chromatography.						
CO3	Students will be able to learn about technique of electrophoresis.						
CO4	Students will be able to estimate DNA and RNA in any sample.						

LABORATORY EXPERIMENTS

1. To verify the validity of Beer-Lambert's law and determine the molar extinction coefficient of NADH/NAD
2. Separation of amino acids/ sugars by paper chromatography.
3. Extraction and estimation of total lipid content in a given sample of oil seed.
4. Partial purification of an enzyme by ammonium sulphate fractionation,
5. Native gel electrophoresis of proteins.
6. To demonstrate the working of HPLC.
7. Quantitative determination of DNA and RNA by spectrophotometric method.

Reference Books:

1. Principles and techniques of Practical Biochemistry: K. Wilson and J. Walker (1994), Cambridge University Press, Cambridge.
2. Introductory practical Biochemistry by S.K. Sawhney and Randhir Singh (2000), Narosa Publishing House, New Delhi.
3. An introduction to Practical Biochemistry by David T. Plummer (1988), McGraw-Hill, Book Company, UK.

BTE-216L	Industrial Microbiology Lab (B.Tech. Biotechnology) Semester -IV						
Lecture	Tutorial	Practical	Credit	Minor Test	Practical	Total	Time
-	-	3	1.5	40	60	100	3 Hrs
Purpose	To learn the Practical Aspects of Industrial Microbiology						
Course Outcomes							
CO1	Learning of Sterilization Techniques used in Microbiology Lab						
CO2	Learning of Identification of industrially important microorganisms						
CO3	Students will learn production of antibiotics and enzymes from microbes						
CO4	Students will learn determination of microbial cell growth						

LABORATORY EXPERIMENTS

1. Sterilization Techniques (Media, air & water)
2. Construction of various fermenters (bioreactors)
3. Identification of industrially important microorganisms e.g. molds, yeasts and bacteria.
4. Production of various products in the lab. Alcohol, wine, cellulase, protease and bread.
5. Isolation of antibiotic producing microorganisms from the soil.
6. Penicillin production and testing of antimicrobial activity.
7. Isolation of streptomycin-resistant mutants by replica plating method.
8. Isolation of UV induced auxotrophic mutants.
9. Determination of cell growth.
10. Production of organic acids (Citric and lactic) by microorganisms.
11. Production of industrially important enzymes (protease, amylase) by microorganisms.

Reference Books:

1. Experiments in Microbiology, Plant Pathology and Biotechnology. Aneja, K.R.(2003) 4th Edition. New Age International Publishers, New Delhi.
2. Fermentations & Biochemical Hand Book: Principles, Process Design and Equipment. HC Vogel and Noyes(1983).
3. Microbiology Laboratory Manual. Cappuccino, J. and Sheeman, N.(2000), 4th Edition, Addison Wesley, California.
4. Manual of Industrial Microbiology and Biotechnology. 2nd Edition. Ed. Arnold L. Demain and Julian E. Davies (1999) ASM Press Washington D.C.

BT-218L Immunology Lab (B.Tech. Biotechnology) Semester -IV							
Lecture	Tutorial	Practical	Credit	Minor Test	Practical	Total	Time
-	-	3	1.5	40	60	100	3 Hrs
Purpose	To learn the practical aspects of Immunology						
Course Outcomes							
CO1	Students will be able to learn basic techniques in handling laboratory animals.						
CO2	Learning of techniques for purification of immunoglobulins.						
CO3	Students will learn the technique of Immunoprecipitation and Agglutination.						
CO4	Students will learn the principles of ELISA.						

LABORATORY EXPERIMENTS

1. Routine techniques in handling laboratory animals: feeding, cleaning and bleeding procedure for mice and rabbit.
2. ABO blood group typing
3. Estimation of hemoglobin in blood sample
4. Detection of antigen/antibody from test sample
5. Purification of immunoglobulins.
6. Immunoprecipitation techniques
7. Agglutination techniques
8. ELISA

Reference Books:

1. Using Antibodies: A Laboratory Manual. Harlow & Lane(1998) Cold Spring Harbor Lab Press.
2. Immunological Techniques Made Easy. Cochet, et al.(1998)Wiley Publishers,Canada.

MC-901	ENVIRONMENTAL SCIENCES (B.Tech. Biotech IV th Sem)						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	-	-	-	75	25	100	3 Hrs.
Purpose	To learn the multidisciplinary nature, scope and importance of Environmental sciences.						
Course Outcomes							
CO1	The students will be able to learn the importance of natural resources.						
CO2	To learn the theoretical and practical aspects of eco system.						
CO3	Will be able to learn the basic concepts of conservation of biodiversity.						
CO4	The students will be able to understand the basic concept of sustainable development.						

UNIT I

The multidisciplinary nature of environmental studies. Definition, Scope and Importance. Need for public awareness. Natural Resources: Renewable and Non-Renewable Resources: Natural resources and associated problems.

- (a) Forest Resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
- (b) Water Resources- Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
- (c) Mineral Resources- Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
- (d) Food Resources- World Food Problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- (e) Energy Resources- Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.
- (f) Land Resources- Land as a resource, land, degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyle.

UNIT II

Ecosystem-Concept of an ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological Succession. Food Chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem-

- a. Forest Ecosystem
- b. Grassland Ecosystem
- c. Desert Ecosystem
- d. Aquatic Ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Field Work. Visit to a local area to document Environment assets- river/forest/grassland/hill/mountain. Visit to a local polluted site- Urban /Rural Industrial/Agricultural. Study of common plants, insects and birds. Study of simple ecosystems-pond, river, hill, slopes etc. (Field work equal to 5 lecture hours).

UNIT III

Biodiversity and its conservation. Introduction, Definition: genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity of global, National and local levels. India as a mega-diversity nation Hot spots of Biodiversity. Threats to biodiversity: Habitat loss, poaching of wild life, man-wildlife conflicts. Endangered and endemic species of India. Conservation of Biodiversity- In situ and Ex-Situ conservation of biodiversity.

Environmental Pollution Definition. Cause, effects and control measures of- (a) Air Pollution (b) Water Pollution (c) Soil Pollution (d) Marine Pollution (e) Noise Pollution (f) Thermal Pollution (g) Nuclear Hazards
Solid waste management- cause, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides

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.

Environmental ethics-issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. Wasteland Reclamation. Consumerism and waste products.

Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and Control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public Awareness.

Human population and the Environment. Population growth, variation among nations. Population explosion-Family Welfare Programme. Environment and human health.

Human rights. Value Education. HIV/AIDS, Women and Child Welfare. Role of Information Technology in Environment and Human Health. Case Studies. Drugs and

their effects; Useful and harmful drugs; Use and abuse of drugs; Stimulant and depressant drugs. Concept of drug de-addiction. Legal position on drugs and laws related to drugs.

Text Books

1. Environmental Studies- Deswal and Deswal. Dhanpat Rai & Co.
2. Environmental Science & Engineering Anandan, P. and Kumaravelan, R. 2009. Scitech Publications (India) Pvt. Ltd., India
3. Environmental Studies. Daniels Ranjit R. J. and Krishnaswamy. 2013. Wiley India.
4. Environmental Science- Botkin and Keller. 2012. Wiley , India

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

DEPARTMENT OF MECHANICAL ENGINEERING
UNIVERSITY INSTITUTE OF ENGINEERING & TECHNOLOGY (U.I.E.T)
(A Constituent Autonomous Institute and Recognized by UGC under Section 12 (B) and 2 (f)); AICTE Approved; TEQIP-III)
Kurukshetra University, Kurukshetra (K.U.K) – 136119, Haryana, INDIA
(Established by the state Legislature Act XII of 1956; ‘A+’ Grade, NAAC Accredited)
Phone: +91-1744-239155, Fax: +91-1744-238967, Web: <http://www.uietkuk.org>

A. Definition of Credit:

1 Hour Lecture (L) per week	1 credit
1Hour Tutorial (T) per week	1 credit
1 Hour Practical (P) per week	0.5 credit
2 Hours Practical (Lab) per week	1 credit

B. Range of Credits:

A total credit of 160 is required for a student to be eligible to get Under Graduate degree in **Mechanical Engineering**. A student will be eligible to get Under Graduate degree (**B.Tech.**) **with Honours**, if he/she completes an additional 20 credits. These could be acquired through MOOCs at Swayam portal or with in-house examination being conducted. In order to have an Honours degree, a student may choose minimum 20 credits provided that the student must ensure the course is approved by the Competent Authority, Government of India.

Bachelor of Technology (Mechanical Engineering), UIET, KUK
Credit-Based (2018-19 Onwards)
SCHEME OF STUDIES/EXAMINATIONS (Semester -II)

S. No.	Course No./ Code	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of exam (Hours)
						Major Test	Minor Test	Practical	Total	
1A	BS-119	Introduction to Electromagnetic theory	3:1:0	4	4	75	25	0	100	3
1B	BS-101	Chemistry	3:1:0	4	4	75	25	0	100	3
2A	ES-105	Programming for Problem Solving	3:0:0	3	3	75	25	0	100	3
2B	HM-101	English	2:0:0	2	2	75	25	0	100	3
3	BS-136	Calculus & Ordinary Differential Equations	3:1:0	4	4	75	25	0	100	3
4A	ES-109	Engineering Graphics & Design	1:2:0	3	3	75	25	0	100	3
4B	ES-111L	Manufacturing Processes Workshop	0:0:3	3	1.5	-	40	60	100	3
5A	BS-141	Biology	2:1:0	3	3	75	25	0	100	3
5B	ES-101	Basic Electrical Engineering	4:1:0	5	5	75	25	0	100	3
6A	BS-121L	Electromagnetics Lab	0:0:3	3	1.5	--	20	30	50	3
6B	BS-103L	Chemistry Lab	0:0:3	3	1.5	--	20	30	50	3
7A	ES-107L	Programming for Problem Solving Lab	0:0:2	2	1	--	20	30	50	3
7B	ES-103L	Basic Electrical Engineering Lab	0:0:2	2	1	--	20	30	50	3
8A	ES-113L	Engineering Graphics & Design Practice	0:0:3	3	1.5	--	20	30	50	3
8B	HM-103L	Language Lab	0:0:2	2	1	--	20	30	50	3
		Total	12:5:8/ 12:3:10	25/ 25	21.0/ 20.0	375/ 300	185/200	90/150	650A/ 650B	

Note: (1) A branch will study either the subjects corresponding to Sr. No. Marked A or corresponding to Sr. No. Marked B in one particular semester.
(2) All students have to undertake the industrial training for 4 to 6 weeks after 2nd semester which will be evaluated in 3rd semester

**BACHELOR OF TECHNOLOGY (MECHANICAL ENGINEERING) CREDIT BASED
KURUKSHETRA UNIVERSITY KURUKSHETRA
SCHEME OF STUDIES/EXAMINATION
SEMESTER III (w.e.f. session 2019-2020)**

S. No.	Course No.	Course Name	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of Exam (Hrs.)
						Major Test	Minor Test	Practical	Total	
1	BS-201	Optics & Waves	3:0:0	3	3	75	25	0	100	3
2	BS-204	Higher Engineering Mathematics	3:0:0	3	3	75	25	0	100	3
3	ES-203	Basic Electronics Engineering	3:0:0	3	3	75	25	0	100	3
4	MEC-201	Theory of Machines	3:1:0	4	4	75	25	0	100	3
5	MEC-203	Mechanics of Solids-I	3:1:0	4	4	75	25	0	100	3
6	MEC-205	Thermodynamics	3:1:0	4	4	75	25	0	100	3
7	MEC-207L	Theory of Machines Lab	0:0:2	2	1	0	40	60	100	3
8	MEC-209L	Mechanics of Solids Lab	0:0:2	2	1	0	40	60	100	3
9	*MEC-211	Industrial Training-I	2:0:0	2	-	-	100	-	100	
10	**MC-901	Environmental Sciences	3:0:0	3	-	75	25	0	100	3
Total				30	23	450	230	120	800	

*MEC-211 is a mandatory non-credit course in which the students will be evaluated for the industrial training undergone after 2nd semester and students will be required to get passing marks to qualify.

**MC-901 is a mandatory credit-less course in which the students will be required to get passing marks in the major test.

**BACHELOR OF TECHNOLOGY (MECHANICAL ENGINEERING) CREDIT BASED
KURUKSHETRA UNIVERSITY KURUKSHETRA
SCHEME OF STUDIES/EXAMINATION
SEMESTER IV (w.e.f. session 2019-2020)**

S. No.	Course No.	Course Name	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of Exam (Hrs.)
						Major Test	Minor Test	Practical	Total	
1	ES-204	Materials Engineering	3:0:0	3	3	75	25	0	100	3
2	MEC-202	Applied Thermodynamics	3:0:0	3	3	75	25	0	100	3
3	MEC-204	Fluid Mechanics & Fluid Machines	3:1:0	4	4	75	25	0	100	3
4	MEC-206	Mechanics of Solids-II	3:1:0	4	4	75	25	0	100	3
5	MEC-208	Instrumentation & Control	3:0:0	3	3	75	25	0	100	3
6	ES-206L	Materials Engineering Lab	0:0:2	2	1	0	40	60	100	3
7	MEC-210L	Fluid Mechanics & Fluid Machines Lab	0:0:2	2	1	0	40	60	100	3
8	*MC-902	Constitution of India	3:0:0	3	-	75	25	-	100	3
Total				24	19	375	205	120	700	

*MC-902 is a mandatory credit-less course in which the students will be required to get passing marks in the major test.

Note: All the students have to undergo 4 to 6 weeks Industrial Training after 4th semester which will be evaluated in 5th semester.

Third Semester

B. Tech (3 rd Semester) Mechanical Engineering							
BS - 201	Optics and Waves						
L	T	P	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	75	25	100	3h
Purpose	To introduce the fundamentals of wave and optics for the applications in Engineering field.						
Course Outcomes							
CO 1	Familiarize with basic phenomenon used in propagation of waves.						
CO 2	Introduce the fundamentals of interference, diffraction, polarization and their applications.						
CO 3	To make the students aware to the importance of Laser in technology.						

Unit - I

Waves: Travelling waves, Characteristics of waves, Mathematical representation of travelling waves, General wave equation, Phase velocity, Light source emit wave packets, Wave packet and Bandwidth, Group velocity and real light waves.

Propagation of light waves: Maxwell's equations, Electromagnetic waves and constitutive relations, Wave equation for free-space, Uniform plane waves, Wave polarization, Energy density, the pointing vector and intensity, Radiation pressure and momentum, Light waves at boundaries, Wave incident normally on boundary, Wave incident obliquely on boundary: law of reflection, Snell's law and reflection coefficients.

Unit - II

Interference: Principle of Superposition, Conditions for Sustained interference, Young's double slit experiment, Division of wave-front: Fresnel's Biprism and its applications, Division of amplitude: Interference due to reflected and transmitted light, Wedge-shaped thin film, Newton's rings and its applications, Michelson Interferometer and its applications.

Unit – III

Diffraction: Types of diffraction, Fraunhofer diffraction at a single slit, Plane transmission diffraction grating: theory, secondary maxima and secondary minima, width of principal maxima, absent spectra, overlapping of spectral lines, determination of wavelength; Dispersive power and resolving power of diffraction grating.

Polarization: Polarization of transverse waves, Plane of polarization, Polarization by reflection, Double refraction, Nicol Prism, Quarter and half wave plate, Specific Rotation, Laurent 's half shade polarimeter, Biquartzpolarimeter.

Unit – IV

Laser: Stimulated Absorption, Spontaneous and Stimulated Emission; Einstein's Coefficients and its derivation, Population Inversion, Direct and Indirect pumping, Pumping

schemes, Main components of Laser, Gas lasers (He-Ne, CO₂), Solid state lasers (Ruby, Neodymium, semiconductor), Dye laser, Characteristics of Laser, Applications of Laser.

Text/Reference Books:

1. P.K. Diwan, Applied Physics for Engineers, *Wiley India Pvt. Ltd., India*
2. N. Subrahmanyam, B. Lal, M.N. Avadhanulu, A Textbook of Optics, *S. Chand & Company Ltd., India.*
3. A. Ghatak, Optics, *McGraw Hill Education(India) Pvt. Ltd., India.*
4. E. Hecht, A.R. Ganesan, Optics, *Pearson India Education Services Pvt. Lt., India.*

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

B. Tech (3rd Semester) Mechanical Engineering							
BS-204	HIGHER ENGINEERING MATHEMATICS						
Lecture	Tutorial	Practical	Credits	Theory	Sessional	Total	Time
3	-	-	3	75	25	100	3 h
Purpose	The objective of this course is to familiarize the prospective Engineers with Laplace Transform, partial differential equations which allow deterministic mathematical formulations of phenomena in engineering processes and to study numerical methods for the approximation of their solution. More precisely, the objectives are as under:						
Course Outcomes							
CO 1	Introduction about the concept of Laplace transform and how it is useful in solving the definite integrals and initial value problems.						
CO 2	To introduce the Partial Differential Equations, its formation and solutions for multivariable differential equations originated from real world problems.						
CO 3	To introduce the tools of numerical methods in a comprehensive manner those are used in approximating the solutions of various engineering problems.						
CO 4	To familiar with essential tool of Numerical differentiation and Integration needed in approximate solutions for the ordinary differential equations.						

UNIT-I

Laplace Transform

Laplace Transform, Laplace Transform of Elementary Functions, Basic properties of Laplace Transform, Laplace transform of periodic functions, finding inverse Laplace transform by different methods, Convolution theorem, solving ODEs by Laplace Transform method.

UNIT-2

Partial Differential Equations

Formation of Partial Differential Equations, Solutions of first order linear and non-linear PDEs, Charpit's method, Solution to homogenous linear partial differential equations (with constant coefficients) by complimentary function and particular integral method.

UNIT-3

Numerical Methods-1

Solution of polynomial and transcendental equations: Bisection method, Newton-Raphson method and Regula-Falsi method, Finite differences, Relation between operators, Interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae.

UNIT-4

Numerical Methods-2

Numerical Differentiation using Newton's forward and backward difference formulae, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules, Ordinary differential equations: Taylor's series, Euler and modified Euler's methods. Runge-Kutta method of fourth order for solving first and second order equations.

Textbooks/References:

1. S. J. Farlow, Partial Differential Equations for Scientists and Engineers, Dover Publications, 1993. AICTE Model Curriculum in Mathematics.
2. R. Haberman, Elementary Applied Partial Differential equations with Fourier Series and Boundary Value Problem, 4th Ed., Prentice Hall, 1998.

3. Ian Sneddon, Elements of Partial Differential Equations, McGraw Hill, 1964.
4. Manish Goyal and N.P. Bali, Transforms and Partial Differential Equations, University Science Press, Second Edition, 2010.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
7. Veerarajan T., Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2008.
8. P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company, 2nd Edition, Reprint 2012.
9. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.
10. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
11. Erwin Kreyszig and Sanjeev Ahuja, Applied Mathematics-II, Wiley India Publication, Reprint, 2015.

Note: The examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

B. Tech (3 rd Semester) Mechanical Engineering							
Basic Electronics Engineering							
ES-203							
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Total	Time (Hrs)
3	0	0	3	75	25	100	3
Purpose : To provide an overview of electronic devices and components to Mechanical engineering students.							
Course Outcomes							
CO 1	To introduce the basic electronics devices along with their applications.						
CO 2	To become familiar with basic operational amplifier circuits with applications and oscillators.						
CO 3	To understand the fundamentals of digital electronics.						
CO 4	To become familiar with basic electronic communication system.						

UNIT-I

Semiconductor Devices and Applications: Introduction to P-N junction Diode and V-I characteristics, Half wave and Full-wave rectifiers, capacitor filter. Zener diode and its characteristics, Zener diode as voltage regulator. BJT structure, its input-output and transfer characteristics, BJT as a Common Emitter amplifier, frequency response and bandwidth.

UNIT-II

Operational amplifier and its applications: Introduction to operational amplifiers, inverting, non-inverting and differential modes, basic parameters of Op-amp, Op-amp in open loop configuration, study of practical op-amp IC 741, Op-amp applications: adder, subtractor, scale changer, averaging amplifier, comparator, integrator and differentiator.

Timing Circuits and Oscillators: IC 555 timer pin diagram: Astable and mono-stable operation, Barkhausen's criteria for oscillations, R-C phase shift and Wein bridge oscillators using BJT and Op-Amp and their frequency of oscillation.

UNIT-III

Digital Electronics Fundamentals : Difference between analog and digital signals, Boolean algebra, Basic and Universal Gates, Symbols, Truth tables, logic expressions, Logic simplification using K-maps, Logic ICs, half and full adder, multiplexers, de-multiplexers, flip-flops, basic counters.

UNIT-IV

Electronic Communication Systems: The elements of communication system, Transmission media: wired and wireless, need of modulation, AM and FM modulation schemes, Mobile communication systems: cellular concept and block diagram of GSM system.

Text Books:

1. Integrated Electronics, Millman & Halkias (Mc-Graw Hill)
2. Electronics Devices & Circuit Theory, RL Boylestad & L Nashelsky (PHI)

Reference Books:

1. Modern Digital Electronics, R P Jain, Tata McGraw Hill.
2. Electronic Communication Systems, G. Kennedy, McGraw Hill, 4th Edition

Note: The paper setter will set the paper as per the question paper templates provided.

B. Tech (3 rd Semester) Mechanical Engineering							
MEC-201	THEORY OF MACHINES						
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Total	Time (Hrs)
3	1	0	4	75	25	100	3
Purpose:	To familiarize the students with design of various types of linkage mechanisms for obtaining specific motion, their analysis and applicability for optimal functioning.						
Course Outcomes							
CO 1	To understand the kinematics of simple mechanisms and methods of determining the link velocities.						
CO 2	To understand the acceleration of different mechanisms and profile generation of cams and followers.						
CO 3	To understand the concepts of static and dynamic force analysis of different mechanisms and balancing of different components.						
CO 4	To familiarize with gear, gear trains, belts and chain drives.						

UNIT-I

Simple Mechanisms: Introduction to mechanism and machine, Kinematic links, pairs and chains, Mobility of mechanisms, Equivalent mechanisms, Four bar chain, Inversion of four bar chain, slider crank chain and inversions.

Velocity Analysis: Determination of link velocities, Relative velocity method, Velocities in four bar mechanism, Slider crank mechanism, crank and slotted lever mechanism and quick return motion mechanism, Instantaneous center method: Types & location of instantaneous centers, Arnold Kennedy theorem, methods of locating instantaneous centers, steering gear mechanisms. Problems.

UNIT-II

Acceleration Analysis: Acceleration of a point on a link, four bar mechanism and slider crank mechanism, Coriolis component of acceleration, Klein's construction, Problems.

Cams and Followers: Classification & terminology, Cam profile by graphical methods with knife edge and radial roller follower for uniform velocity, simple harmonic, constant acceleration and deceleration and cycloidal motion of followers, Problems.

UNIT-III

Static and Dynamic Force Analysis: constraints and applied forces, static equilibrium, equilibrium of two and three-force member, equilibrium of four-forces and torque, free body diagrams. Dynamic Force Analysis: D'Alembert's principle, equivalent offset inertia force, Dynamic analysis of four-link, Dynamic analysis of slider-crank mechanisms, velocity and acceleration of piston, angular velocity and angular acceleration of connecting rod, turning moment on crank shaft, turning moment diagrams, fluctuation of energy, flywheels, Problems.

Balancing: rotating masses: Static and Dynamic Balancing, Single Rotating mass, Many Masses rotating in same plane and in different planes. Analytical method for balancing of rotating masses. Reciprocating masses: Balancing of reciprocating engine, Balancing of Multi-cylinder in line engines, balancing machines.

UNIT-IV

Belts and Chain Drives: classifications of belt, law of belting, Length of open and cross flat belt, Ratio of tensions, Centrifugal tension, power transmission, condition for maximum power transmission, creep of belt, V-belt drives: driving tensions, Chain drives: classifications, terminology of chains, kinematics of chains, Problems.

Gears and Gear Trains:Classification & terminology, Law of gearing, Tooth forms & comparisons, Length of path of contact, Contact ratio, Interference & undercutting in involute gear teeth, Minimum number of teeth on gear and pinion to avoid interference. Gear Trains:simple, compound, reverted and planetary gear trains, Problems.

Text Books:

1. Theory of Mechanisms and Machines: Amitabha Ghosh and Ashok Kumar Mallik, Third Edition Affiliated East-West Press.
2. Thomas Bevan, Theory of Machines, 3rd edition, CBS Publishers & Distributors, 2005.
3. Cleghorn W.L., Mechanisms of Machines, Oxford University Press, 2005. 3. Robert L. Norton, Kinematics and Dynamics of Machinery, Tata McGrawHill, 2009.
4. Theory of Machines and Mechanisms: Joseph Edward Shigley and John Joseph Uicker, Jr. Second Edition, MGH, New York.

Reference Books:

1. Mechanism and Machine Theory: J.S. Rao and R.V. Duggipati Second Edition New age International.
2. Theory and Machines: S.S. Rattan, Tata McGraw Hill.
3. Kinematics of Machines-Dr. Sadhu Singh, Pearson Education

Note: The paper setter will set the paper as per the question paper templates provided.

B. Tech. (3 rd Semester) Mechanical Engineering							
MECHANICS OF SOLIDS-I							
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Total	Time (Hrs.)
3	1	0	4	75	25	100	3
Purpose	The objective of this course is to make the students aware of Stress, Strain and deformation of solids with the applications to beams, shafts and column and struts. The course will help the students to build the fundamental concepts in order to solve engineering problems.						
Course Outcomes							
CO1	Apply fundamental principles of mechanics & principles of equilibrium to simple and practical problems of engineering, determine centroid and moment of inertia of a different geometrical shapes and able to understand its importance. Explain the basic concepts of stress and strain and solve the problems						
CO 2	Determine and calculate the values of principal stresses. Express the concept of shear force and bending moment of beams. Construct shear force and bending moment diagram for beams.						
CO 3	Express the concept of torsion of circular shaft and able to solve the problems on torsion of circular shaft. Illustrate and solve the problems on bending and shear stresses on beams						
CO 4	Solve the problems on column and strut and Derive the derivations and solve the problems on slope and deflection.						

Unit-I

Introduction: Force, types of forces, Characteristics of a force, System of forces, Composition and resolution of forces, forces in equilibrium, principle and laws of equilibrium, Free body diagrams, Lami's Theorem, equations of equilibrium, Concept of center of gravity and centroid, centroid of various shapes: Triangle, circle, semicircle and trapezium, theorem of parallel and perpendicular axes, moment of inertia of simple geometrical figures, polar moment of inertia. Numerical Problems

Simple Stresses & Strains: Concept & types of Stresses and strains, Poisson's ratio, stresses and strain in simple and compound bars under axial loading, stress strain diagrams, Hook's law, elastic constants & their relationships, temperature stress & strain in simple & compound bars under axial loading, Numerical problems.

Unit-II

Principle Stresses: Two dimensional systems, stress at a point on a plane, principal stresses and principal planes, Mohr's circle of stresses, Numerical Problems.

Shear Force & Bending Moments: Definitions, SF & BM diagrams for cantilevers, simply supported beams with or without over-hang and calculation of maximum BM & SF and the point of contraflexure under (i) concentrated loads, (ii) uniformly distributed loads over whole span or a part of it, (iii) combination of concentrated loads and uniformly distributed loads, (iv) uniformly varying loads and (v) application of moments, relation between the rate of loading, the shear force and the bending moments, Numerical Problems.

Unit-III

Torsion of Circular Members: Derivation of equation of torsion, Solid and hollow circular shafts, tapered shaft, stepped shaft & composite circular shafts, Numerical problems.

Flexural and Shear Stresses – Theory of simple bending, Assumptions, derivation of equation of bending, neutral axis, determination of bending stresses, section modulus of rectangular & circular (solid & hollow), I,T, Angle, channel sections, composite beams, shear stresses in beams with derivation, shear stress distribution across various beam sections like rectangular, circular, triangular, I, T, angle sections. combined bending and torsion, equivalent torque,. Numerical problems.

Unit-IV

Columns & Struts: Column under axial load, concept of instability and buckling, slenderness ratio, derivation of Euler's formula for crippling load for columns of different ends, concept of equivalent length, eccentric loading, Rankine formulae and other empirical relations, Numerical problems.

Slope & Deflection : Relationship between bending moment, slope & deflection, moment area method, method of integration, Macaulay's method, calculations for slope and deflection of (i) cantilevers and (ii) simply supported beams with or without overhang under concentrated load, Uniformly distributed loads or combination of concentrated and uniformly distributed loads, Numerical problems.

Text Books:

1. Strength of Materials – R.K. Rajput, Dhanpat Rai & Sons.
2. Strength of Materials – Sadhu Singh, Khanna Publications.
3. Strength of Materials – R.K. Bansal, Laxmi Publications.

Reference Books:

1. Strength of Materials – Popov, PHI, New Delhi.
2. Strength of Materials – Robert I. Mott, Pearson, New Delhi
3. Strength of Material – Shaums Outline Series – McGraw Hill
4. Strength of Material – Rider – ELBS

Note: The paper setter will set the paper as per the question paper templates provided.

B. Tech. (3 rd semester) Mechanical Engineering							
MEC-205 THERMODYNAMICS							
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Total	Time (Hrs.)
3	1	0	4	75	25	100	3
Purpose	The objective of this course is to make the students aware of Energy, Entropy, and Equilibrium, various laws of thermodynamics, concepts and principles. The course will help the students to build the fundamental concepts to apply in various applications like IC engines and Air conditioning systems.						
Course Outcomes							
CO 1	Analyze the work and heat interactions associated with a prescribed process path and to perform an analysis of a flow system.						
CO 2	Define the fundamentals of the first and second laws of thermodynamics and explain their application to a wide range of systems.						
CO 3	Evaluate entropy changes in a wide range of processes and determine the reversibility or irreversibility of a process from such calculations.						
CO 4	Solve the problems related to Steam and plot the processes on H-S and T-S diagram. Understand thermodynamics relations.						

Unit-I

Basic Concepts: Thermodynamics: Macroscopic and Microscopic Approach, Thermodynamic Systems, Surrounding and Boundary, Thermodynamic Property – Intensive and Extensive, Thermodynamic Equilibrium, State, Path, Process and Cycle, Quasi-static, Reversible and Irreversible Processes, Working Substance. Concept of Thermodynamic Work and Heat, Zeroth Law of Thermodynamic and its utility.

First Law of Thermodynamics: Energy and its Forms, Energy and 1st law of Thermodynamics, Internal Energy and Enthalpy, 1st Law Applied to Non-Flow Process, Steady Flow Process and Transient Flow Process, Throttling Process and Free Expansion Process.

Unit-II

Second Law of Thermodynamics: Limitations of First Law, Thermal Reservoir Heat Source and Heat Sink, Heat Engine, Refrigerator and Heat Pump, Kelvin- Planck and Clausius Statements and Their Equivalence, Perpetual Motion Machine of Second Kind. Carnot Cycle, Carnot Heat Engine and Carnot Heat Pump, Carnot's Theorem and its Corollaries, Thermodynamic Temperature Scale, Numericals

Entropy: Clausius Inequality and Entropy, Principle of Entropy Increase, Temperature-Entropy Plot, Entropy Change in Different Processes, Introduction to Third Law of thermodynamics.

Unit -III

Availability, Irreversibility and Equilibrium: High and Low Grade Energy, Available Energy and Unavailable Energy, Loss of Available Energy Due to Heat Transfer Through a Finite Temperature Difference, Availability of a Non-Flow or Closed System, Availability of a Steady Flow System, Helmholtz and Gibb's Functions, Effectiveness and Irreversibility.

Pure Substance: Pure Substance and its Properties, Phase and Phase Transformation, Vaporization, Evaporation and Boiling, Saturated and Superheated Steam, Solid – Liquid – Vapour Equilibrium, T-V, P-V and P-T Plots During Steam Formation, Properties of Dry, Wet and Superheated Steam, Property Changes During Steam Processes, Temperature – Entropy (T-S) and Enthalpy – Entropy (H-S) Diagrams, Throttling and Measurement of Dryness Fraction of Steam.

Unit-IV

Thermodynamic Relations: TDS Relations, Enthalpy and Internal Energy as a Function of Independent Variables, Specific Heat Capacity Relations, Clapeyron Equation, Maxwell Relations.

Gas Power Cycles: Air standard efficiency, Otto cycle, Diesel cycle, Dual cycle, Atkinson cycle, Stirling and Ericsson cycles, Brayton or Joule cycle, Lenoir cycle

Text Books:

1. Engineering Thermodynamics – C P Arora, Tata McGraw Hill
2. Engineering Thermodynamics – P K Nag, Tata McGraw Hill
3. Thermodynamics – An Engineering Approach; Y. A. Cengel, M. A. Boles; Tata McGraw Hill

Reference Books:

1. Thermal Science and Engineering – D S Kumar, S K Kataria and Sons
2. Engineering Thermodynamics -Work and Heat transfer – G F C Rogers and Maghew
Y R Longman

Note: The paper setter will set the paper as per the question paper templates provided.

B.Tech (3 rd Semester) Mechanical Engineering								
MEC-207L THEORY OF MACHINES LAB								
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Practical	Total	Time (Hrs)
0	0	2	1	0	40	60	100	3
Purpose : To familiarize and practice the students with various kinds of mechanisms and machines.								
Course Outcomes								
CO 1	To learn about various types of basic mechanism & their applications in different machines.							
CO 2	To study the effect of static and dynamic force on the components of single slider crank mechanism.							
CO 3	To find gyroscopic couple of a motorized gyroscope experimentally.							
CO 4	To study the design and working of various gear, gear trains, steering systems, belt drives, brakes and dynamometers.							

List of experiments

1. To study inversions of 4 bar mechanisms, single and double slider crank mechanisms.
2. To determine the ratio of times and tool velocities of Whitworth quick-return mechanism.
3. To plot slider displacement, velocity and acceleration against crank rotation for single slider crank mechanism.
4. To find out experimentally the Coriolis component of acceleration and compare with theoretical value.
5. To determine the moment of inertia of a flywheel.
6. To plot follower displacement v/s cam rotation for various cam follower systems.
7. To find gyroscopic couple on motorized gyroscope and compare with applied couple.
8. To calculate the torque on planet carrier and torque on internal gear using epicycle gear train and holding torque apparatus.
9. To determine the coefficient of friction between belt and pulley and plot a graph between $\log_{10} T_1/T_2$ v/s θ
10. To study the different types of centrifugal and inertia governor with demonstration.
11. To study different types of brakes and dynamometers with demonstration.
12. To study various types of steering mechanisms.

Note: At least eight experiments are required to be performed by students from the above list and two may be performed from the experiments developed by the institute.

B.Tech. (3 rd semester) Mechanical Engineering								
MEC-209L MECHANICS OF SOLIDS LAB								
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Practical	Total	Time (Hrs.)
0	0	2	1	0	40	60	100	3
Purpose	To make the students aware of different properties of material using different experiments.							
Course Outcomes								
CO1	Ability to design and conduct experiments, acquire data, analyze and interpret data							
CO 2	Ability to determine the behavior of ferrous metals subjected to normal and shear stresses by means of experiments.							
CO 3	Ability to determine the behavior of structural elements, such as bars subjected to tension, compression, shear, bending, and torsion by means of experiments.							
CO 4	Physical insight into the behavior materials and structural elements, including distribution of stresses and strains, deformations and failure modes.							
CO5	Write individual and group reports: present objectives, describe test procedures and results, synthesize and discuss the test results.							

List of Experiments:

1. To study the Brinell hardness testing machine & perform the Brinell hardness test.
2. To study the Rockwell hardness testing machine & perform the Rockwell hardness test.
3. To study the Vickers hardness testing machine & perform the Vickers hardness test.
4. To study the Erichsen sheet metal testing machine & perform the Erichsen sheet metal test.
5. To study the Impact testing machine and perform the Impact tests (Izod&Charpy).
6. To study the Universal testing machine and perform the tensile, compression & bending tests.
7. To perform the shear test on UTM.
8. To study the torsion testing machine and perform the torsion test.
9. To draw shear Force, Bending Moment Diagrams for a simply Supported Beam under point and distributed Loads.
10. To prepare the composite specimen using hot compression molding machine and test for different mechanical properties.

Note: At least eight experiments are required to be performed by students from the above list and two may be performed from the experiments developed by the institute.

B.Tech. (3 rd semester) Mechanical Engineering								
MEC-211 INDUSTRIAL TRAINING-I								
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Practical	Total	Time (Hrs.)
2	0	0	--	--	100	--	100	
Purpose	To provide comprehensive learning platform to students where they can enhance their employ ability skills and exposure to the industrial environment.							
Course Outcomes								
CO1	Capability to acquire and apply fundamental principles of engineering.							
CO 2	Become updated with all the latest changes in technological world.							
CO 3	Capability and enthusiasm for self-improvement through continuous professional development and life-long learning							
CO 4	Awareness of the social, cultural, global and environmental responsibility as an engineer.							

Note:MEC-211 is a mandatory non-credit course in which the students will be evaluated for the industrial training undergone after 2nd semester and students will be required to get passing marks to qualify.

The candidate has to submit a training report of his/her work/project/assignment completed in the industry during the training period. The evaluation will be made on the basis of submitted training report and viva-voce/presentation.

B.Tech. (3 rd semester) Mechanical Engineering							
MC-901 Environmental Sciences							
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Total	Time
3	0	0	-	75	25	100	3 Hrs.
Purpose	To learn the multidisciplinary nature, scope and importance of Environmental sciences.						
Course Outcomes							
CO1	The students will be able to learn the importance of natural resources.						
CO2	To learn the theoretical and practical aspects of eco system.						
CO3	Will be able to learn the basic concepts of conservation of biodiversity.						
CO4	The students will be able to understand the basic concept of sustainable development.						

UNIT I

The Multidisciplinary Nature of Environmental Studies. Definition, Scope and Importance. Need for public awareness. Natural Resources: Renewable and Non-Renewable Resources: Natural resources and associated problems.

- (a) Forest Resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
- (b) Water Resources- Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
- (c) Mineral Resources- Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
- (d) Food Resources- World Food Problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- (e) Energy Resources- Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.
- (f) Land Resources- Land as a resource, land, degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources, equitable use of resources for sustainable lifestyle.

UNIT II

Ecosystem-Concept of an Ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological Succession. Food Chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem-

- a. Forest Ecosystem
- b. Grassland Ecosystem
- c. Desert Ecosystem
- d. Aquatic Ecosystems(ponds, streams, lakes, rivers, oceans, estuaries)

Field Work. Visit to a local area to document Environment assets-river/forest/grassland/hill/mountain. Visit to a local polluted site- Urban /Rural Industrial/Agricultural. Study of common plants, insects and birds. Study of simple ecosystems-pond, river, hill, slopes etc. (Field work equal to 5 lecture hours).

UNIT III

Biodiversity and Its Conservation. Introduction, Definition: genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Bio-diversity of global, National and local levels. India as a mega-diversity nation Hot spots of Biodiversity. Threats to biodiversity: Habitat loss, poaching of wild life, man-wildlife conflicts.

Endangered and endemic species of India. Conservation of Biodiversity- In situ and Ex-Situ conservation of biodiversity.

Environmental Pollution Definition. Cause, effects and control measures of- (a) Air Pollution (b) Water Pollution (c) Soil Pollution (d) Marine Pollution (e) Noise Pollution (f) Thermal Pollution (g) Nuclear Hazards

Solid waste management- cause, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides

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.

Environmental Ethics-Issues and Possible Solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. Wasteland Reclamation. Consumerism and waste products.

Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and Control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public Awareness.

Human Population and the Environment. Population growth, variation among nations. Population explosion-Family Welfare Programme. Environment and human health. Human rights. Value Education. HIV/AIDS, Women and Child Welfare. Role of Information Technology in Environment and Human Health. Case Studies. Drugs and their effects; Useful and harmful drugs; Use and abuse of drugs; Stimulant and depressant drugs. Concept of drug de-addiction. Legal position on drugs and laws related to drugs.

Text Books

1. Environmental Studies- Deswal and Deswal. Dhanpat Rai & Co.
2. Environmental Science & Engineering Anandan, P. and Kumaravelan, R. 2009. Scitech Publications (India) Pvt. Ltd., India

Reference Books:

1. Environmental Studies. Daniels Ranjit R. J. and Krishnaswamy. 2013. Wiley India.
2. Environmental Science- Botkin and Keller. 2012. Wiley, India

Note: The paper setter will set the paper as per the question paper templates provided.

Fourth Semester

B.Tech. (4 th Semester) Mechanical Engineering							
ES-204 MATERIALS ENGINEERING							
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Total	Time (Hrs.)
3	0	0	3	75	25	100	3
Purpose:	To understand internal structure- properties relationship of different types of materials and learn about Metallographic analysis and Characterization.						
Course Outcomes							
CO 1	To understand the Crystal structures and deformation mechanism in various materials.						
CO 2	To study various types of phase diagrams, TTT curve and Iron carbon diagram. To learn about different heat treatment processes.						
CO 3	To learn about the failure mechanisms like Creep and Fatigue and designation of materials.						
CO 4	To study Basics of Metallography and Basic Principle involved in the working of various types of Material characterization techniques.						

UNIT I

Crystallography: Review of Crystal Structure, Space Lattice, Coordination Number, Number of Atoms per Unit Cell, Atomic Packing Factor; Numerical Problems Related to Crystallography.

Imperfection in Metal Crystals: Crystal Imperfections and their Classifications, Point Defects, Line Defects, Edge & Screw Dislocations, Surface Defects, Volume Defects.

Introduction to Engineering materials and Standard Materials Designation: Introduction to Engineering materials, Steel Terminology, Standard Designation System for Steels, Indian Standard specifications for steels as per BIS: Based on Ultimate Tensile Strength and based on Composition, AISI-SAE standard designation for Steels and Aluminium Alloys

UNIT II

Phase Diagrams: Alloy Systems, Solid solutions, Hume Rothery's Rules, Intermediate phases, Phase Diagrams, Gibbs Phase Rule, Cooling curves, The Lever Rule, binary phase diagrams, Applications of Phase Diagrams, Phase Transformation, Micro constituents of Fe-C system, Allotropic forms of Iron, Iron-iron carbide phase diagram, Modified Iron Carbon Phase Diagrams, Isothermal Transformation, TTT Curve,

Heat Treatment: Heat treatment of steels, Annealing, Normalising, Hardening, Tempering, Case Hardening, Ageing, Austempering and Martempering, Surface Hardening, Mass Effect, Equipments for Heat Treatment, Major Defects in Metals or Alloys due to faulty Heat treatment.

UNIT III

Deformation of Metal: Elastic and Plastic Deformation, Mechanism of Plastic Deformation, Slip; Critical Resolved Shear Stress, Twinning, Conventional and True Stress Strain Curves for Polycrystalline Materials, Yield Point Phenomena, Bauschinger Effect, Work Hardening.

Failure of Materials: Fatigue, Fatigue fracture, fatigue failure, Mechanism of Fatigue Failure, Fatigue Life calculations, Fatigue Tests, Theories of Fatigue.

Creep: Creep Curve, Types of Creep, Factors affecting Creep, Mechanism of Creep, Creep Resistant Material, Creep Fracture, Creep Test, Stress Rupture test.

UNIT IV

Introduction to Metallography: Metallography, Phase analysis, Dendritic growth, Cracks and other defects Corrosion analysis, Intergranular attack (IGA), Coating thickness and integrity, Inclusion size, shape and distribution, Weld and

heat-affected zones (HAZ), Distribution and orientation of composite fillers, Graphite nodularity, Intergranular fracturing

Materials Characterization Techniques: Characterization techniques such as X-Ray Diffraction (XRD), Scanning Electron Microscopy, transmission electron microscopy, atomic force microscopy, scanning tunneling microscopy, Atomic absorption spectroscopy.

Text Books:

1. Material Science by S.L. Kakani, New Age Publishers.
2. The Science and Engineering of Materials, Donald R. Askeland, Chapman & Hall.
3. Fundamentals of Material Science and Engineering by W. D. Callister, Wiley.
4. Fundamentals of Light Microscopy and Electronic Imaging by Douglas B. Murphy, Kindle Edition 2001
5. Materials Science and Engineering, V. Raghvan
6. Phase Transformation in Metals and Alloys, D. A. Porter & K.E. Easterling

Reference Books:

7. Material Science by Narula, TMH
8. Metallographic Handbook by Donald C. Zipperian, Pace Technologies, USA.
9. Robert Cahn Concise Encyclopedia of Materials Characterization, Second Edition: 2nd Edition (Advances in Materials Science and Engineering) Elsevier Publication 2005.
10. Smart Materials and Structures by Gandhi and Thompson, Chapman and Hall.

Note: The paper setter will set the paper as per the question paper templates provided.

B. Tech. (4 th Semester) Mechanical Engineering							
MEC-202 APPLIED THERMODYNAMICS							
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Total	Time (Hrs.)
3	0	0	3	75	25	100	3
Purpose:	This course aims to provide a platform to students to understand, model and analyze concept of dynamics involved in thermal energy transformation. To prepare them to carry out experimental investigation and analysis of problems related to applied thermodynamics.						
Course Outcomes							
CO1	Understand the working of boilers, types of boilers, accessories and mountings used on boilers.						
CO 2	Learn about simple and modified Rankine cycles.						
CO 3	Understand the design and analysis of steam flow through steam nozzles. To learn about the working of different types of condensers.						
CO 4	Analyze the working and design of the steam turbine and apply the knowledge in solving the engineering problems of turbines.						

UNIT I

Steam Generators: Introduction; classification of boilers; comparison of fire tube and water tube boiler; their advantages; description of boiler; Lancashire; locomotive; Babcock; Wilcox etc.; boiler mountings; stop valve; safety valve; blow off valve; feed check etc.; water level indicator; fusible plug; pressure gauge; boiler accessories; feed pump; feed water heater; preheater; super heater; economizer; natural draught chimney design; artificial draught; steam jet draught; mechanical draught; calculation of boiler efficiency and equivalent evaporation.

UNIT II

Vapour Power Cycles: Simple and modified Rankine cycle; effect of operating parameters on Rankine cycle performance; effect of superheating; effect of maximum pressure; effect of exhaust pressure; reheating and regenerative Rankine cycle; types of feed water heater; reheat factor; binary vapour cycle. Simple steam engine, compound engine; function of various components.

UNIT III

Steam Nozzle: Function of steam nozzle; shape of nozzle for subsonic and supersonics flow of stream; variation of velocity; area of specific volume; steady state energy equation; continuity equation; nozzle efficiency; critical pressure ratio for maximum discharge; physical explanation of critical pressure; super saturated flow of steam; design of steam nozzle. Advantage of steam condensation; component of steam condensing plant; types of condensers; air leakage in condensers; Dalton's law of partial pressure; vacuum efficiency; calculation of cooling water requirement; air expansion pump.

UNIT IV

Steam Turbines: Introduction; classification of steam turbine; impulse turbine; working principle; compounding of impulse turbine; velocity diagram; calculation of power output and efficiency; maximum efficiency of a single stage impulse turbine; design of impulse turbine blade section; impulse, reaction turbine; working principle; degree of reaction; parsons turbine; velocity diagram; calculation of power output; efficiency of blade height; condition of maximum efficiency; internal losses in steam turbine; governing of steam turbine.

Text Books:

1. Thermal Engineering – P L Ballaney, Khanna Publishers.
2. Thermodynamics and Heat Engines vol II – R Yadav, Central Publishing House

3. Engineering Thermodynamics Work and Heat Transfer - G. F. C Rogers and Y. R. Mayhew, Pearson.
4. Applied Thermodynamics for Engineering Technologists - T. D. Eastop and A. McConkey, Pearson.

Reference Books:

1. Applied Thermodynamics for Engineering Technologists – T D Eastop and A. McConkey, Pearson Education
2. Heat Engineering – V P Vasandani and D S Kumar, Metropolitan Book Co Pvt Ltd.

Note: The paper setter will set the paper as per the question paper templates provided.

B. Tech. (4 th Semester) Mechanical Engineering							
MEC-204 FLUID MECHANICS&FLUID MACHINES							
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Total	Time
3	1	0	4	75	25	100	3
Purpose: To build a fundamental understanding of concepts of Fluid Mechanics and their application in rotodynamic machines.							
Course Outcomes							
CO1	Upon completion of this course, students will be able to apply mass and momentum conservation laws to mathematically analyze simple flow situations.						
CO2	The students will be able to obtain solution for boundary layer flows using exact or approximate methods.						
CO3	The students will be able to estimate the major and minor losses through pipes and learn to draw the hydraulic gradient and total energy lines.						
CO4	The students will be able to obtain the velocity and pressure variations in various types of simple flows.						
CO5	They will be able to analyze the flow and evaluate the performance of pumps and turbines.						

Unit I

Fluid Properties: Definition of fluid, Newton's law of viscosity, Units and dimensions-Properties of fluids, mass density, weight density, specific volume, specific gravity, viscosity, compressibility, surface tension and capillarity.

Fluid Kinematics: Types of fluid flows, stream, streak and path lines; flow rate and continuity equation, differential equation of continuity in cartesian and polar coordinates, rotation and vorticity, circulation, stream and potential functions, flow net. Problems.

Fluid Dynamics: Concept of system and control volume, Euler's equation, Navier-Stokes equation, Bernoulli's equation and its practical applications, Impulse momentum equation. Problems.

Unit II

Viscous Flow: Flow regimes and Reynold's number, relationship between shear stress and pressure gradient. Exact flow solutions, Couette and Poiseuille flow, laminar flow through circular conduits. Problems.

Turbulent Flow Through Pipes: Darcy Weisbach equation, friction factor, Moody's diagram, minor losses in pipes, hydraulic gradient and total energy lines, series and parallel connection of pipes, branched pipes; equivalent pipe, power transmission through pipes. Problems.

Boundary Layer Flow: Concept of boundary layer, measures of boundary layer thickness, Blasius solution, von-Karman momentum integral equation, laminar and turbulent boundary layer flows, separation of boundary layer and its control. Problems.

Unit III

Dimensional Analysis: Need for dimensional analysis – methods of dimension analysis – Dimensionless parameters – application of dimensionless parameters. Problems.

Hydraulic Pumps: Introduction, theory of Rotodynamic machines, Classification, various efficiencies, velocity components at entry and exit of the rotor, velocity triangles; Centrifugal pumps, working principle, work done by the impeller, minimum starting speed, performance curves, Cavitation in pumps, Reciprocating pumps, working principle, Indicator diagram, Effect of friction and acceleration, air vessels, Problems.

Unit IV

Hydraulic Turbines: Introduction, Classification of water turbines, heads and efficiencies, velocity triangles, Axial, radial and mixed flow turbines, Pelton wheel, Francis turbine and Kaplan turbines, working principles, work done, design of turbines, draft tube and types, Specific speed, unit quantities, performance curves for turbines, governing of turbines. Problems.

Text Books:

1. Introduction to Fluid Mechanics – R.W. Fox, Alan T. McDonald, P.J. Pritchard, Wiley Publications.
2. Fluid Mechanics – Frank M. White, McGraw Hill
3. Fluid Mechanics and Fluid Power Engineering – D.S. Kumar, S.K. Kataria and Sons
4. Fluid Mechanics – Streeter V L and Wylie E B, Mc Graw Hill
5. Introduction to Fluid Mechanics and Fluid Machines – S.K. Som and G. Biswas, Tata McGraw Hill.

Reference Books:

1. Mechanics of Fluids – I H Shames, Mc Graw Hill
2. Fluid Mechanics: Fundamentals and Applications - YunusCengel and John Cimbala, McGraw Hill.
3. Fluid Mechanics: Pijush K. Kundu, Ira M. Cohen and David R. Rowling, Academic Press.

Note: The paper setter will set the paper as per the question paper templates provided.

B. Tech. (4 th Semester) Mechanical Engineering							
MEC-206 MECHANICS OF SOLIDS-II							
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Total	Time (Hrs.)
3	1	0	4	75	25	100	3
Purpose	The objective of this course is to show the development of strain energy and stresses in springs, pressure vessel, rings, links, curved bars under different loads. The course will help the students to build the fundamental concepts in order to solve engineering problems						
Course Outcomes							
CO1	Identify the basics concepts of strain energy and various theories of failures and solve the problems						
CO 2	Differentiate different types of stresses induced in thin pressure vessel and solve the problems. Use of Lamé's equation to calculate the stresses induced in thick pressure vessel.						
CO 3	Able to compute stresses in ring, disk and cylinder due to rotation. Classify the different types of spring and analyze the stresses produced due to loading						
CO 4	Determine the stresses in crane hook, rings, chain link for different cross section and also the deflection of curved bars and rings. Analyze the stresses due to unsymmetrical bending and determine the position of shear centre of different section.						

Unit I

Strain Energy & Impact Loading: Definitions, expressions for strain energy stored in a body when load is applied (i) gradually, (ii) suddenly and (iii) with impact, strain energy of beams in bending, beam deflections, strain energy of shafts in twisting, energy methods in determining spring deflection, Castigliano's theorem, Numerical.

Theories of Elastic Failures: Various theories of elastic failures with derivations and graphical representations, applications to problems of 2- dimensional stress system with (i) Combined direct loading and bending, and (ii) combined torsional and direct loading, Numericals.

Unit II

Thin Walled Vessels: Hoop & Longitudinal stresses & strains in cylindrical & spherical vessels & their derivations under internal pressure, wire wound cylinders, Numericals.

Thick Cylinders & Spheres: Derivation of Lamé's equations, radial & hoop stresses and strains in thick, and compound cylinders and spherical shells subjected to internal fluid pressure only, hub shrunk on solid shaft, Numericals.

Unit III

Rotating Rims & Discs: Stresses in uniform rotating rings & discs, rotating discs of uniform strength, stresses in (i) rotating rims, neglecting the effect of spokes, (ii) rotating cylinders, hollow cylinders & solid cylinders. Numericals.

Springs: Stresses in closed coiled helical springs, Stresses in open coiled helical springs subjected to axial loads and twisting couples, leaf springs, flat spiral springs, concentric springs, Numericals.

Unit IV

Bending of Curved Bars : Stresses in bars of initial large radius of curvature, bars of initial small radius of curvature, stresses in crane hooks, rings of circular & trapezoidal sections, deflection of curved bars & rings, deflection of rings by Castigliano's theorem, stresses in simple chain links, deflection of simple chain links, Problems.

Unsymmetrical Bending: Introduction to unsymmetrical bending, stresses due to unsymmetrical bending, deflection of beam due to unsymmetrical bending, shear center for angle, channel, and I-sections, Numericals.

Text Books:

1. Strength of Materials – R.K. Rajput, Dhanpat Rai & Sons.
2. Strength of Materials – Sadhu Singh, Khanna Publications.
3. Strength of Materials – R.K. Bansal, Laxmi Publications.

Reference Books:

1. Strength of Materials – Popov, PHI, New Delhi.
2. Strength of Materials – Robert I. Mott, Pearson, New Delhi
3. Strength of Material – Shaums Outline Series – McGraw Hill
4. Strength of Material – Rider – ELBS

Note: The paper setter will set the paper as per the question paper templates provided.

B. Tech. (4 th Semester) Mechanical Engineering							
Instrumentation & Control							
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Total	Time(Hrs)
3	0	0	3	75	25	100	3
Purpose	To understand the basics of the measurement of various quantities using instruments, their accuracy and range and the techniques for controlling devices automatically.						
Course Outcomes							
CO1	Students will have basic knowledge about measurement systems and their components.						
CO2	Students will learn about various sensors used for measurement of mechanical quantities.						
CO3	Students will have basic knowledge of process monitoring and control.						

Unit I

Instrumentation System: introduction, typical applications of instrument systems, functional elements of a measurement system, classification of instruments, standards and calibration, static and dynamic characteristics of measurement systems.

Statistical Error Analysis: statistical analysis of data and measurement of uncertainty: probability, confidence interval or level, mean value and standard deviation calculation, standard normal distribution curve and probability tables, sampling and theory based on samples, goodness of fit, curve fitting of experimental data.

Unit II

Sensors and Transducers: introduction and classification, transducer selection and specifications, primary sensing elements, resistance transducers, variable inductance type transducers, capacitive transducers, piezo-electric transducers, strain gauges. Smart Sensors: Introduction, architecture of smart sensor, bio sensor and physical sensor, Piezo-resistive pressure sensor, microelectronic sensor.

Measurement of force, torque, shaft power, speed and acceleration: force and weight measurement system, measurement of torque, shaft power, speed and velocity: electrical and contactless tachometers, acceleration: vibrometers, seismic and piezo-electric accelerometer.

Unit III

Measurement of pressure, temperature and flow: Basic terms, Pressure: Liquid column manometers, elastic type pressure gauges, electrical types for pressure and vacuum, temperature measuring instruments: RTD sensors, NTC thermistor, thermocouples, and semiconductor based sensors. Flow Measurement: drag force flow meter, turbine flow meter, electronic flow meter, electromagnetic flow meter, hot-wire anemometer.

Instruments for measuring Humidity, Density, and Viscosity: Humidity definitions, Humidity measuring devices, Density and Specific Gravity, Basic terms, Density measuring devices, Density application considerations, Viscosity, Viscosity measuring instruments, basic terms used in pH, pH measuring devices, pH application considerations. Problems.

Unit IV

Basic Control System: Introduction, basic components of control system, classification : closed loop and open loop control system, transfer function, block diagram representation of closed loop system and its reduction techniques, mathematical modelling of various mechanical systems and their analogy with electrical systems, signal flow graph and its representation.

Mechanical Controllers: Basics of actuators: pneumatic controller, hydraulic controller and their comparison.

Text Books:

1. Instrument and control by Patranabis D., PHI Learning.
2. Fundamental of Industrial Instrumentation and Process control by W.C.DUNN, McGrawHill,
3. Thomas G. Beckwith, Roy D. Marangoni, John H. LienhardV , Mechanical Measurements (6th Edition), Pearson Education India, 2007
4. Gregory K. McMillan, Process/Industrial Instruments and Controls Handbook, Fifth Edition, McGraw-Hill: New York, 1999.

Reference Books:

1. Mechanical Measurement and Control by A K Sawhney
2. Modern control Engineering by Katsuhiko Ogata, PHI publication

Note: The paper setter will set the paper as per the question paper templates provided.

B. Tech. (4 th Semester) Mechanical Engineering								
ES-206L MATERIALS ENGINEERING LAB								
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Practical	Total	Time (Hrs.)
0	0	2	1	-	40	60	100	3
Purpose	To make the students aware of material structure and properties of material using different experiments.							
Course Outcomes								
CO 1	Ability to design and conduct experiments, acquire data, analyze and interpret data							
CO 2	Ability to determine the grain size and microstructure in different Ferrous alloys by means of experiments.							
CO 3	Ability to learn about microstructures of different Non-Ferrous alloys by means of experiments.							
CO 4	To learn about heat treatment processes through experiments.							
CO 5	Ability to Analyze microstructure of Heat-treated specimens and perform Fatigue and creep test on different materials.							

List of Experiments:

1. To Study various Crystal Structures through Ball Models.
2. To study the components and functions of Metallurgical Microscope.
3. To learn about the process of Specimen Preparation for metallographic examination.
4. To perform Standard test Methods for Estimation of Grain Size.
5. To perform Microstructural Analysis of Carbon Steels and low alloy steels.
6. To perform Microstructural Analysis of Cast Iron.
7. To perform Microstructural Analysis of Non-Ferrous Alloys: Brass & Bronze.
8. To perform Microstructural Analysis of Non-Ferrous Alloys: Aluminium Alloys.
9. To Perform annealing of a steel specimen and to analyze its microstructure.
10. To Perform Hardening of a steel specimen and to analyze its microstructure.
11. To perform Fatigue test on fatigue testing machine.
12. To perform Creep test on creep testing machine.

Note: At least eight experiments are required to be performed by students from the above list and two may be performed from the experiments developed by the institute.

B. Tech. (4 th Semester) Mechanical Engineering								
MEC-210L FLUID MECHANICS & FLUID MACHINES LAB								
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Practical	Total	Time
0	0	2	1	0	40	60	100	3
Purpose	To familiarize the students with the equipment and instrumentation of Fluid Mechanics and Machines							
Course Outcomes								
CO1	Operate fluid flow equipment and instrumentation.							
CO2	Collect and analyse data using fluid mechanics principles and experimentation methods.							
CO3	Determine the coefficient of discharge for various flow measurement devices.							
CO4	Calculate flow characteristics such as Reynolds number, friction factor from laboratory measurements.							
CO5	Analyze the performance characteristics of hydraulic pumps.							
CO6	Analyze the performance characteristics of hydraulic turbines.							

List of Experiments:

1. To verify the Bernoulli's Theorem.
2. To determine coefficient of discharge of an orifice meter.
3. To determine the coefficient of discharge of Venturimeter.
4. To determine the coefficient of discharge of Notch.
5. To find critical Reynolds number for a pipe flow.
6. To determine the friction factor for the pipes.
7. To determine the meta-centric height of a floating body.
8. Determination of the performance characteristics of a centrifugal pump.
9. Determination of the performance characteristics of a reciprocating pump.
10. Determination of the performance characteristics of a gear pump.
11. Determination of the performance characteristics of Pelton Wheel.
12. Determination of the performance characteristics of a Francis Turbine.
13. Determination of the performance characteristics of a Kaplan Turbine.
14. Determination of the performance characteristics of a Hydraulic Ram.

Note: At least ten experiments are required to be performed by students from the above list and two may be performed from the experiments developed by the institute.

B. Tech. (4 th Semester) Mechanical Engineering							
MC-902	Constitution of India						
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Total	Time
3	0	0	-	75	25	100	3 Hrs.
Purpose	To know the basic features of Constitution of India						
	Course Outcomes						
CO1	The students will be able to know about salient features of the Constitution of India.						
CO2	To know about fundamental duties and federal structure of Constitution of India.						
CO3	To know about emergency provisions in Constitution of India.						
CO4	To know about fundamental rights under constitution of India.						

UNIT I

Meaning of the constitution law and constitutionalism, Historical perspective of the Constitution of India. Salient features and characteristics of the Constitution of India.
Scheme of the fundamental rights

UNIT II

The scheme of the Fundamental Duties and its legal status. The Directive Principles of State Policy – Its importance and implementation. Federal structure and distribution of legislative and financial powers between the Union and the States.
Parliamentary Form of Government in India – The constitution powers and status of the President of India

UNIT III

Amendment of the Constitutional Powers and Procedure. The historical perspectives of the constitutional amendments in India.
Emergency Provisions: National Emergency, President Rule, Financial Emergency. Local Self Government – Constitutional Scheme in India.

UNIT IV

Scheme of the Fundamental Right to Equality. Scheme of the Fundamental Right to certain Freedom under Article 19.

Scope of the Right to Life and Personal Liberty under Article 21.

Text Books

1. Constitution of India. Prof. Narender Kumar (2008) 8th edition. Allahabad Law Agency.

Reference Books:

1. The constitution of India. P.M. Bakshi (2016) 15th edition. Universal law Publishing.