Gurugram University Gurugram

Curriculum for UG Degree Course

in

ROBOTICS AND AUTOMATION

(Engineering & Technology)

Gurugram University Scheme of Studies and Examination

Bachelor of Technology Semester 3

S. No.	Category	Code	Course Title	Hours per week			Credits	Marks for Sessional	Marks for End Term Examination	Total
				L	T	P				
1	BSC		Mathematics-III	3	0	0	3	**30**	**70**	**100**
2	ESC		Electronic Devices and Circuits	3	0	0	3	**30**	**70**	**100**
3	ESC		Digital Electronics	3	0	0	3	**30**	**70**	**100**
4	PCC		Thermodynamics	3	0	0	3	**30**	**70**	**100**
5	ESC		Object Oriented Programming using C++	3	0	0	3	**30**	**70**	**100**
6	PCC		Strength of Materials	3	0	0	3	**30**	**70**	**100**
7	LC		Digital Electronics (P)	0	0	2	1	**50**	**50**	**100**
8	LC		Thermodynamics _LAB (P)	0	0	2	1	**50**	**50**	**100**
9	LC		Strength of materials _LAB (P)	0	0	2	1	**50**	**50**	**100**
10	LC		Object Oriented Programming using C++	0	0	2	1	**50**	**50**	**100**
11	MC		**Constitution of India**	2	0	0	0	30	70	100
TOTAL				28			22			

NOTE:

Indian Constitution: Non-credit mandatory course, students have to attain pass marks (40%)

The examination of the regular students will be conducted by the concerned college/Institute internally. Each student will be required to score a minimum of 40% marks to qualify in the paper. The marks will not be included in determining the percentage of marks obtained for the award of a degree. However, these marks will be shown in the detailed marks certificate of the students.

Mathematics III

Course code					
Course title	**Mathematics III**				
Category	**Basic Science Course**				
Semester and Credits	L	T	P	**Credits**	Semester
	3	0	0	3	III
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objectives:

(1) To introduce the solution methodologies for second order Partial Differential Equations with applications in engineering

(2) To provide an overview of probability and statistics to engineers

UNIT-I

Definition of Partial Differential Equations, First order partial differential equations, solutions of first order linear PDEs; Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method. Second-order linear equations and their classification, Initial and boundary conditions, D'Alembert's solution of the wave equation.

UNIT-II

Duhamel's principle for one dimensional wave equation. Heat diffusion and vibration problems, Separation of variables method to simple problems in Cartesian coordinates. The Laplacian in plane, cylindrical and spherical polar coordinates, solutions with Bessel functions and Legendre functions. One dimensional diffusion equation and its solution by separation of variables.

UNIT-III

Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality. Continuous random variables and their properties, distribution functions and densities, normal, exponential, and gamma densities. Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.

UNIT-IV

Basic Statistics, Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation. Curve fitting by the method of least squares- fitting of straight lines, second-degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, Tests for single mean, difference of means, and difference of standard deviations. Test for ratio of variances – Chi-square test for goodness of fit and independence

of attributes.

Course Outcomes:
Upon completion of this course, students will be able to

1. Solve field problems in engineering involving PDEs.
2. Formulate and solve problems involving random variables
3. Apply statistical methods for analysing experimental data.
4. Acquire a solid understanding of linear algebra and its applications in engineering
5. Enhance mathematical reasoning and critical thinking
6. Gain knowledge of Probability and its types

Textbooks/References:
1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
3. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
4. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

Electronic Devices and Circuits

Course Code					
Category	Professional Core Course				
Course Title	Electronic Devices and Circuits				
Semester and Credits	L	T	P	Credits	Semester - III
	3	0	0	3	
Class Work	30 Marks				
Examination	70 Marks				
Total	100 Marks				
Duration of Exams	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objectives:
OBJECTIVES:

- The student should be made to:
- Understand the structure of basic electronic devices.
- Be exposed to active and passive circuit elements.
- Explore the characteristics of amplifier gain and frequency response.
- Learn the required functionality of positive and negative feedback systems

UNIT I

PN junction diode structure, operation and V-I characteristics, diffusion and transition capacitance Rectifiers: Half Wave and Full Wave Rectifier, Display devices: LED, Laser diodes, Zener diode characteristics, Zener Reverse characteristics , Zener as regulator, thyristors and IGBTS structure and characteristics.

UNIT II
BJT small signal model: Analysis of CE, CB, CC amplifiers-Gain and frequency response MOSFET small signal model: Analysis of CS and Source follower, Gain and frequency response High frequency analysis.

UNIT III
BIMOS cascade amplifier, Differential amplifier :Common mode and Difference mode analysis FET input stages ,Single tuned amplifiers , Gain and frequency response ,Neutralization methods, power amplifiers Types (Qualitative analysis).

UNIT IV
Advantages of negative feedback ,voltage / current, series, Shunt feedback ,positive feedback Condition for oscillations, phase shift ,Wien bridge, Hartley, Colpitts and Crystal oscillators.

Course Outcomes:
After completing this course, the students should be able to
CO1 : Explain the structure and working operation of basic electronic devices.

CO2 : Able to identify and differentiate both active and passive elements
CO3 : Analyse the characteristics of different electronic devices such as diodes and transistors
CO4 : Choose and adapt the required components to construct an amplifier circuit.
CO5 : Employ the acquired knowledge in design and analysis of oscillators

TEXT BOOKS:
1. David A. Bell ,"Electronic devices and circuits", Oxford University higher education, 5th edition 2008.
2. Electronic Devices and Circuit Theory" by Robert L. Boylestad and Louis Nashelsky.
REFERENCE BOOKS
1. Balbir Kumar, Shail.B.Jain, "Electronic devices and circuits" PHI learning private limited, 2nd edition 2014.
2. Thomas L.Floyd, "Electronic devices" Conventional current version, Pearson prentice hall, 10th Edition, 2017.
3. Donald A Neamen, "Electronic Circuit Analysis and Design" Tata McGraw Hill, 3rd Edition, 2003.
4. Robert L.Boylestad, "Electronic devices and circuit theory", 2002

Course Code					
Category	**Professional Core Course**				
Course Title	**Digital Electronics**				
Semester and Credits	L	T	P	Credits	Semester - III
	3	0	0	3	
Class Work	30 Marks				
Examination	70 Marks				
Total	100 Marks				
Duration of Exams	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objective: The objectives of this course are as under:

- To provide a comprehensive introduction to digital logic design leading to the ability to understand binary codes, binary arithmetic and Boolean algebra and its relevance to digital logic design.
- To study number system and codes.
- To design & analyse combinational circuits and synchronous sequential logic circuits.
- To familiarize students with basics of digital logic families.

Unit-I

Number system and codes: Binary, octal, hexadecimal and decimal Number systems and their inter conversion, BCD numbers (8421-2421), gray code, excess–3 code, cyclic code, code conversion, ASCII, EBCDIC codes. Binary addition and subtraction, signed and unsigned binary numbers, 1's and 2's complement representation.

Unit-II

Boolean Algebra: Basic logic circuits: Logic gates (AND, OR, NOT, NAND, NOR, Ex-OR, Ex NOR and their truth tables,), Universal Gates, Laws of Boolean algebra, De-Morgan's theorem, Min term, Max term, POS, SOP, K Map, Simplification by Boolean theorems, don't care condition

Logic Families: Introduction to digital logic family such as RTL, DTL, TTL, ECL, CMOS, IIR, HTL etc., their comparative study, Basic circuit, performance characteristics, Wired logic, open collector output etc.

Unit-III

Combinational Logic: The Half adder, the full adder, subtractor circuit. Multiplexer demultiplexer, decoder, BCD to seven segment decoders, encoders.

Flip flop and Timing circuit: set-reset laches, D-flipflop, R-S flip-flop, J-K Flip-flop, Master slave Flip flop, edge triggered flip-flop, T flip-flop.

Unit-IV

Registers & Counters: Synchronous/Asynchronous counter operation, Up/down synchronous counter, application of counter, Serial in/Serial out shift register, Serial in/Serial out shift register, Serial in/parallel out shift register, parallel in/ parallel out shift register, parallel in/Serial out shift register, Bi-directional register.

Course outcomes:

After completing this course, the students should be able to

CO 1:To present a problem oriented introductory knowledge of Digital circuits and its applications.

CO2: Learn Number system and codes.

CO3: Study Boolean algebra and theorems

CO4:To focus on the study of electronic circuits

CO5::Design and analyse combinational circuits.
CO6:Design and analyse synchronous sequential logic circuits.

Text/Reference Books:

1. R.P. Jain, “Modern digital Electronics”, Tata McGraw Hill.
2. Digital Fundamentals by Morris and Mano, PHI Publication
3. Fundamental of digital circuits by A. ANANDKUMAR, PHI Publication

THERMODYNAMICS

Category	Professional Core Course				
Course Title	**Thermodynamics**				
Semester and Credits	L	T	P	Credits	Semester - III
	3	0	0	3	
Class Work	30 Marks				
Examination	70 Marks				
Total	100 Marks				
Duration of Exams	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objectives:

1 To learn about work and heat interactions, and balance of energy between system and its surroundings
2 To learn about application of I law to various energy conversion devices
3 To evaluate the changes in properties of substances in various processes
4 To understand the difference between high grade and low-grade energies and II law limitations on energy conversion

UNIT-I

Fundamentals - System & Control volume; Property, State & Process; Exact & Inexact differentials; Work-Thermodynamic definition of work; examples; Displacement work; Path dependence of displacement work and illustrations for simple processes; electrical, magnetic, gravitational, spring and shaft work.
Temperature, Definition of thermal equilibrium and Zeroth law; Temperature scales; Various Thermometers-Definition of heat; examples of heat/work interaction in systems- First Law for Cyclic & Non-cyclic processes; Concept of total energy E ; Demonstration that E is a property; Various modes of energy, Internal energy and Enthalpy.

UNIT-II

Definition of Pure substance, Ideal Gases and ideal gas mixtures, Real gases and real gas mixtures, Compressibility charts- Properties of two phase systems - Const. temperature and Const. pressure heating of water; Definitions of saturated states; P-v-T surface; Use of steam tables and R134a tables; Saturation tables; Superheated tables; Identification of states & determination of properties, Mollier's chart.

UNIT-III

First Law for Flow Processes - Derivation of general energy equation for a control volume; Steady state steady flow processes including throttling; Examples of steady flow devices; Unsteady processes; examples of steady and unsteady I law applications for system and control volume. Second law - Definitions of direct and reverse heat engines; Definitions of thermal efficiency and COP; Kelvin-Planck and Clausius statements; Definition of reversible process; Internal and external irreversibility; Carnot cycle; Absolute temperature scale.

UNIT-IV

Clausius inequality; Definition of entropy S ; Demonstration that entropy S is a property; Evaluation of S for solids, liquids, ideal gases and ideal gas mixtures undergoing various processes; Determination of s from steam tables-Principle of increase of entropy; Illustration of processes in Ts coordinates; Definition of Isentropic efficiency for compressors, turbines and nozzles-Irreversibility and Availability, Availability function for systems and Control volumes undergoing different processes, Lost work. Second law analysis for a control volume. Exergy balance equation and Exergy analysis. Thermodynamic cycles - Basic Rankine cycle; Basic Brayton cycle; Basic vapor compression cycle and comparison with Carnot cycle.

Course Outcomes:

After completing this course, the students will be able to

CO1. Apply energy balance to systems and control volumes, in situations involving heat and work interactions

CO2. Evaluate changes in thermodynamic properties of substances

CO3. Evaluate the performance of energy conversion devices

CO4. Differentiate between high grade and low grade energies.

CO5. Comprehend thermodynamic principles to analyze and solve problems related to energy transfer and conversion in engineering systems

CO6. Analyze and evaluate the behavior of thermodynamic systems, such as ideal gases, mixtures, and pure substances

Text Books:

1. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, Fundamentals of Thermodynamics, John Wiley and Sons.

2. Jones, J. B. and Duggan, R. E., 1996, Engineering Thermodynamics, Prentice-Hall of India

3. Moran, M. J. and Shapiro, H. N., 1999, Fundamentals of Engineering Thermodynamics, John Wiley and Sons.

4. Nag, P.K, 1995, Engineering Thermodynamics, Tata McGraw-Hill Publishing Co. Ltd.

OBJECT ORIENTED PROGRAMMING USING C++

Course Code					
Category	**ENGINEERING SCIENCE COURSE (ESC)**				
Course Title	**Object Oriented Programming using C++**				
Semester and Credits	L	T	P	Credits	Semester - III
	3	0	0	3	
Class Work	30 Marks				
Examination	70 Marks				
Total	100 Marks				
Duration of Exams	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objectives

- To learn how to overload functions and operators in C++.
- To learn how inheritance and virtual functions implement dynamic binding with polymorphism.
- To learn how to use exception handling in C++ programs.

UNIT I

Introduction to C++ Procedural programming, Object based programming, Object Oriented Programming, Concepts in C++, Comparison of C++ with C, Console input/output in C++, Variables in C++, Data types in C++, operators in C++ , Statements-IF, ELSE, IF-ELSE, SWITCH, BREAK, CONTINUE, GOTO, Loops- WHILE.

UNIT II

Object Based Programming :Introduction to Classes and Objects, Member functions and member data, Objects and functions, Objects and arrays, Implicit this pointer, Class scope, Constructors and Destructors in Class, Copy constructor, Friend Class, Static Class members, Static Member functions, Nested Class.
Function, Arrays, Structure and Union :Function declaration, call, definition, recursion, one dimensional arrays, two dimensional arrays, searching and sorting, strings, structure & union.

UNIT III

Function Overloading and Operator Overloading :Overloading and scope, Function matching and argument conversions, three steps in overload resolution, argument type conversion, pointer to functions. Overloading Operators- Operator Overloading, Friend functions, Operator =, Operator [ ], Operator (), Operator ->, Operators ++ and --, Operators new and delete.

Section D

Object Oriented Programming :Inheritance-Base class and derived class pointers, function overriding, base class initialization, protected access specifiers, different kinds of inheritance, Virtual functions- Need for virtual functions, Mechanism of virtual functions, Pure virtual functions.

Course Outcome

After completing this course, the students should be able to
CO 1: Describe OOPs concepts.

CO 2 :Use functions and pointers in your C++ program.
CO 3:Understand tokens, expressions, and control structures.
CO 4:Explain arrays and strings and create programs using them.
CO 5:Describe and use constructors and destructors.
CO 6:Understand and employ file management.

SUGGESTED READING/ BOOKS

1. Herbert Schildt, C++ The Complete reference, 4th Edition, TMH.
2. E. Balaguruswami, Object oriented programming using C++, TMH.
3. Bjarne Stroustroup, The C++ Programming language, Pearson Education.
4. Robert C Lafore, Turbo C++, Galgotia Publications.
5. E. Balaguruswami, Ansi C, TMH.

Category	Professional Core Course				
Course Title	Strength of Materials				
Semester and Credits	L	T	P	Credits	Semester - III
	3	0	0	3	
Class Work	30 Marks				
Examination	70 Marks				
Total	100 Marks				
Duration of Exams	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit

Course Objectives:

- To understand the nature of stresses developed in simple geometries such as bars, cantilevers, beams, shafts, cylinders and spheres for various types of simple loads
- To calculate the elastic deformation occurring in various simple geometries for different types of loading

UNIT-I

Deformation in solids- Hooke's law, stress and strain- tension, compression and shear stresses elastic constants and their relations- volumetric, linear and shear strains- principal stresses and principal planes- Mohr's circle.

UNIT-II

Beams and types transverse loading on beams- shear force and bend moment diagrams- Types of beam supports, simply supported and over-hanging beams, cantilevers. Theory of bending of beams, bending stress distribution and neutral axis, shear stress distribution, point and distributed loads.

UNIT-III

Moment of inertia about an axis and polar moment of inertia, deflection of a beam using double integration method, computation of slopes and deflection in beams, Maxwell's reciprocal theorems. Columns & Struts: Column under axial load, concept of instability and buckling, slenderness ratio, derivation of Euler's formulae for the elastic buckling load, Euler's, Rankine, Gordon's formulae Johnson's empirical formula for axial loading columns and their applications, eccentric compression of a short strut of rectangular & circular sections, Numerical.

UNIT-IV

Torsion, stresses and deformation in circular and hollow shafts, stepped shafts, deflection of shafts fixed at both ends, stresses and deflection of helical springs. Axial and hoop stresses in cylinders subjected to internal pressure, deformation of thick and thin cylinders, deformation in spherical shells subjected to internal pressure. Slope & Deflection: Relationship between bending moment, slope & deflection, Mohr's theorem, 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.

Course Outcomes:

After completing this course, the students should be able to

CO1. Recognize various types loads applied on machine components of simple geometry and understand the nature of internal stresses that will develop within the components

CO2. Evaluate the strains and deformation that will result due to the elastic stresses developed within the materials for simple types of loading
CO3. Analyze stress and strain in various structural components, including axial stress and strain, shear stress and strain, and bending stress and strain
CO4. Determine important material properties, such as modulus of elasticity, yield strength, ultimate strength, and toughness
CO5. Analyze the behavior of structural components subjected to axial and torsional loading
CO6. Familiar with energy methods, such as strain energy and virtual work principles.

Text Books:

1. Egor P. Popov, Engineering Mechanics of Solids, Prentice Hall of India, New Delhi, 2001.
2. R. Subramanian, Strength of Materials, Oxford University Press, 2007.
3. Ferdinand P. Been, Russel Johnson Jr and John J. Dewole, Mechanics of Materials, Tata McGraw-Hill Publishing Co. Ltd., New Delhi 2005.

DIGITAL ELECTRONICS LABORATORY

Course Code						
Category	**Laboratory Courses**					
Course title	**Digital Electronics Laboratory**					
Scheme	**L**	**T**	**P**	**Credits**	**Semester : III**	
	0	**0**	**2**	**1**		
Class Work	50 Marks					
Exam	50 Marks					
Total	100 Marks					
Duration of Exam	02 Hrs					

Notes:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus

LIST OF EXPERIMENTS

1. To study of TTL gates – AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR.
2. To design & realize a given function using K-maps and verify its performance.
3. To verify the operation of multiplexer & Demultiplexer.
4. To verify the operation of comparator.
5. To verify the truth tables of S-R, J-K, T & D type flip flops.
6. To study FLIP-FLOP conversion.
7. To verify the operation of bi-directional shift register.
8. To design & verify the operation of 3-bit synchronous counter.
9. To design and verify the operation of synchronous UP/DOWN decade counter using
10. J K flip-flops &drive a seven-segment display using the same.
11. To design and verify the operation of asynchronous UP/DOWN decade counter using
12. J K flip-flops &drive a seven-segment display using the same.
13. To design a 4-bit shift register and verify its operation.

Lab outcomes: At the end of this lab, student will be able to

1. To present a problem oriented introductory knowledge of Digital circuits and its applications.
2. Learn Number system and codes.
3. Study Boolean algebra and theorems
4. To focus on the study of electronic circuits
5. Design and analyze combinational circuits.
6. Design and analyze synchronous sequential logic circuits.

Thermodynamics Lab

Course code					
Course title	**Thermodynamics Lab**				
Category	**Engineering Science Course**				
Semester and Credits	L	T	P	**Credits**	Semester III
	0	0	2	1	
Marks for Sessional	50 Marks				
Marks for End term Examination	50 Marks				
Total	100 Marks				

Notes:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus

Course Objectives:

1. To understand Vapour power cycles.
2. To understand steam boilers, their types and components.
3. To learn fundamentals of flow of steam through a nozzle.
4. To understand Steam turbines ,condensers and compressors.

List of Experiments:

1. To study low pressure boilers and their accessories and mountings.
2. To study high pressure boilers and their accessories and mountings.
3. To prepare heat balance sheet for given boiler.
4. To study the working of impulse and reaction steam turbines.
5. To find dryness fraction of steam by separating and throttling calorimeter.
6. To find power out put& efficiency of a steam turbine.
7. To find the condenser efficiencies.
8. To study and find volumetric efficiency of a reciprocating air compressor.
9. To study cooling tower and find its efficiency.
10. To find calorific value of a sample of fuel using Bomb calorimeter.
11. Calibration of Thermometers and pressure gauges.

Course Outcome:

The Students will be able to understand the practical exposure of:

CO1. Vapour power cycles and find and compare different cycles based on their performance parameters and efficiencies.

CO2. Steam boilers, their types and components.

CO3. Fundamentals of flow of steam through a nozzle.

CO4. Steam turbines and can calculate their work done and efficiencies.

CO5. Types and working of condensers and compressors and define their different types of efficiencies

Strength of Materials Lab

Course code					
Course title	**Strength of Materials Lab**				
Category	**Professional Core Course**				
Semester and Credits	L	T	P	**Credits**	Semester III
	0	0	2	1	
Marks for Sessional	50 Marks				
Marks for End term Examination	50 Marks				
Total	100 Marks				

Notes:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus

Course Objectives

1. To learn the principles of mechanics of solid and various properties of materials.
2. Able to understand the concepts of stress, strain of materials and ability to interpret the data from the experiments.

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 Erichsensheet 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 test.
7. To perform compression & bending tests on UTM.
8. To perform the sheer test on UTM.
9. To study the torsion testing machine and perform the torsion test.

Course Outcomes:

The students will be able to understand

CO1. Learn the principles of mechanics of solids and engineering.

CO2. Preparation of formal laboratory reports describing the results of experiments.

CO3. Acquire to operate basic instruments in the mechanics of materials lab.

CO4. Able to understand the concepts of stress, strain of materials and ability to interpret the data from the experiments.

Object Oriented Programming Using C++ Lab

Course code					
Course Title	**Object Oriented Programming Using C++ Lab**				
Category	**Professional Core Course**				
Semester and Credits	L	T	P	**Credits**	Semester III
	0	0	2	1	
Marks for Sessional	50 Marks				
Marks for End term Examination	50 Marks				
Total	100 Marks				

Notes:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus

Objectives

1. Familiarization with the C++ programming language
2. Implementation of object-oriented concepts
3. Hands-on practice with C++ language features

LIST OF EXPERIMENTS

1. Write a program that uses a class where the member functions are defined inside a class.
2. Write a program that uses a class where the member functions are defined outside a class.
3. Write a program to demonstrate the use of const data members.
4. Write a program to demonstrate the use of zero argument and parameterized constructors.
5. Write a program to demonstrate the use of dynamic constructor.
6. Write a program to demonstrate the use of explicit constructor
7. Write a program to demonstrate the use of initializer list.
8. Write a program to demonstrate the overloading of increment and decrement operators.
9. Write a program to demonstrate the overloading of binary arithmetic operators.
10. Write a program to demonstrate the overloading of memory management operators.
11. Write a program to demonstrate the typecasting of basic type to class type.
12. Write a program to demonstrate the typecasting of class type to basic type.
13. Write a program to demonstrate the typecasting of class type to class type.
14. Write a program to demonstrate the multilevel inheritance.
15. Write a program to demonstrate the multiple inheritance.
16. Write a program to demonstrate the virtual derivation of a class.
17. Write a program to demonstrate the runtime polymorphism.

18. Write a program to demonstrate the exception handling.
19. Write a program to demonstrate the use offunction template.
20. Write a program to copy the contents of a file to another file byte by byte. The name of the source file and destination file should be taken as command-line arguments,

Course Outcomes:

CO 1:Students should develop a strong understanding of the C++ programming language, including its syntax, semantics, and features.
CO 2:Able to develop programs with reusability
CO 3: Student will understand how to model the real world scenario using class diagram and be able to exhibit communication between objects using sequence diagram.
CO 4: CO4: Students will be able to demonstrate various collection classes.
CO 5:Students will be able to create and user interfaces and packages
CO6: The students will be able to demonstrate programs on exceptions, multithreadi

CONSTITUTION OF INDIA

Semester	III				
Course code					
Category	Mandatory courses				
Course title	Constitution of India				
Scheme and Credits	L	T	P	Credits	
	2	0	0	-	
Classwork	-				
Exam	-				
Total	-				
Duration of Exam	-				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.
4. To learn procedure and effects of emergency, composition and activities of election commission and amendment procedure.

UNIT - I

Philosophy of Indian Constitution: Salient features of Indian Constitution, Preamble, and Nature of Indian Constitution, Procedure for amendment of the Constitution.

UNIT - II

Federal structure and distribution of legislative and financial powers between the Union and the States

UNIT - III

Organs of Governance: President – Qualification and Powers of the President, Governor- Qualification and Powers of Governor,

Parliament: Composition, Qualifications and Disqualifications, Judiciary: Appointment, Tenure and Removal of Judges.

UNIT - IV

Fundamental Rights: Origin and development of Fundamental rights, Need for fundamental rights. Introduction to Rights to equality, right to freedom, right against exploitation, Right to freedom of religion, Cultural and Education rights and Fundamental duties.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.

CO2: Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to a revolution in India.

CO3: Exercise his fundamental rights in proper sense at the same time identifies his responsibilities in national building.

CO4: Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.

CO5: Discuss the passage of the Hindu Code Bill of 1956.

CO6: Analyse the Indian political system, the powers and functions of the Union, State and Local Governments in detail.

TEXT AND REFERENCE BOOKS:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S.N. Busi, Dr. B.R. Ambedkar framing of Indian Constitution, latest Edition
3. M.P. Jain, Indian Constitution Law, Lexis Nexis, latest edition
4. D.D. Basu, Introduction to Constitution of India, Lexis Nexis, latest edition.

NOTE: The examination of the regular students will be conducted by the concerned college/Institute internally. Each student will be required to score a minimum of 40% marks to qualify in the paper. The marks will not be included in determining the percentage of marks obtained for the award of a degree. However, these marks will be shown in the detailed marks certificate of the students.

Semester IV

S. No.	Course Code		Course Title	Hours per week			Credits	Marks for Sessional	Marks for End Term Examination	Total
				L	T	P				
1	BSC		Statistics And Numerical Methods	3	0	0	**3**	**30**	**70**	**100**
2	PCC		Machine Elements Design	3	0	0	**3**	**30**	**70**	**100**
3	PCC		Power Electronics & Drives	3	0	0	**3**	**30**	**70**	**100**
4	PCC		Control Systems Engineering	3	0	0	**3**	**30**	**70**	**100**
5	PCC		Kinematics of Machine	3	0	0	**3**	**30**	**70**	**100**
6	PCC		Computer Aided Design & Manufacturing	3	0	0	**3**	**30**	**70**	**100**
7	LC		Power Electronics & Drives Lab	0	0	2	**1**	**50**	**50**	**100**
8	LC		Kinematics of Machine_ Lab.	0	0	2	**1**	**50**	**50**	**100**
9	LC		Computer Aided Design & Manufacturing _LAB	0	0	2	**1**	**50**	**50**	**100**
10	MC		**Scientific & Technical writing Skills***	2	0	0	**0**	**30**	**70**	**100***
			TOTAL	26			**21**	**900**		

NOTE:

- **Scientific & Technical writing Skills: Non-credit mandatory course, students have to attain pass marks (40%)**
  The examination of the regular students will be conducted by the concerned college/Institute internally. Each student will be required to score a minimum of 40% marks to qualify in the paper. The marks will not be included in determining the percentage of marks obtained for the award of a degree. However, these marks will be shown in the detailed marks certificate of the students.

Practical Training

- At the end of 4th semester each student has to undergo Practical Training of 4/6 weeks in an Industry/Institute/ Professional Organization/Research Laboratory/ training centre etc. and submit typed report along with a certificate from the organization & its evaluation shall be carried out in the 5th Semester

Course Code					
Category	**Basic Science Course**				
Course Title	**Statistics and Numerical Methods**				
Semester and Credits	L	T	P	Credits	Semester - IV
	3	0	0	2	
Class Work	50 Marks				
Examination	50 Marks				
Total	100 Marks				
Duration of Exams	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit

OBJECTIVES:

This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.

To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.

To introduce the basic concepts of solving algebraic and transcendental equations.

To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.

UNIT I

Sampling distributions-Estimation of parameters-Statistical hypothesis-Large sample tests based on Normal distribution for single mean and difference of means-Tests based on t, Chi-square and F distributions for mean, variance and proportion-Contingency table (test for independent)Goodness of fit.

UNIT II

Solution of algebraic and transcendental equations-Fixed point iteration method–Newton Raphson Method-Solution of linear system of equations-Gauss elimination method–Pivoting-Gauss Jordan method–Iterative methods of Gauss Jacobi and Gauss Seidel-Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices.

UNIT III

Lagrange's and Newton's divided difference interpolations–Newton's forward and backward difference interpolation–Approximation of derivates using interpolation polynomials–Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules.

UNIT IV

Single step methods : Taylor's series method-Euler's method-Modified Euler's method-Fourth order Runge-Kutta method for solving first order equations-Multi step methods : Milne's and Adams-Bash forth predictor corrector methods for solving first order equations.

COURSE OUTCOMES : Upon successful completion of the course, students will be able to:

CO1 :Apply the concept of testing of hypothesis for small and large samples in real life problems.

CO2:Apply the basic concepts of classifications of design of experiments in the field of agriculture.

CO3:Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.

CO4:Understand the knowledge of various techniques and methods for solving first and second order ordinary

differential equations.
CO5:Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.
CO6: Enhance critical thinking and decision-making abilities based on statistical analysis.

TEXT BOOKS: 1.Grewal. B.S. and Grewal. J.S., "Numerical Methods in Engineering and Science ", 10thEdition, Khanna Publishers, New Delhi, 2015.
2.Johnson, R.A., Miller, Iand Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8thEdition, 2015.

REFERENCES: 1.Burden, R.L and Faires, J.D, "Numerical Analysis", 9thEdition, Cengage Learning, 2016.
2.Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8thEdition, 2014.
3.Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 2006.

Category	**Professional Core Course**				
Course Title	**Machine Elements Design**				
Semester and Credits	L	T	P	Credits	Semester - IV
	3	0	0	3	
Class Work	50 Marks				
Examination	50 Marks				
Total	100 Marks				
Duration of Exams	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit

Course Objective

Enable students to attain the basic knowledge required to understand, analyze, design and select machine elements required in transmission systems.
Reinforce the philosophy that real engineering design problems are open-ended and challenging
Impart design skills to the students to apply these skills for the problems in real life industrial applications
Inculcate an attitude of team work, critical thinking, communication, planning and scheduling through design projects
Create awareness amongst students about safety, ethical, legal, and other societal constraints in execution of their design projects.

UNIT I

Design of Machine Elements :Scope and meaning of machine design. Sources of design data. Design considerations from economics, manufacturing, aesthetics and ergonomics aspects. Design Process, Selection of Materials.

UNIT II

Screwed Joints: Design of Bolted joints, Bolted Joints under eccentric Loading. Welded Joints: - Design of Fillet Welded Joints, Butt Joints, Un-symmetric Welded sections, eccentrically loaded welded joints.
Riveted Joints :Design of Lap Joints, Butt Joints, Diamond Riveting, eccentrically loaded riveted joints, Design of Cotter and Knuckle Joints.

UNIT III

Shafts :Design of shafts under different types of loading conditions.
Keys & Couplings :Design of rectangular and square keys, muff coupling, split muff coupling, flange coupling, bushed-pin flexible coupling.

UNIT IV

Levers :Design of straight levers, Bell - Crank levers, foot levers, hand levers. Brakes and Clutches
Design of friction plate and cone clutches, simple type brakes.
Introduction to Design for Manufacturing and Assembly. :

COURSE OUTCOME

- Apply the knowledge of Indian Standard codes and engineering fundamentals of material selection and manufacturing considerations in design.
- Identify the factors for engineering components design and analyse various members subjected to direct stress.
- Design various members such as beams, levers, laminated springs for bending and stiffness.

- Design various machine components under torsion such as shafts, shaft couplings, and keys. Design various threaded fasteners, power screws and curved machine components.

Suggested Readings / Books:

Design J.E. Shigley, Mechanical Engineering, McGraw-Hill Education (India) Pvt Ltd.
Dr. Sadhu Singh, Machine Design, Khanna Publishers.
R.S.Khurmi & J.K.Gupta, A text book of machine design, S. Chand & Co.
D.K.Aggarwal & P.C.Sharma, Machine Design, S.K Kataria and Sons.
Krishnamurthi, Design and Manufacturing S.K. Kataria and Sons.

NOTE: Design data book is NOT allowed in the examination.

Control system Engineering

Course Code					
Category	**Professional Core Courses**				
Course title	**Control System Engineering**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: IV**
	3	**1**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objective: The objectives of this course are as under:

1. To understand concepts of the mathematical modelling, feedback control and stability analysis in Time and Frequency domains
2. To develop skills, to analyse feedback control systems in continuous- and discrete time domains.
3. To learn methods for improving system response transient and steady state behavior (response).
4. The compensator design of linear systems is also introduced.

Unit-I

Systems Components and Their Representation Control System: Terminology and Basic Structure-Feed forward and Feedback control theory-Electrical and Mechanical Transfer Function Models-Block diagram Models-Signal flow graphs models-DC and AC servo Systems-Synchronous -Multivariable control system

Unit-II

Time Response Analysis and Stability Concept Transient response-steady state response-Measures of performance of the standard first order and second order system-effect on an additional zero and an additional pole-steady error constant and system- type number-PID control.

Concept of stability-Bounded - Input Bounded - Output stability-Routh stability criterion- Relative stability-Root locus concept-Guidelines for sketching root locus.

Unit-III

Frequency Domain Analysis Bode Plot - Polar Plot- Nyquist Plots-Design of compensators using Bode Plots-Cascade lead compensation-Cascade lag compensation-Cascade lag-lead compensation

Unit-IV

Control System Analysis Using State Variable Methods State variable representation-Conversion of state variable models to transfer functions-Conversion of transfer functions to state variable models-Solution of state equations-Concepts of Controllability and Observability-Stability of linear systems-Equivalence between transfer function and state variable representations

Course Outcomes: At the end of this course students will demonstrate the ability to

1. Understand the concepts of control systems and importance of feedback in control systems.
2. Perform signal flow graph and formulate transfer function.
3. Perform computations and solve problems on frequency response analysis.
4. Analyse Polar, Bode and Nyquist's plot.

5. Evaluate different types of state models and time functions.
6. Analyse different types of control systems like linear and non-linear control systems, etc.

TEXT BOOKS

- B.S. Manke, Linear Control system, Khanna Publications.

REFERENCE BOOKS

- I.J. Nagrath & Gopal, Control System Engineering, Wiley Eastern Ltd.
- K. Ogata, Modern Control Engg, Prentice Hall.
- J.F. Gibsen, Control System Components, Mcgraw Hill.
- B.C. Kuo, Automatic Control System, Prentice Hall.

Code					
Category	**Professional Core Course**				
Course Title	**Power Electronics and Drives**				
Semester and Credits	L	T	P	Credits	Semester - IV
	3	0	0	3	
Class Work	50 Marks				
Examination	50 Marks				
Total	100 Marks				
Duration of Exams	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Objectives:

- To introduce basic concepts of load and drive interaction, speed control concepts of ac and dc drives, speed reversal, regenerative braking aspects, design methodology.
- To familiarize students to the principle of operation, design and synthesis of different power conversion circuits and th eir applications.
- To provide strong foundation for further study of power electronic circuits and systems.

UNIT I

Thyristors and their characteristics :Introduction to thyristor family V-I characteristics of SCR, SUS, PUT, SCS, GTO, LASCR, DIAC and TRIAC. Principle of operation of SCR. Two transistor analogy. Turn on methods of a thyristor Switching characteristics of thyristors during turn-on and turn-off. Gate characteristics. Firing of thyristors. Gate triggering circuits. Series and parallel, operation of SCRs and their triggering circuits. Thyristor specifications; such as latching current and bolding current, dv/dt and di/dt, PTV etc. Protection of SCR from over voltage and over current. Snubber circuits. Power dissipation.

UNIT II

Thyristor commutation Techniques :Load commutation (Class A), Resonant-Pulse commutation (class B), impulse commutation (class D), Line commutation (class F).

Phase controlled Techniques :Introduction to phase angle control. Single phase half wave controlled rectifiers. Single phase half controlled and full controlled bridge rectifiers. Three phase full controlled bridge rectifiers. Effect of resistive, inductive and resistive conductive loads. Basic circuit and principle of operation of Dual Converter, circulating current mode and non-circulating current mode of operation. Applications of rectifiers and dual converters to speed control of DC motor drives.

UNIT III

Choppers :Introduction and principle of chopper operations. Control strategies, two quadrant chopper, Four quadrant chopper. Regenerative chopper. Steady state time domain analysis of type A-chopper, voltage commutated chopper or classical Jones chopper.

Cyclo converters :Basic circuit and operation of single phase cyclo converter. Single phase bridge cyclo converter. Three phase to single phase to single phase cyclo converter. Advantages disadvantages of cyclo converters.

UNIT IV

Inverters : Introduction to inverter. Operating principle and already state analysis of single phase, voltage source, bridge inverter. Modified Mc murray half-bridge and full bridge inverter. Three phase bridge inverters. Voltage control (PWM control etc.) and reduction of harmonics in the inverter output voltage. Series inverter.

Course Outcome:

CO1:Relate basic semiconductor physics to properties of power devices and combine circuit mathematics and characteristics o f linear and non-linear devices.

CO2.Describe basic operation and compare performance of various power semiconductor devices, passive components and swi tching circuits

CO3:Design and Analyze power converter circuits and learn to select suitable power electronic devices by assessing the requir ements of application fields.

CO4:Formulate and analyze a power electronic design at the system level and assess the performance. Students

CO 5:Understanding feedback control, pulse width modulation (PWM) techniques, and implementing closed-loop control of power electronic converters.

CO6: Analyze and design motor control systems.

SUGGESTED READING/ BOOKS

- P.S. Bimbhra, Power Electronics, Khanna Publishers.
- M.D. Singh, K.B. Khanchandani, Power Electronics, Tata Mc Graw Hill Publishing company limited.
- M.H. Rashid, Power Electronics, PHI.
- P.C. Sen, Power Electronics, Tata Mc Graw Hill Publishing company limited.

Code					
Category	**Professional Core Course**				
Course Title	**Kinematics of Machine**				
Semester and Credits	L	T	P	Credits	Semester - IV
	3	0	0	3	
Class Work	50 Marks				
Examination	50 Marks				
Total	100 Marks				
Duration of Exams	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objectives:

1 To understand the kinematics and rigid- body dynamics of kinematically driven machine components.\
2 To understand the motion of linked mechanisms in terms of the displacement, velocity and acceleration at any point in a rigid link.\
3 To be able to design some linkage mechanisms and cam systems to generate specified output motion.\
4 To understand the kinematics of gear trains.

UNIT-I

Introduction: mechanism and machines, kinematics links, kinematics pairs, kinematics chains, degree of freedom, Grubler's rule, kinematics inversion, equivalent linkages, four link planar mechanisms, straight line mechanisms, steering mechanisms, pantograph, problems. Kinematics Analysis of Plane Mechanisms: displacement analysis, velocity diagram, velocity determination, relative velocity method, instantaneous center of velocity, Kennedy's theorem, graphical and analytical methods of velocity and acceleration analysis, problems.

UNIT-II

Cams: Classification of cams and followers, disc cam nomenclature, construction of displacement, velocity and acceleration diagrams for different types of follower motions, analysis of follower motions, determination of basic dimension, synthesis of cam profile by graphical methods, cams with specified contours, problems. Gears: fundamental law of gearing, involute spur gears, characteristics of involute and cycloidal action, Interference and undercutting, center distance variation, path of contact, arc of contact, non standard gear teeth, helical, spiral bevel and worm gears, problems.

UNIT-III

Gear Trains: synthesis of simple, compound and reverted gear trains, analysis of epicylic gear trains, problems Kinematics synthesis of Mechanisms: function generation, path generation, Freudenstein's equation, two and three position synthesis of four bar and slider crank mechanisms by graphical and analytical methods, precision positions, structural error; Chebychev spacing, transmission angle, problems.

UNIT-IV

Friction : Types of friction, laws of friction, motion along inclined plane, screw threads, efficiency on inclined plane, friction in journal bearing, friction circle and friction axis, pivots and collar friction, uniform pressure and uniform wear. Belts and pulleys: Open and cross belt drive, velocity ratio, slip, material for belts, crowning of pulleys, law of belting, types of pulleys, length of belts, ratio of tension, centrifugal tension, power transmitted by belts and ropes, initial tension, creep, chain drives, chain length, classification of chains.

Course Outcomes: Students would be able :

CO1 - To understand about the applications of mechanism and machines.\
CO2 - To understand about the basics Cams and Friction\
CO3 - Familiarize about power transmitted with Belts and pulleys and also Gears and Gear Trains.\
CO4 - Students having familiarization with calculate Kinematics Analysis of Plane Mechanisms\
CO5 - Students would be able to know the Kinematics synthesis of Mechanisms.\
CO6- Perform kinematics synthesis of mechanisms

TEXT BOOKS:

1. Theory of Mechanisms and Machines: Amitabha Ghosh and Ashok kumar Malik, Third Edition Affiliated East-West Press. 2. Theory of Machines and Mechanisms: Joseph Edward Shigley and John Joseph Uicker, Jr. Second Edition, MGH, New York.

References:

1. Mechanism and Machine Theory : J.S. Rao and R.V. Dukkipati Second Edition New age International. 2. Theory and Machines: S.S. Rattan, Tata McGraw Hill. 3. Theory of Machines, Beven, Pearson Indian Education Service Pvt. Ltd. India.

Course code					
Course title	Computer Aided Design & Manufacturing				
Category	**Professional Core Course**				
Semester and Credits	L	T	P	**Credits**	Semester IV
	3	1	0	3	
Marks for Sessional	30 Marks				
Marks for End term Examination	70 Marks				
Total	100 Marks				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objectives:

1 Understand the fundamentals of various Computer Aided Design, basics of geometric modeling, curves surfaces, solids and Additive Manufacturing Technologies for application to various industrial needs.
2 Learn what Advanced/Additive manufacturing (AM) is and understand why it has become one of the most important technology trends in decades for product development and innovation.
3 Differentiate between subtractive and Additive manufacturing.

UNIT-I

Introduction: Introduction to CAD/CAM/CAE, Design Process, Importance and Necessity of CAD, Applications of CAD, Hardware and Software requirement of CAD. Fundamentals of Additive Manufacturing (AM), Basic steps to perform AM, Classification of AM, Applications of AM: Aerospace, Biomedical, Automotive, Bio-printing, Tissue & Organ Engineering, Architectural Engineering, Surgical simulation, Art, Health care.

UNIT-II

Basics of geometric and solid modeling, coordinate systems. Transformations: Introduction, transformation of points and line, 2-D rotation, reflection, scaling and combined transformation, homogeneous coordinates, 3-D scaling, shearing, rotation, reflection and translation, combined transformations. Curves: Algebraic and geometric forms, reparametrization, Analytical and Synthetic curves, cubic splines, Bezier curves and B-spline curves. Surfaces and Solids: Plane surface, ruled surface, surface of revolution, tabulated cylinder, bicubic surface, Bezier surface, B-spline surface, Solid models and representation scheme, boundary representation, constructive solid geometry, sweep representation, cell decomposition.

UNIT-III

Finite Element Method: Introduction, Procedure, Finite Element Analysis, Finite Element Modeling, Analysis of 1D, 2D structural problems. Design for Additive Manufacturing, Software issues for AM, Direct Digital Manufacturing. Difference between machining and additive manufacturing. Photo polymerization Processes, Powder bed fusion processes, Extrusion Based systems, Printing Processes, Effects of significant parameters.

UNIT-IV

Flexible Manufacturing Systems & Computer aided process planning: Introduction, FMS components, types of FMS, FMS layouts, planning for FMS, advantages and applications Conventional process planning, types of CAPP, Steps in variant process planning, planning for CAPP.

COURSE OUTCOMES: Upon completion of this course the student will be able to:
CO1. Demonstrate the knowledge of Computer Aided design and Additive Manufacturing.
CO 2. Understand the concept of wireframe modeling, surface modeling and solid modeling.
CO3. Understand the method of manufacturing of liquid based, powder based and solid based techniques

CO4. Apply the FEM to perform structural analysis and solve engineering problems
CO5. Analyze 1D and 2D structural problems
CO6. Evaluate the benefits and challenges of implementing FMS in manufacturing environments.

Text Books
1. CAD/ CAM by Groover and Zimmer, Prantice Hall.
2. CAD/ CAM Theory and Practice by Zeid, McGraw Hill

Reference Books

1. Numerical Control and Computer Aided Manufacturing by Kundra, Rao & Tiwari, TMH.
2. Ian Gibson, Davin Rosen, Brent Stucker "Additive Manufacturing Technologies, Springer, 2nd Ed, 2014.

Code					
Category	**Professional Core Course**				
Course Title	**Power Electronics & Drives lab**				
Semester and Credits	L	T	P	Credits	Semester - IV
	0	0	2	1	
Class Work	50 Marks				
Examination	50 Marks				
Total	100 Marks				
Duration of Exams	03 Hours				

Notes:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus

Course Objective: The objectives of this course are as under:

- To introduce the basic of power switching device.
- To impart knowledge on the concepts of Rectifiers and regulators.
- To impart knowledge on the concepts of converters.
- To impart knowledge on the concepts of inverter.
- To impart knowledge on the concepts of cycloconverter

List of Experiments

1. To study principle of operation of SCR, plot V-I characteristics and study the effect of gate triggering on turning on of SCR.
2. To draw V-I characteristics of an UJT and to use UJT as relaxation oscillator.
3. To study the effect of free-wheeling diode on power factor for single phase half-wave rectifier with R-L load.
4. To plot waveforms for output voltage and current, for single phase full-wave, fully controlled bridge rectifier, for resistive and resistive cum inductive loads.
5. Study of the microprocessor based firing control of a bridge converter.
6. To study three phase fully controlled bridge converter and plot waveforms of output voltage, for different firing angles.
7. Study of Jones chopper or any chopper circuit to check the performance.
8. Thyristorised speed control of a D.C. Motor.
9. Speed Control of induction motor using thyristors.
10. Study of series inverter circuit and to check its performance.
11. Study of a single-phase cycloconverter.
12. To check the performance of a Mc Murray half-bridge inverter.

Course Outcomes: At the end of this course students will demonstrate the ability to;

1. Understand the differences between signal level and power level devices.
2. Understand working of AC regulators.
3. Analyze controlled rectifier circuits.
4. Analyze the operation of DC-DC choppers.
5. Analyze the operation of voltage source inverters.

Category	**Professional Core Course**				
Course Title	**Kinematics of Machine LAB (P)**				
Semester and Credits	L	T	P	Credits	Semester - IV
	0	0	2	1	
Class Work	50 Marks				
Examination	50 Marks				
Total	100 Marks				
Duration of Exams	03 Hours				

Notes:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus

Course Objectives:

- To understand the kinematics and rigid- body dynamics of kinematically driven machine components.
- To understand the motion of linked mechanisms in terms of the displacement, velocity and acceleration at any point in a rigid link.
- To be able to design some linkage mechanisms and cam systems to generate specified output motion.
- To understand the kinematics of gear trains.

List of Experiments:

1. To study various types of Kinematic links, pairs, chains and Mechanisms.
2. To study inversions of 4 Bar Mechanisms, Single and double slider crank mechanisms.
3. To plot slider displacement, velocity and acceleration against crank rotation for single slider crank mechanism.
4. To find coefficient of friction between belt and pulley.
5. To study various type of cam and follower arrangements.
6. To plot follower displacement vs cam rotation for various Cam Follower systems.
7. To study various types of Steering Mechanism.
8. To study various types of gears – Helical, cross helical worm, bevel gear.
9. To study various types of gear trains – simple, compound, reverted, epicyclic and differential.
10. To study the working of Screw Jack and determine its efficiency.
11 To study various types of Belt, Rope and Chain Drives.

Course Outcomes (COs): After studying this course, students will be able:

CO 1- Understand the various practical demonstrations of mechanism.

CO 2- Knowledge of Motions in mechanism with practical demonstration.

CO 3- Learning the Special purpose machine members used in designing of a machine.

CO 4- Synthesis of working model using the various linkages.

Note: 1. At least ten experiments are to be performed in the Semester.

Category	**Professional Core Course**				
Course Title	**Computer Aided Design & Manufacturing _LAB**				
Semester and Credits	L	T	P	Credits	Semester - IV
	0	0	2	1	
Class Work	50 Marks				
Examination	50 Marks				
Total	100 Marks				
Duration of Exams	03 Hours				

Notes:

(i) At least 7 experiments are to be performed by students in the semester.

(ii) At least 4 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus

Course Objectives:

At the end of the course, the student shall be able to: Display of the basic fundamentals of modeling package. Explore the surface and solid modeling features. Learning the techniques of 3D modeling of various mechanical parts.

List of Experiments:

The students will be required to carry out the following exercises using software packages (e.g. Solid works / Pro Engineer/AutoCAD/ I-Deas/ Solid Edge/CURA etc.)

1. CAD Modeling Assignments

(i) Use and learn import/export techniques and customization of software.

(ii) Construction of simple machine parts and components like Coupling, Crankshaft, Pulley, Piston , Connecting rod, nuts, bolts, gears and helical springs

(iii) Assembly drawing with sectioning and bill of materials from given detailed drawings of assemblies: Lathe Tail stock, Machine vice, Pedestal bearing, Drill jigs and Milling fixture.

(iv) Make the part family/family table of a bolt.

2. CAM Assignments Tool path generation, Part programming, G & M codes development for machining operations, Physical interpretation of machining features and tool geometries.

3. To perform reverse engineering of a product using 3D scanner.

4. To print coupling, crankshaft, pulley, piston, connecting rod, nuts, bolts with FDM 3D printer with suitable filament like Nylon, ABS etc.

5. To print a product with FDM 3D printer which is developed with reverse engineering.

6. To Draw Orthographic projection Drawings (Front, Top and side) of boiler safety valve giving name the various components of the valve.

7. Make an Isometric dimensioned drawing of a connecting Rod using isometric grid and snap.

8. Draw 3D models by extruding simple 2D objects, dimension and name the objects.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Display of the basic fundamentals of modeling package.

CO 2- Explore the surface and solid modeling features.

CO 3- Learning the techniques of 3D modeling of various mechanical parts.

CO 4- To expedite the procedure and benefits of FEA and CAE.

Category	**Humanities and Social including Management**				
Course Title	**Scientific & Technical writing Skills**				
Semester and Credits	L	T	P	Credits	Semester - IV
	2	0	0	o	
Class Work	-				
Examination	-				
Total	-				
Duration of Exams	-				

Note: The examination of the regular students will be conducted by the concerned college/Institute internally. Each student will be required to score a minimum of 40% marks to qualify in the paper. The marks will not be included in determining the percentage of marks obtained for the award of a degree.

The following course content to conduct the activities is prescribed for the Scientific & Technical writing Skills Lab:

1. Activities on Writing Skills - Structure and presentation of different types of writing - letter writing/ Resume writing/ e-correspondence/ Technical report writing/ Portfolio writing - planning for writing - improving one's writing.
2. Activities on Presentation Skills - Oral presentations (individual and group) through JAM sessions/seminars/PPTs and written presentations through posters/ projects/ reports/ e-mails/ assignments etc.
3. Activities on Group Discussion and Interview Skills - Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation- Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video-conferencing and Mock Interviews.

Text references:

1. A Course Book of Advanced Communication Skills (ACS) Lab published by Universities Press, Hyderabad.
2. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.
3. Advanced Communication Skills Laboratory Manual by Sudha Rani, D, Pearson Education 2011.
4. Technical Communication by Paul V. Anderson, 2007. Cengage Learning pvt. Ltd. New Delhi.
5. Business and Professional Communication: Keys for Workplace Excellence, Kelly M. Quintanilla & Shawn T. Wahl. Sage South Asia Edition. Sage Publications, 2011.
6. The Basics of Communication: A Relational Prespective, Stev Duck & David T. Mc Mahan. Sage South Asia Edition. Sage Publications, 2012.
7. English Vocabulary in Use series, Cambridge University Press 2008.
8. Management Shapers Series by Universities Press (India) Pvt Ltd., Himayatnagar, Hyderabad 2008.
9. Handbook for Technical Communication by David A. McMurrey & Joanne Buckley, 2012. Cengage Learning.
10. Communication Skills by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009.
11. Handbook for Technical Writing by David A McMurrey & Joanne Buckely CENGAGE Learning 2008.
12. Job Hunting by Colm Downes, Cambridge University Press 2008.
13. Master Public Speaking by Anne Nicholls, JAICO Publishing House, 2006.
14. English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc graw Hill 2009.
15. Books on TOFEL/ GRE/ GMAT/ CAT/ IELTS by Barron's/ DELTA/ Cambridge University Press.
16. International English for Call Contres by Barry Tomalin and Suhashini Thomas, Macmillan Publishers, 2009.

Mini Project: As a part of Internal Evaluation

1. Seminar/ Professional Presentation
2. A Report on the same has to be prepared and presented.
    - Teachers may use their discretion to choose topics relevant and suitable to the needs of students.
    - Not more than two students to work on each mini project.
    - Students may be assessed by their performance both in oral presentation and written report.