COURSE STRUCTURE

AND

SYLLABUS FOR

DIPLOMA PROGRAMMES

in

Civil Engineering (CE)

Semester IV

(APPLICABLE FROM AY 2024-2025 ADMITTED BATCH ONWARDS)

COURSE STRUCTURE

4th Semester / 2nd Year							
Name of the Programme		**Diploma in Civil Engineering**					
Name of the Department		**Civil Engineering**					
A.		**Theory Courses**					
Sl No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	**Coordinating Department**
1	DCE401	Fluid Mechanics	3	1	0	4	CE
2	DCE402	Surveying-II	3	0	0	3	CE
3	DCE403	Building Construction	3	0	0	3	CE
4	DCE404	Structural Analysis	3	1	0	4	CE
5	DCE405	Construction Technology	3	0	0	3	CE
Total of A			**15**	**2**	**0**	**17**	
B.		**Laboratory/Project/Seminar Courses**					
Sl No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	**Coordinating Department**
1	DCE471	Fluid Mechanics Lab	0	0	2	1	CE
2	DCE472	Surveying-II Lab:	0	0	2	1	CE
3	DCE473	Computer Aided Building Drawing:	0	0	2	1	CE
Total of B			**0**	**0**	**6**	**3**	
C.		**Audit/Non-credit Courses**					
Sl No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	**Coordinating Department**
1	DHS401	Indian Knowledge System	2	0	0	0	HSS
Total of C			**0**	**0**	**0**	**0**	
Grand Total (A+B+C)			**15**	**2**	**6**	**20**	

Course Code:	DCE 401
Course Title:	Fluid mechanics
Course Credit:	4
L-T-P:	3-1-0
Total Contact Hours:	48

Course objective:	The objectives of this course are: • To provide knowledge of fluid properties and fluid statics • To derive the equation of conservation of mass and its application • To Classify the types of flow • To evaluate kinematic problems such as finding particle paths and stream lines • To solve problems based on mass momentum and energy balance equations • To understand the various flow measuring devices • To Evaluate the head loss in pipes.
Pre-requisites:	Basic concepts of Engineering mechanics, basic physics, Newton's Laws
Course outcomes:	After completion of this course students will be able to: 1. Understand the various properties of fluids and their influence on fluid motion 2. Solve practical problems involving fluid properties and hydrostatic pressure 3. Evaluate fluid kinematic properties to classify types of fluid flow using flow visualization techniques 4. To use important concepts of continuity equation, Bernoulli's equation and turbulence, and apply the same to problems 5. Estimate the pumping power by considering major and minor losses in flow through pipes 6. To Draw simple hydraulic and energy gradient lines.

Module no.	**Topic**	**Nos. of contact hours**

1	Properties of fluid: Mass, Mass Density, Specific Weight, Specific Volume Specific Gravity, Viscosity, Compressibility, Bulk Modulus, Surface Tension and Capillarity. Fluid statics – Pascal's Law, Hydrostatic Law, Types of Pressure, Pressure measuring device: Manometers and pressure gauges	13
2	Fundamentals of fluid flow: Fluid Motion, Types of Fluid Flow, Continuity Equation, Velocity and Acceleration, Bernoulli's equation, Venturi meter, Orifice meter, Pitot Tube	13
3	Fluid flow in pipes - Darcy - Weisbach equation, Major and Minor Head loss, Hydraulic and Total Energy, Flow through Syphon, Pipes in Series and Parallel, equivalent pipe, pipe Network	11
4	Dimensional Analysis and Dynamic Similitude - Definitions of Reynolds Number, Froude Number, Mach Number, Weber Number and Euler Number; Buckingham's π-Theorem.	11

Textbooks:

1. Dr. R K Bansal, "A Text Book of Fluid Mechanics and Hydraulic Machines", Laxmi Publication, Revised Ninth Edition 2019.
2. Fluid Mechanics and Machinery, C. S.P. Ojha, R. Berndtsson and P. N. Chadramouli, Oxford University Press, 2010

References:

1. Hydraulics and Fluid Mechanics, P M Modi and S M Seth, Standard Book House New Delhi.
2. Mechanics of Fluids, Merle C. Potter, David C. Wiggert, and Bassem H. Ramadan, CENGAGE Learning.
3. Fluid Mechanics and Machinery, C.S.P. Ojha, R. Berndtsson, and P.N. Chandramouli, Oxford Higher Education.
4. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata Mc Graw Hill

Course Code:	DCE402
Course Title:	Surveying-II
Credit:	03
L-T-P:	3-0-0
Total Contact Hours	36

Course Objectives:	• To develop an understanding of advanced surveying instruments and techniques beyond basic chain and compass surveys. • To impart practical knowledge of theodolite, tacheometry, and contouring. • To introduce modern digital and remote sensing techniques such as Total Station, GPS, and Drone Surveying. • To enhance field data collection, computation, and mapping skills aligned with current industry practices.
Pre-requisites:	Knowledge of basic Surveying
Course Outcomes:	After successful completion of the course, the student will be able to: 1. Operate and use theodolite for angular measurements and traverse computations. 2. Apply the principles of tacheometric and trigonometric levelling for determining distances and elevations. 3. Conduct plane table surveys and prepare contour maps effectively. 4. Use Total Station and GPS for field data acquisition and mapping. 5. Integrate traditional and modern surveying techniques in civil engineering projects. 6. Prepare survey reports and digital maps using basic data processing tools.

Module No.	Topic	Nos. of contact hours
1	**Plane Table Surveying:** Equipment and methods of plane table survey, Radiation, intersection, traversing, and resection methods, Errors and precautions, Contour mapping and plotting from plane table data.	6
2	**Theodolite Surveying:** Introduction, parts and adjustments of theodolite, Measurement of horizontal and vertical angles, Methods of repeating and reiteration, Traverse survey using theodolite – computation and balancing, Plotting and adjustment of traverse.	8

3	**Tacheometric Surveying:** Introduction to tacheometry, instruments used, and principles of stadia and tangential methods, Measurement of horizontal distance, vertical angle, and reduced levels on horizontal and inclined sights, Field observation techniques, reduction of tacheometric data, applications.	8
4	**Electronic Distance Measurement:** Principle of EDM, Total station; Parts of Total Station, Accessories. Advantages and Applications, Digital theodolite, parts, field procedure.	6
5	**Application of Modern Surveying Techniques:** Introduction to Remote Sensing, GIS and Global Positioning System (GPS), DGPS, and, Drone (UAV) Surveying, Data Processing: software for plotting and map preparation	8

Textbooks:

1. B.C. Punmia, *Surveying Vol. II*, Laxmi Publications.
2. S.K. Duggal, *Surveying Vol. II*, Tata McGraw Hill.
3. Arora, K.R., *Surveying Vol. II*, Standard Book House.
4. Satheesh Gopi et al., *Advanced Surveying: Total Station, GPS, GIS & Remote Sensing*, Pearson Education.

References:

1. Anderson & Mikhail, *Surveying: Theory and Practice*, McGraw Hill.
2. Ghilani & Wolf, *Elementary Surveying: An Introduction to Geomatics*, Pearson.
3. James M. Anderson, *Modern Surveying*, Springer.
4. IS 12757: Guidelines for Theodolite Survey and Tacheometry (BIS).

Course Code:	DCE403
Course Title:	Building Construction
Credit:	03
L-T-P:	3-0-0
Total Contact Hours	36

Course Objectives:	• To understand elements of building construction with respect to substructure and superstructure. • To understand the construction of built forms from foundation to roof in various building practices. • To gain in depth knowledge and understanding of different building materials used for construction.
Pre-requisites:	NIL
Course Outcomes:	After completion of this course, students will be able to: 1. Understand and apply the knowledge of material science & behaviour of different building materials used in construction. 2. Identify and differentiate between various types of bond use in brick and stone masonry. 3. Discuss the building components and use their construction process in building industry.

Module No.	Topic	Nos. of contact hours
1	**Foundation:** Foundation: Introduction, functions of foundation, types of foundation.	5
2	**Brick Masonry:** Brick masonry: Introduction, general principles in brick masonry construction, Bond in brick masonry.	4
3	**Form work and Scaffolding:** Form work: Types of form work, types of forms for different structural members; Scaffolding: Component parts and types of scaffolding.	4
4	**Doors and Windows:** Doors and windows: Introduction, component parts of doors and windows, sizes of doors and windows, and types of doors and windows.	5
5	**Arches and lintels:** Arches and lintels: Component parts and classification of arches and lintels.	5

6	**Roofs and Floors:** Roofs: Introduction and Classification of roofs and roof coverings; Floors: Introduction, components of a floor, types of floors, cement concrete and mosaic floors.	5
7	**Stairs:** Introduction, component parts of staircase, dimension of a step, classification of stairs; Protective and Decorative finishes	4
8	**Damp proof courses:** Introduction, causes of dampness, methods and materials used for damp proofing.	4

Textbooks:

1. Building Construction, B.C. Punmia, Laxmi Publishers, New Delhi.
2. Building Construction, Shushil Kumar, Standard Publishers, Delhi.
3. Maintenance of Building, A.C. Panchdhari, New Age International, New Delhi.

References:

1. Building Construction Vol I to IV, W.B. Mackey, Orient Longman, Mumbai.

Course Code:	DCE 404
Course Title:	Structural Analysis
Course Credit:	4
L-T-P:	3-1-0
Total Contact Hours:	48

Course objective:	The objective of this course are: • Understand the fundamental concepts of structural systems, types of supports, loads, and conditions of equilibrium. • Develop the ability to determine reactions, internal forces, slopes, and deflections in statically determinate structures using analytical methods. • Apply the principles of strain energy and virtual work to compute deflections and analyze redundant structures. • Analyze pin-jointed trusses and appreciate the applications of various theorems such as Maxwell's and Betti's for equilibrium and compatibility. • Understand the behavior and analysis of arches, cables, and suspension bridges subjected to different loading conditions.
Pre-requisites:	Basic knowledge of Strength of Materials
Course outcomes:	After completion of this course students will be able to: 1. Draw and interpret free-body diagrams and determine support reactions for various types of structures. 2. Compute slopes and deflections in beams using double integration, moment area, and conjugate beam methods. 3. Apply Castigliano's theorem and virtual work principles to determine deflections and redundant forces in simple structures. 4. Analyze pin-jointed trusses by the method of joints and sections, and determine deflections of joints using graphical and analytical approaches. 5. Evaluate the horizontal thrust and internal forces in three-hinged arches and analyze cables and suspension bridges under different loading conditions.

Module no.	**Topic**	**Nos. of contact hours**

1	**Introduction to Structural analysis:** Forms of structures, Loads and Forces, Free body diagram, conditions of equilibrium of forces, support and connections – reactions, Difference between determinate and indeterminate structures.	4
2	**Deflection of statically determinate structures:** Computation of slope and deflection by double integration, moment area method, conjugate beam method, applications to simply supported, overhang and cantilever beams.	9
3	**Strain Energy and Virtual work:** Strain energy for axial force, bending, shear and torsion. Castigliano's theorems and their applications to find deflection and redundant forces in simple cases.	9
4	**Analysis of Pin-Jointed Structure:** Method of joints and sections, Graphical method, Deflection of joints, Truss with single redundancy, Maxwell's reciprocal theorem, Betti's theorem and their applications.	8
5	**Three hinged arches:** Types, three hinged parabolic and circular arch, horizontal thrust in arches, arches supported at different levels.	9
6	**Cables and suspension bridges:** Equilibrium of a loaded cord, Vector diagram, Cable carrying uniformly distributed load, Suspension bridge with three-hinged stiffening girder.	9

Textbooks:

1. Bhavikatti, S. S. *Structural Analysis-II*. Vikas Publishing House, 2013.
2. Junnarkar, S. B. *Structural Mechanics Volume I and II*. Charotar Publishers, 2016.
3. Jain, O. P., and A. S. Arya. *Theory and Analysis of Structures*. Vol. 2, Nem Chand & Brothers, 2001.
4. Reddy, C. S. *Basic Structural Analysis*. Tata McGraw Hill, 2011.
5. Vazirani, V. N., and M. M. Ratwani. *Analysis of Structures*. Vol. 1 and 2, Khanna Publishers, 2014.

References:

1. Utku, S., et al. *Elementary Structural Analysis*. 4th ed., McGraw Hill, 1991.
2. Timoshenko, S., and D. H. Young. *Theory of Structures*. 2nd ed., McGraw Hill, 1965.
3. Wang, C. K. *Intermediate Structural Analysis*. McGraw Hill, 1984.
4. Neal, B. G. *Structural Theorems and Their Application*. Pergamon Press, 1972.
5. Timoshenko, S., and D. H. Young. *Theory of Structures*. Tata McGraw Hill, 1965.
6. Negi, L. S., and R. S. Jangid. *Structural Analysis*. Tata McGraw Hill, 2008.

Course Code:	UCE405
Course Title:	Construction Technology
Course Credit:	3
L-T-P:	3-0-0
Total contact hours:	36

Course Objectives:	• Identify and use construction hand tools and power tools safely and effectively. • Interpret and create construction blueprints, drawings, and plans. • Understand and implement construction site safety practices • Understand basic principles of construction methods, materials, equipment, and building codes.
Pre-requisites:	Basic knowledge of Construction Materials and Basic Surveying knowledge.
Course Outcomes:	1. Demonstrate proficiency in using construction tools, equipment, and materials safely and effectively. 2. Accurately read and interpret construction drawings, blueprints, and specifications. 3. Apply construction methods and techniques to build structural components like walls, floors, and roofs.

Module No.	Topics	Nos. of contact hours
1	**Introduction and Safety:** Introduction to standards of safety, personal protective equipment, and hand and power tools.	4
2	**Construction Materials:** Types and properties of construction materials: wood, steel, concrete, masonry, Material estimation techniques and sustainability topics.	7
3	**Project Design and Drawings:** Reading and interpreting blueprints, schematic layouts, and construction documents, learning building codes, regulations, and standards relevant to residential and commercial projects.	6
4	**Building Structural Components:** Introduction to floor, wall, and roof framing systems, material estimation, and component assembly.	6
5	**Site Layout and Foundations:** Site selection, surveying basics, soil properties, and excavation procedures, planning and constructing basic foundations: types of footings, forms, and reinforcement.	6

6	**Systems and Finishes**: Installation fundamentals for electrical, plumbing, HVAC, interior and exterior wall finishing: drywall, painting, doors, and windows installation, procedures for ensuring weatherproofing and insulation.	7

Textbooks:

1. Construction Technology by Rajesh Kumar R, Jyothis Publishers,
2. Construction Equipment and Its Management by S.C. Sharma, Khanna Book Publishing
3. Construction Safety by R K Mishra, Jyothis Publishers
4. Comprehensive HVAC System Design by N.C. Gupta Viva Books

References:

1. Construction Technology and Management by Gaurav K. Sagar and Arvind K. Sagar, Visionias
2. National Building Code of India 2016, Bureau of Indian Standards, New Delhi

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Course Code:	DCE 471
Course Title:	Fluid mechanics
Course Credit:	01
L-T-P:	0-0-2
Total contact hours:	24

Course objective:	• To Enrich the concept of fluid mechanics and hydraulic machines. • To Demonstrate the classical experiments in fluid mechanics and hydraulic machinery. • To Correlate various flow measuring devices such as Venturi meter, orifice meter and notches etc. • To Discuss the performance characteristics of turbines and pumps
Pre-requisite:	
Course outcomes:	1. Understanding of basic physics of fluid. 2. Calculate the different fluid properties using various type of equipment's like measurement of flow, pressure velocity and head loss. 3. Understand the basic properties and characteristics of incompressible fluid in laboratory. 4. Able to calculate and design engineering application involving fluids. 5. Understanding of analysing flow systems in terms of mass, momentum, and energy balance.

Module No.	Topic	Nos. of contact hours
1	Stability of Floating Body	24
2	Verification of Bernoulli's Theorem	
3	Venturi meter	
4	Orifice meter	
5	Pitot Tube	

6	Flow Visualization	
7	Vortex Flow	
8	Losses in Pipes	
9	Pipes in Series	
10	Pipes in parallel.	

Textbooks:

1. Dr. R K Bansal, "A Text Book of Fluid Mechanics and Hydraulic Machines", Laxmi Publication, Revised Ninth Edition 2019.
2. Fluid Mechanics and Machinery, C.S.P.Ojha, R. Berndtsson and P. N. Chadramouli, Oxford University Press, 2010.

References:

1. Hydraulics and Fluid Mechanics, P M Modi and S M Seth, Standard Book House.
2. Damodara Reddy Annapureddy, "Fluid Mechanics and Hydraulic Machines Lab Manual", 1/e, LAP Lambert Academic Publishing, 2012.
3. Kumara Swamy N., "Fluid Mechanics and Machinery Lab Manual", 1/e, Charotar Publishing House Pvt. Ltd., 2008.

Paper Code:	DCE472
Paper Name:	Surveying-II Lab
Credit:	01
L-T-P:	0-0-2
Total contact hours:	24

Course Objectives:	The objectives of this practical course are: • To enable students to develop practical skills in the use of theodolite, tacheometer, plane table, Total Station, and GPS. • To provide field exposure for conducting surveys, collecting and recording data, and preparing plans or contour maps. • To introduce students to digital data processing and plotting using software tools. • To promote teamwork, accuracy, and systematic fieldwork documentation through survey projects.
Pre-requisites:	Basics knowledge of surveying
Course Outcomes:	After successful completion of the practical course, the students will be able to: 1. Handle and operate surveying instruments confidently and accurately in the field. 2. Conduct theodolite and tacheometric surveys to determine horizontal and vertical distances. 3. Perform plane table surveys and prepare field sketches and contour maps. 4. Use Total Station and GPS for data collection and coordinate determination. 5. Prepare drawings and plans using field data and digital tools. 6. Work effectively in teams and present survey reports with appropriate analysis and interpretation.

Module No.	Topic	Nos. of contact hours
1	Study of components, temporary adjustments, and setting up of Theodolite.	
2	Measurement of horizontal angles by repetition and reiteration methods using Theodolite.	

3	Measurement of vertical angles and determination of height of inaccessible object (Trigonometrical levelling).	24
4	Theodolite traversing – measurement of included angles, plotting and balancing the traverse.	
5	Determination of horizontal distance and elevation by Tacheometric methods (Stadia and Tangential).	
6	Plane table survey by Radiation and Intersection methods.	
7	Contouring by Plane Table survey and preparation of contour map.	
8	Setting out of simple circular curve using Theodolite.	
9	Use of Total Station for measurement of coordinates, distances, and area mapping.	
10	GPS survey – determination of positions and coordinates, and preparation of layout plan	

Textbooks:

1. B.C. Punmia, *Surveying Vol. II*, Laxmi Publications.
2. S.K. Duggal, *Surveying Vol. II*, Tata McGraw Hill.
3. Arora, K.R., *Surveying Vol. II*, Standard Book House.
4. Satheesh Gopi, R. Sathikumar, and N. Madhu, *Advanced Surveying: Total Station, GPS, GIS & Remote Sensing*, Pearson Education.

References:

1. Anderson & Mikhail, *Surveying: Theory and Practice*, McGraw Hill.
2. Paul R. Wolf and Charles D. Ghilani, *Elementary Surveying: An Introduction to Geomatics*, Pearson Education.
3. James M. Anderson, *Modern Surveying*, Springer.
4. IS 12757: Guidelines for Theodolite Survey and Tacheometry (BIS).

Course Code:	DCE473
Course Title:	Computer Aided Building Drawing
Credit:	01
L-T-P:	0-0-2
Total Contact Hours:	24

Course Objectives:	• The objective of this lab is to teach the student usage of Auto cad, basic drawing fundamentals in various civil engineering applications, especially in building drawing. • The objective of this course is to teach students the basic commands and tools necessary for professional 2D drawing, 3D drawing and drafting using AutoCAD • Students able to learn to sketch and take field dimensions. • Students able to learn to take data and transform it into graphic drawings. Students able to learn basic engineering drawing formats
Pre-requisites:	NIL
Course Outcomes:	After completion of this course, students will be able to: 1. Understand CAD software and basic functions. 2. Evaluate plans of Single storied building & multi-storeyed buildings. 3. Develop different sections at different elevations 4. Detailing of building components like doors, windows roof trusses. 5. Develop section and elevation for single and multistoried buildings using CAD software.

Module No.	Topic	Nos. of contact hours
1	Introduction to computer aided drafting & coordinate system. Exercise on Draw & Modify tool bars. Exercise on Layer, Dimension, Texting & Block etc	24
2	Drawing a plan of Building and dimensioning using layers. a) Single storied buildings b) Multi storied buildings.	
3	Developing sections and elevations for given a) Single storied buildings b) Multi storied buildings.	
4	Drawing of building components like walls, lintels, Doors, and Windows.	
5	Introduction to 3 – D view. Exercise on 3 – D.	
6	Drawing the plan, section and elevation for an industrial building	

Textbooks:

1. Scott Onstott, AutoCAD 2018 and AutoCAD LT 2018 Essentials, Wiley (2017), (ISBN: 9788126569298)
2. M.G.Shah, Kale, Patki, Building Drawing with an Integrated Approach to Built Environment, Tata McGraw-Hill Education India, 5th edition, 2011, (ISBN: 9780071077873, 0071077871).
3. Building Services Environmental And Electro Mechanical Services, Second Revised, 2014, (ISBN: 9788175259805)

References:

1. Bureau of Indian Standards, " HAND BOOK OF FUNCTIONAL REQUIREMENTS OF BUILDINGS, (SP-41 & SP- 32)", BIS 1987 and 1989, (SP-41: ISBN: 8170610117).
2. Croome, J. D. & Roberts, B. M., "AIR-CONDITIONING AND VENTILATION OF BUILDINGS VOL-1". Pergamon Press, (ISBN: 0080247792).
3. SP-35 (1987): Handbook of Water supply & drainage-BIS, (SP- 35: ISBN: 8170610095).
4. N.B.C.-2016, Volume 1 & 2, BIS, (ISBN: 8170610990).

Course Code:	DHS401
Course Title:	Indian Knowledge System
Credit:	0
L-T-P:	2-0-0
Total Contact Hours:	24

**To be Prepared by Dept. of HSS

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COURSE STRUCTURE

AND

SYLLABUS FOR

DIPLOMA PROGRAMMES

in

Computer Science and Engineering (CSE)

Semester IV

(APPLICABLE FROM AY 2024-2025 ADMITTED BATCH ONWARDS)

4TH SEMESTER DIPLOMA

COURSE CODE	COURSE NAME	L	T	P	C
DCS401	Operating Systems	3	0	0	3
DCS402	Introduction to DBMS	3	0	0	3
DCS403	Object Oriented Programming using C++	3	0	0	3
DCS404	Software Engineering	3	0	0	3
DCS405	Web Technologies	2	0	0	2
DCS471	Operating Systems Lab	0	0	4	2
DCS472	DBMS Lab	0	0	4	2
DCS473	Object Oriented Programming Lab	0	0	2	1
DCS475	Web Technologies Lab	0	0	2	1
		Total			**20**

Course Code	Course Name	L	T	P	C
DCS401	Operating Systems	3	0	0	3

Course Learning Objectives:

A general introduction to various ideas in implementation of operating systems, particularly UNIX. Introduce to various options available so as to develop capacity to compare, contrast, and evaluate the key trade-offs between different design choices.

Course Content:

UNIT 1: Overview of Operating System, basic concepts, UNIX/LINUX Architecture, Kernel, services and systems calls, system programs.

UNIT 2: Process Management: Process concepts, operations on processes, IPC, Process Scheduling, Multi-threaded programming, Deadlock, Deadlock handling ways (deadlock occurrence, avoidance & prevention), Banker's algorithm.

UNIT 3: Memory management: Memory allocation, Swapping, Paging, Segmentation, Virtual Memory, various faults, Page replacement algorithms.

UNIT 4: File management: Concept of a file, access methods, directory structure, file system mounting, file sharing and protection, file system structure and implementation, directory implementation, free space management, efficiency and performance. Different types of file systems

UNIT 5: I/O System: Mass storage structure - overview, disk structure, disk attachment, disk scheduling algorithms, swap space management, RAID types.

UNIT 6: OS Security: Authentication, Access Control, Access Rights, System Logs

Reference Books:

1. Operating System Concepts, Silberschatz and Galvin, Wiley India Limited
2. UNIX Concepts and Applications, Sumitabha Das, McGraw-Hill Education
3. Operating Systems, Internals and Design Principles, Stallings, Pearson Education, India
4. Operating System Concepts, Ekta Walia, Khanna Publishing House
5. Modern Operating Systems, Andrew S. Tanenbaum, Prentice Hall of India
6. Operating systems, Deitel & Deitel, Pearson Education, India

Course outcomes:

Students should be able to demonstrate basic knowledge about Operating System, be able to apply OS concepts such as processes, memory and file systems to system design, able to configure OS in an efficient and secure manner.

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Course Code	Course Name	L	T	P	C
DCS402	Introduction to DBMS	3	0	0	3

Course Learning Objectives:

PC It covers the development of database-driven applications using the capabilities provided by modern database management system software. The concepts include conceptual modeling, relational database design and database query languages.

Course Content:

UNIT 1: Introduction; Database System Concepts and Architecture

UNIT 2: Data Modeling using the Entity-Relationship Model; The Enhanced Entity-Relationship (EER) model

UNIT 3: The Relational Data Model and Relational Database Constraints; ER/EER to Relational Model mapping; Relational Algebra and Relational Calculus

UNIT 4: Schema definition, Constraints, Queries, and Views; Security; Introduction to SQL programming Techniques

UNIT 5: Functional dependencies and normalization for relational databases; Relational database design algorithms and further dependencies.

Reference Books:

1. Fundamentals of Database Systems, Elmasri & Navathe, Pearson Education

2. Database Management Systems, Raghurama Krishnan, Johannes Gehrke, Tata McGraw-Hill.

3. Database System Concepts, Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill, New Delhi, India.

4. Introduction to Database Systems, C.J.Date, Pearson Education

5. Introduction to SQL, Rick F.Vander Lans, Pearson Education

Course outcomes:

After completing the course, the students will understand (i) how to design a database, database-based applications (ii) How to use a DBMS (iii) the critical role of database system in designing several information system-based software systems or applications.

Course Code	Course Name	L	T	P	C
DCS403	Object Oriented Programming using C++	**3**	**0**	**0**	**3**

Course Learning Objectives

To inculcate knowledge on Object-oriented programming concepts using C++. To gain Knowledge on object oriented concept like Abstraction, Encapsulation, Inheritance and Polymorphism

UNIT – I : Introduction to C++ - key concepts of Object-Oriented Programming –Advantages – Object Oriented Languages – I/O in C++ - C++ Declarations. Control Structures : - Decision Making and Statements : If ..else, jump, goto, break, continue, Switch case statements - Loops in C++ : for, while, do - functions in C++ - inline functions – Function Overloading.

UNIT – II: Classes and Objects: Declaring Objects – Defining Member Functions – Static Member variables and functions – array of objects –friend functions – Overloading member functions – Bit fields and classes – Constructor and destructor with static members.

UNIT- III: Operator Overloading: Overloading unary, binary operators – Overloading Friend functions – type conversion – Inheritance: Types of Inheritance – Single, Multilevel, Multiple, Hierarchal, Hybrid, Multi path inheritance – Virtual base Classes – Abstract Classes.

UNIT – IV: Pointers – Declaration – Pointer to Class , Object – this pointer – Pointers to derived classes and Base classes – Arrays – Characteristics – array of classes – Memory models – new and delete operators – dynamic object – Binding, Polymorphism and Virtual Functions.

UNIT – V: Files – File stream classes – file modes – Sequential Read / Write operations – Binary and ASCII Files – Random Access Operation – Templates – Exception Handling - String – Declaring and Initializing string objects – String Attributes – Miscellaneous functions .

TEXT BOOK:

1. E. Balagurusamy, “Object-Oriented Programming with C++”, TMH 2013, 7th Edition.

REFERENCE BOOKS:

1. Ashok N Kamthane, “Object-Oriented Programming with ANSI and Turbo C++”, Pearson Education 2003.
2. Maria Litvin & Gray Litvin, “C++ for you”, Vikas publication 2002.

Course outcomes:

After completing the course, the students will understand object-oriented principles (constructors, destructors, operator overloading, inheritance models, virtual functions, interfaces) and will realise where to apply the object oriented concept.

Course Code	Course Name	L	T	P	C
DCS404	Software Engineering	3	0	0	3

Course Learning Objectives:

PC Inculcate essential technology and software engineering knowledge and skills essential to build a reasonably complex usable and maintainable software iteratively. 2) Emphasize on structured approach to handle software development. 3) Enhance communication skills.

Course Content:

UNIT 1: Introduction to Software Engineering, Lifecycle, Process Models - Traditional v/s Agile processes.

UNIT 2: Development Activities - Requirements Gathering and Analysis, Design Concepts, Software architecture and Architectural styles, Basic UI design, Effective Coding and Debugging techniques.

UNIT 3: Software Testing Basics, Unit, Integration, System and Acceptance Testing, Introduction to various testing techniques (e.g. Stress testing), Writing and executing test cases, Quality Assurance.

UNIT 4: Project Management - Project management concepts, Configuration and Release Management, Version Control and its tools (Git), Release Planning, Change Management, Software Maintenance, Project Metrics.

Reference Books:

1. Software Engineering – A Practitioner's Approach, 7th Edition, Roger Pressman.

2. Software engineering, Ian Sommerville, Pearson Education

3. An Integrated Approach to Software Engineering, Pankaj Jalote, Springer Verlag

4. Software Engineering, Nasib Singh Gill, Khanna Book Publishing Co. India.

5. Software Engineering, K. K. Agarval, Yogesh Singh, New Age International Publishers

6. Fundamentals of Software Engineering, Rajib Mall, PHI

Course outcomes:

The proposed course is expected to provide an introduction to software engineering concepts and techniques to the students, thus enabling them to work in a small team to deliver a software system. The course content and project will introduce various software technologies, process and project management skills that are needed for the delivery of software in a team setting.

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Course Code	Course Name	L	T	P	C
DCS405	Web Technologies	2	0	0	2

Course Learning Objectives:

PC To provide basic skills on tools, languages and technologies related to website development. Learnings from this course can be used in the web project development.

Course Content:

UNIT 1: Introduction to www protocols and programs, secure connections, application and development tools, the web browser, what is server, setting up UNIX and LINUX web servers, Logging users, dynamic IP Web Design: Web site design principles, planning the site and navigation

UNIT 2: Web systems architecture of web-based systems- client/server (2-tier) architecture, 3-Tier architecture, building blocks of fast and scalable data access concepts - Caches-proxies-indexes-load balancers- queues, Web Application architecture (WAA)

UNIT 3: JavaScript client-side scripting, what is JavaScript, simple JavaScript, variables, functions, conditions, loops and repetition

UNIT 4: Advance scripting JavaScript and objects, JavaScript own objects, DOM and web browser environments, forms and validations, DHTML: Combining HTML, CSS and JavaScript, events and buttons, controlling your browser, Ajax: Introduction advantages & disadvantages, Ajax based web application, alternatives of ajax XML, XSL and XSLT: Introduction to XML, uses of XML, simple XML, XML key components, DTD and Schemas, XML with application, XSL and XSLT. Introduction to Web Services

UNIT 5: PHP server-side scripting, Arrays, function and forms, advance PHP Databases: Basic command with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP my admin and database bugs.

Reference Books:

1. Web Technologies--A Computer Science Perspective, Jeffrey C.Jackson,

2. Internet & World Wide Web How To Program, Deitel, Deitel, Goldberg, Pearson Education

3. Web programming- Building Internet Application, Chris Bales

4. Web Applications: Concepts and Real-World Design, Knuckles.

Course Outcomes:

Student will be able to develop/build a functional website with full features.

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Course Code	Course Name	L	T	P	C
DCS471	**Operating Systems Lab**	**0**	**0**	**4**	**2**

Course Learning Objectives:

This Lab course is intended to practice and do experiment on concepts taught in theory class of 'Operating Systems' and gain insight into functioning of the Operating Systems.

Course Content:

Sl No	Topics for Practice
1	Practice of various commands like man, cp, mv, ln, rm, unlink, mkdir, rmdir, etc.
2	Implement two-way process communication using pipes
3	Implement message queue form of IPC
4	Implement shared memory and semaphore form of IPC
5	Simulate the CPU scheduling algorithms - Round Robin, SJF, FCFS, priority
6	Simulate Bankers algorithm for Deadlock Avoidance and Prevention
7	Simulate all FIFO Page Replacement Algorithm using C program
8	Simulate all LRU Page Replacement Algorithms using C program
9	Simulate Paging Technique of Memory Management
10	Practice various commands/utilities such as catnl, uniq, tee, pg, comm, cmp, diff, tr, tar, cpio, mount, umount, find, umask, ulimit, sort, grep, egrep,fgrep cut, paste, join, du, df , ps, who, etc and many more.

Reference Books:

1. Operating System Concepts, Silberschatz, Abraham and Galvin, Peter, Wiley India Limited

2. UNIX Concepts and Applications, Sumitabha Das, McGraw-Hill Education

3. Operating System Concepts, Ekta Walia, Khanna Publishing House

Course outcomes:

Students should be able to demonstrate basic knowledge about Operating System, be able to apply OS concepts such as processes, memory and file systems to system design, able to configure OS in an efficient and secure manner, and become an advance user of operating system.

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Course Code	Course Name	L	T	P	C
DCS472	DBMS Lab	0	0	4	2

Course Learning Objectives:

This Lab course is intended to practice whatever is taught in theory class of 'Introduction to DBMS'. A few sample case studies are listed with some suggested activities. More case studies may be added to this list. You need to develop these case studies, apply all relevant concepts learnt in theory class as the course progress, identify activities/operations that may be performed on the database. It will be a good idea to also use concepts learnt in the course on Software Engineering

Course Content:

Sl no	Topics for Practice
1	Case Study-1: Employee database – 'Create' employee table, 'Select' and display an employee matching a given condition, 'Delete' duplicate records, delete rows using triggers, insert and update records, find net salary, etc
2	Case Study-2: Visitor Management database
3	Case Study-3: Students Academic database
4	Case Study-4: Inventory Management System database
5	Case study-5: Bank Operations database
6	Case Study-6: Bus Operator (Roadways) – Do related activities such as prepare E-R Model, Relational Model, do Normalisation, Create Tables, insert data, Delete Data, Query database, create stored procedures, etc.

Reference Books:

1. Elmasri & Navathe, Fundamentals of Database Systems, Pearson Education

2. Raghurama Krishnan, Johannes Gehrke, Database Management Systems, Tata McGraw-Hill,

3. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, McGraw-Hill, New Delhi, India.

4. Introduction to Database Systems, C.J.Date, Pearson Education

5. Introduction to SQL, Rick F.Vander Lans, Pearson Education

Course outcomes:

After completing the course, the students will understand (i) how to design a database, database-based applications (ii) How to use a DBMS (iii) the critical role of database system in designing several information system-based software systems or applications.

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Course Code	Course Name	L	T	P	C
DCS473	Object Oriented Programming Lab	**0**	**0**	**2**	**1**

Course Learning Objectives:

This Lab course is intended to practice whatever is taught in theory class of 'Object Oriented Concept'. Some of the things that should necessary be covered in lab are listed below:

1. Program using conditional statements (if, else-if, switch).
2. Program using loops (for, while, do-while) for patterns or series.
3. Program to demonstrate functions (call by value, call by reference).
4. Program to implement inline functions and default arguments.
5. Program to create a class and objects demonstrating data members and member functions.
6. Program to show use of constructors and destructors (default, parameterized).
7. Program to implement copy constructor.
8. Program to demonstrate function overloading.
9. Program to demonstrate operator overloading (e.g., unary ++, binary +).
10. Program to implement static data members and static member functions.
11. Program to demonstrate single inheritance.
12. Program for multilevel inheritance.
13. Program for multiple inheritance using C++ classes.
14. Program to demonstrate function overriding.
15. Program using virtual functions and runtime polymorphism.
16. Program for file handling (read/write text file).
17. Program using class templates.
18. Program using function templates.
19. Program to implement exception handling (try–catch).
20. Program to create a simple student database using classes and file handling.

Course outcomes:

Student will be able to address their problems with the Object Oriented concept and able to understand where to use the Object Oriented concept.

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Course Code	Course Name	L	T	P	C
DCS475	Web Technologies Lab	0	0	2	1

Course Learning Objectives:

This Lab course is intended to practice whatever is taught in theory class of 'Web Technologies'. Some of the things that should necessary be covered in lab are listed below:

Course Content:

S.No.	Topics for Practice
1	Coding Server Client Programs
2	Developing Web Application using HTML, JavaScript
3	Developing Advanced Web Application Programs using CSS
4	Practicing PHP: Basics
5	Practicing PHP: Web Application Development
6	Practicing PHP: MySQL - tiered Applications
7	Developing a fully functional Web Service Application using all the technologies learned in this course.

Reference Books:

1. Web Technologies--A Computer Science Perspective, Jeffrey C.Jackson,
2. Internet & World Wide Web How to Program, Deitel, Deitel, Goldberg, Pearson Education
3. Web programming- Building Internet Application, Chris Bales
4. Web Applications: Concepts and Real-World Design, Knuckles

Course outcomes:

Student will be able to develop/build a functional website with full features.

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COURSE STRUCTURE

AND

SYLLABUS FOR

DIPLOMA PROGRAMMES

in

Electronics and Communication Engineering

(ECE)

Semester IV

(APPLICABLE FROM AY 2024-2025 ADMITTED BATCH ONWARDS)

COURSE STRUCTURE	
4th Semester / 2nd Year	
Name of the Programme	**Diploma**
Name of the Department	**ECE**

A.		Theory Courses					
Sl No.	Course Code	Course Title	L	T	P	C	Coordinating Department
1	DEC401	Microcontroller and its Applications	3	0	0	3	ECE
2	DEC402	Consumer Electronics	3	0	0	3	ECE
3	DEC403	Digital Communication Systems	3	0	0	3	ECE
4	DEC404	Linear Integrated Circuits	3	0	0	3	ECE
5	DEC411	A. Electronic Equipment Maintenance or B. PC System Technology	3	0	0	3	ECE
Total of A						15	

B.		Laboratory / Project / Seminar Courses					
Sl No.	Course Code	Course Title	L	T	P	C	Coordinating Department
6	DEC471	Microcontroller and its Application Lab	0	0	2	1	ECE
7	DEC472	Digital Communication Systems Lab	0	0	2	1	ECE
8	DEC473	Linear Integrated Circuits Lab	0	0	2	1	ECE
9	DEC491	Micro Project	0	0	2	1	ECE
Total of B						4	

C.		Audit / Non-credit Courses					
Sl No.	Course Code	Course Title	L	T	P	C	Coordinating Department
10	DHS*	Essence of Indian Knowledge and Tradition	2	0	0	0	HSS
Total of C						0	
Grand Total (A+B+C)						19	

Semester:	**4**
Name of the Program:	**Diploma in Electronics & Communication Engineering**
Course Code:	**DEC401**
Course Title:	**Microcontroller and its application**
Course Credit:	4 (L: 3 T: 1 P: 0)

Course objective:	1. Introduce students to the basic concepts of microprocessors and microcontrollers, emphasizing their architectures and functional differences. 2. Explain the architecture and operation of Intel MCS-51 family, particularly the 8051microcontroller. 3. Develop programming skills in assembly and embedded C for 8051 microcontrollers. 4. Provide knowledge on interfacing microcontrollers with external devices such as LEDs, LCDs, keypads, ADCs, DACs, and sensors. 5. Introduce ARM processor core-based microcontrollers and explain their architecture, features, and applications. 6. Build the ability to design and implement small embedded control systems using microcontrollers.
Pre-requisites:	Basics of digital logic, sequential and combinational circuits
Course outcomes:	1. Explain the architecture and operation of microprocessors (8085, 8086) and microcontrollers (8051). 2. Describe the instruction set, addressing modes, and programming techniques of the 8051 microcontroller. Understanding/Applying 3. Write and execute assembly language and C programs for 8051 to perform I/O operations, timer/counter control, and interrupt handling. 4. Interface 8051 with peripheral devices such as LCDs, keypads, LEDs, ADCs, DACs, and sensors. 5. Explain the fundamentals of ARM processor-based microcontrollers and their features, with reference to LPC214x.

	6. Design and develop simple embedded system applications using 8051 or ARM-based microcontrollers.

Unit/ Module no.	Topic	Nos. of contact hours	Distribution of marks (out of 100)
1.	**Introduction:** Introduction to Microprocessors and Microcontrollers, Architectures [8085, 8086], Intel MCS-51 family features – 8051 - organization and architecture	6	
2.	**Programming with 8051:** Instruction set, addressing modes, conditional instructions, I/O Programming, Arithmetic logic instructions, single-bit instructions, interrupt handling, programming counters, timers, and stack	8	
3.	**MCS51 and external Interfaces:** user interface—keyboard, LCD, LED, real-world interface-ADC, DAC, SENSORS Communication interface	8	
4.	**C programming with 8051:** I/O Programming, Timers/counters, Serial Communication, interrupts, user interfaces (LCD, Keypad, LED, and communication interfaces [RS232]	6	
5.	**ARM processor core-based microcontrollers:** Need for RISC processor—ARM processor fundamentals, ARM core-based controller [LPC214X], IO ports, ADC/DAC, timers.	8	

Text Books:

S. No.	Title of Book	Author	Publication
1	The 8051 Microcontroller and Embedded Systems	Muhammad Ali Mazidi & Janice Gilli Mazidi, D. Kinely	Pearson Education India, 2nd Ed.

Reference Books:

S. No.	Title of Book	Author	Publication
1.	The 8051 Microcontroller	Kenneth Ayala	Cengage India, 3rd Ed. 2007
2.	Microprocessor & Microcontroller Architecture: Programming & Interfacing using 8085, 8086, 8051	Soumitra Kumar Mandal	McGraw Hill Education
3.	Microcontrollers: Architecture, Implementation, and Programming	Taba Daniel, Hintz Kenneth	Tata McGraw Hill, 2007
4.	Embedded Systems with Arm Cortex-M Microcontrollers in Assembly Language and C:	Yifeng Zhu	E-Man Press LLC, 2017
5.	Microprocessors and interfacing: programming and hardware	Douglas V. Hall	Tata McGraw Hill, 2nd Editon, 2007

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Semester:	**4**
Course Code:	**DEC471**
Course Title:	**Microcontroller and its application Lab**
Course Credit:	**1(L: 0, T:0 P: 2)**
Name of the Program:	**Diploma in Electronics & Communication Engineering**
Course objective:	1. Provide hands-on experience with microcontroller programming using assembly language and C. 2. Teach students how to interface basic I/O devices such as LEDs, switches, and displays with microcontrollers. 3. Develop skills in using timers, counters, and interrupts for time-dependent tasks. 4. Understand and implement serial communication techniques (transmission/reception) using microcontrollers. 5. Introduce basic concepts of digital logic operations, stack operations, and memory management in microcontroller systems. 6. Familiarize students with the use of lookup tables and the execution of logic operations on hexadecimal data. 7. Enable students to perform real-time embedded tasks such as creating delays, blinking LEDs, and handling matrix keypads.
Pre-requisites:	Basics of Digital logic, sequential and combinational circuits
Course outcomes:	1. Write C programs to perform basic I/O operations such as adding two numbers and displaying the result at a digital I/O port. 2. Develop and execute C programs to blink an LED with a controlled delay using microcontrollers. 3. Write assembly programs to perform arithmetic operations and save the results to a stack or I/O port. CO4 Perform logical operations on hexadecimal data and display the result at a given port using C programming. 4. Utilise lookup tables for storing and accessing characters, and display the output with a delay on I/O ports. 5. Interface a 4x4 matrix keypad with a microcontroller and display the entered values using C or Assembly language. 6. Write assembly programs using timers for generating a square wave with Mode 2 in microcontroller systems. 7. Design and implement serial communication routines (transmission and reception) using assembly or C programming for microcontrollers. 8. Understand and implement internal interrupts in microcontroller programming using C or Assembly.

	9. Work with hardware interrupts and perform task execution based on interrupt signals in embedded systems.

Unit/ Module no.	Topic	Nos. Of contact hours	Distribution of marks (out of 100)
1	Blinking of LED with a certain delay in C	2	
2	An assembly program for the addition of 25 10 times and save the result to the digital I/O port.	2	
3	An assembly language program for performing arithmetic operations and saving the result into the stack.	2	
4	Perform logical operations on different hexadecimal data and display at a given port with C.	2	
5	Use of a lookup table for storing, accessing, and displaying the characters at an I/O port with a delay.	2	
6	Interface the 4x4 matrix switch and display the values with C/assembly language.	2	
7	Use Timers for generating a square wave with Mode 2 in Assembly	2	
8	Assembly/C programming for Serial data transmission and reception	2	
9	Working on the internal Interrupts: Assembly or C.	2	
10	Use of hardware interrupts and task execution.	2	
11	Make-up/practice lab	2	
12	Make-up/practice lab	2	

Text Books:

S. No.	Title of Book	Author	Publication
1.	The 8051 Microcontroller and Embedded Systems	Muhammad Ali Mazidi & Janice Gilli Mazidi, D. Kinely	Pearson Education India, 2nd Ed.

Reference Books:

S. No.	Title of Book	Author	Publication
1.	The 8051 Microcontroller	Kenneth Ayala	Cengage India, 3rd Ed. 2007
2.	Microprocessor & Microcontroller Architecture: Programming & Interfacing using 8085, 8086, 8051	Soumitra Kumar Mandal	McGraw Hill Education
3.	Microcontrollers: Architecture implementation and Programming	Taba Daniel, Hintz Kenneth	Tata McGraw Hill, 2007
4.	Embedded Systems with Arm Cortex-M Microcontrollers in Assembly Language and C:	Yifeng Zhu	E-Man Press LLC, 2017
5.	Microprocessors and interfacing: programming and hardware	Douglas V. Hall	Tata McGraw Hill, 2nd Editon, 2007

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Name of the Program:	Diploma in Electronics & Communication Engineering
Semester:	4
Course Code:	DEC402
Course Title:	Consumer Electronics
Course Credit:	4 (L: 3 T: 1 P: 0)

Course objective:	1. Understand the basic characteristics of sound signals, audio measurement techniques, and various audio input/output transducers. 2. Explain the construction, working principles, and applications of different audio and television systems. 3. Analyse the standards, signal processing concepts, and transmission principles used in monochrome and colour television systems. 4. Examine the architecture and operation of modern video systems and interfaces used in digital multimedia devices. 5. Familiarise yourself with the functional blocks, control mechanisms, and electronic systems used in common home and office appliances.
Prerequisites:	Nil
Course outcomes:	1. Identify and describe the characteristics of sound signals and the functioning of various audio devices such as microphones, speakers, and recording systems. 2. Demonstrate knowledge of audio system design, including FM tuners, PA systems, and digital audio consoles. 3. Interpret and compare different television standards, scanning processes, and video signal components used in monochrome and colour TV systems. 4. Evaluate and troubleshoot modern television and video receiver technologies, including digital display systems and multimedia interfaces. 5. Apply theoretical knowledge to explain the operation and control of electronic appliances such as microwave ovens, air conditioners, photocopiers, and washing machines.

Unit/ Module no.	Topic	Nos. Of contact hours	Distribution of marks (out of 100)
1.	**Audio Fundamentals and Devices:** Basic characteristics of sound signal, Audio level metering, decibel level in acoustic measurement, Microphone & Types, speaker types & working principle, Sound recording	6	
2.	**Audio Systems:** CD player, home theatre sound system, surround sound, Digital console block diagram, working principle, applications, FM tuner, ICs used in FM tuner TDA7021T, PA address system.	8	
3.	**Television Systems:** Monochrome TV standards, scanning process, aspect ratio, persistence of vision and flicker, interlaced scanning, picture resolution, composite video signal, colour TV standards, colour theory, hue, brightness, saturation, luminance and chrominance, and different types of TV cameras and transmission standards.	8	
4.	**Television Receivers and Video Systems:** PAL-D colour TV receiver, digital TVs (LCD, LED, PLASMA, HDTV, 3-D TV, projection TV, DTH receiver), video interface, digital video, SDI, HDMI multimedia interface, digital video interface, CD and DVD player.	8	
5.	**Office Appliances:** Diagrams, operating principles, and controllers for FAX and Photocopier, Microwave Oven, and Washing Machine Machines, Air Conditioners and Refrigerators, and Digital Cameras and Camcorders.	6	

Textbooks:

S. No.	Title of Book	Author	Publication
1.	Consumer Electronics	Dr. B. R. Gupta, V. Singhal	S. K. Kataria & Sons

Reference Books:

S. No.	Title of Book	Author	Publication
1.	Consumer Electronics	Bali S.P.	Pearson Education India,2010, latest edition
2.	Audio Video Systems: principles, practices & troubleshooting	Bali R and Bali S.P	Khanna Book Publishing Co. (P) Ltd., 2010, Delhi, India, latest edition
3.	Modern Television practices	Gulati R.R.	New Age International Publication (P) Ltd. New Delhi ,Year 2011, latest edition
4.	Audio-video systems	Gupta R.G.	Tata McGraw-Hill, New Delhi, India, 2010, latest edition
5.	Mastering Digital Television	Whitaker Jerry & Benson Blair	McGraw-Hill Professional, 2010, latest edition
6.	Standard handbook of Audio engineering	Whitaker, Jerry & Benson Blair	McGraw-Hill Professional, 2010, latest edition.

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Name of the program:	**Diploma in Electronics & Communication Engineering**
Semester:	**4**
Course Code:	**DEC403**
Course Title:	**Digital Communication Systems**
Course Credit:	4 (L: 3 T: 1 P: 0)

Course objective:	1. To introduce the fundamental concepts and block-level understanding of digital communication systems and their subsystems. 2. To explain the principles of signal sampling, quantisation, and various pulse modulation techniques used in digital transmission. 3. To analyse the performance of baseband transmission systems under the influence of noise and intersymbol interference (ISI). 4. To provide a detailed understanding of digital modulation schemes and their performance in terms of bandwidth efficiency and error probability. 5. To familiarise students with the concepts of information and coding theory for efficient and reliable digital communication.
Prerequisites:	Nil
Course outcomes:	1. **Describe** the structure and operation of digital communication systems, including PCM, TDM, and synchronisation mechanisms. 2. **Apply** sampling, quantisation, and line coding techniques to analyse and design digital transmission systems. 3. **Evaluate** the performance of digital baseband systems using matched filters and the Nyquist criteria to minimise ISI. 4. **Compare and analyse** various digital modulation schemes (BPSK, QPSK, FSK, DPSK, etc.) based on their error performance and bandwidth efficiency.

	5. **Explain and implement** basic concepts of information theory and coding techniques such as Hamming and Reed–Solomon codes for error detection and correction.

Unit/ Module no.	Topic	Nos. of contact hours	Distribution of marks (out of 100)
1	Block diagram and subsystem description of a digital communication system. Sampling of low-pass and band-pass signals, PAM, PCM, signal-to-quantization noise ratio analysis of linear and nonlinear quantizers, line codes and bandwidth considerations, PCM TDM hierarchies, frame structures, frame synchronization, and bit stuffing.	8	
2	Quantization noise analysis of DM and ADM; DPCM and ADPCM. Baseband transmission, matched filter, performance in additive Gaussian noise; Intersymbol interference (ISI), Nyquist criterion for zero ISI, and digital subscriber lines.	8	
3	Geometric representation of signals; Correlation receiver, equivalence with matched filter. Generation, detection, and probability of error analysis of OOK, BPSK, coherent FSK, QPSK, and DPSK; Comparison of bandwidth and bit rate of digital modulation schemes.	10	
4	Introduction to Information and Coding Theories: Information Theory: information measures, Shannon entropy, differential entropy, mutual information. Coding Theory: linear block codes—definitions, properties, some specific codes (Hamming, RS, Concatenated).	10	

Text Books:

	Title of Book	Author	Publication
1.	Communication Systems	Haykin, S	4th Ed., John Wiley & Sons
2.	Modern Digital and Analog Communication Systems	Lathi, B.P. and Ding, Z	Intl. 4th Ed., Oxford University Press.

Reference Books:

S. No.	Title of Book	Author	Publication
1.	Digital Communications	Proakis, J.G. and Saheli, M	5th Ed., McGraw-Hill
2.	Digital Communication: Fundamentals and Applications	Sklar, B., and Ray, P.K	2nd Ed., Dorling Kindersley
3.	Elements of Information Theory	T. Cover and J. Thomas	2/e, Wiley.
4.	Principles of Digital Communication	R. G. Gallager	Cambridge Univ. Press
5.	A Foundation in Digital Communication	A. Lapidoth	Cambridge Univ. Press
6.	Error Control Coding	S. Lin and D. Costello	2/e, Prentice Hall.

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Name of the program:	**Diploma in Electronics & Communication Engineering**
Semester:	**4**
Course Code:	**DEC473**
Course Title:	**Digital Communication Systems Lab**
Course Credit:	**1 (L: 0, T:0, P: 2)**

Course objective:	1. Provide hands-on experience with various pulse and digital modulation techniques, including PCM, DPCM, DM, and ADM. 2. Enable students to simulate and analyze bandpass digital transmission systems such as ASK, FSK, and PSK using software tools or hardware kits. 3. Develop the ability to measure and interpret system performance parameters (e.g., bit error rate, signal-to-noise ratio) for different modulation schemes. 4. Familiarize students with multiplexing and synchronization techniques, including Time Division Multiplexing (TDM) and Phase-Locked Loop (PLL)-based systems. 5. Strengthen practical understanding of digital communication system design, testing, and troubleshooting using laboratory instruments and simulation tools.
Prerequisites:	Nil
Course outcomes:	1. Demonstrate and analyze the principles of Pulse Code Modulation (PCM) and Differential PCM (DPCM). 2. Implement and compare Delta Modulation (DM) and Adaptive Delta Modulation (ADM) techniques for efficient signal representation. 3. Simulate and interpret bandpass digital modulation schemes such as ASK, FSK, and PSK using software or hardware platforms. 4. Evaluate the performance characteristics (e.g., BER, SNR) of bandpass signal transmission and reception systems. 5. Design and implement practical ASK, FSK, and PSK modulators and demodulators. 6. Construct and test a Time Division Multiplexing (TDM) system and apply PLL-based synchronization for clock and data recovery.

	7. Integrate knowledge of modulation, multiplexing, and synchronization to analyze complete digital communication links.

Unit/ Module no.	Topic	Nos. of contact hours	Distribution of marks (out of 100)
1	Pulse Code Modulation and Differential Pulse Code Modulation	2	
2	Delta modulation and adaptive delta modulation.	2	
3	Simulation of Bandpass Signal Transmission and Reception, Amplitude Shift Keying, Frequency Shift Keying, Phase Shift Keying.	4	
4	Performance Analysis of Bandpass Signal Transmission and Reception, Amplitude Shift Keying, Frequency Shift Keying, Phase Shift Keying.	2	
5.	Implementation of Amplitude Shift Keying.	2	
6.	Implementation of Frequency Shift Keying.	2	
7.	Implementation of Phase Shift Keying.	2	
8.	Time Division Multiplexing: PLL (CD 4046)-based synch, clock, and data extraction	4	
9.	Make-up/practice lab	2	
10.	Make-up/practice lab	2	

Text books:

	Title of Book	Author	Publication
1.	Communication Systems	Haykin, S	4th Ed., John Wiley & Sons
2.	Modern Digital and Analog Communication Systems	Lathi, B.P. and Ding, Z	Intl. 4th Ed., Oxford University Press.

Reference books:

S. No.	Title of Book	Author	Publication
1.	Digital Communications	Proakis, J.G. and Saheli, M	5th Ed., McGraw-Hill
2.	Digital Communication: Fundamentals and Applications	Sklar, B., and Ray, P.K	2nd Ed., Dorling Kindersley
3.	Elements of Information Theory	T. Cover and J. Thomas	2/e, Wiley.
4.	Principles of Digital Communication	R. G. Gallager	Cambridge Univ. Press
5.	A Foundation in Digital Communication	A. Lapidoth	Cambridge Univ. Press
6.	Error Control Coding	S. Lin and D. Costello	2/e, Prentice Hall.

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Course Title:	**Linear Integrated Circuits**
Name of the program:	**Diploma in Electronics & Communication Engineering**
Course Credit:	**3 (L: 3, T: 0, P: 0)**
Semester:	**4**
Course Code:	**DEC404**

Course objective:	1. Understand the fabrication process, internal structure, and circuit configurations of linear integrated circuits. 2. Analyze the characteristics and performance parameters of operational amplifiers under various configurations. 3. Apply operational amplifiers to design analog signal processing circuits, including amplifiers, filters, and waveform generators. 4. Comprehend and utilize analog building blocks such as multipliers, phase-locked loops, and data converters in system applications. 5. Explore special function integrated circuits for practical applications, including voltage regulation, waveform generation, and signal conversion.
Pre-requisites:	Basics of Network and circuit theory, analog electronics
Course outcomes:	1. Explain the IC fabrication process, and describe the construction and characteristics of monolithic components and differential amplifier stages. 2. Analyze and design operational amplifier circuits for linear and non-linear applications. 3. Evaluate the operation of analog multipliers and phase-locked loops (PLLs) and apply them in communication and control systems. 4. Differentiate and design various A/D and D/A converters, understanding their architecture, performance, and limitations. 5. Design and implement waveform generators, voltage regulators, and special function IC-based circuits for real-world electronic systems.

Unit/ Module no.	Topic	Nos. of contact hours	Distribution of marks (out of 100)
1.	**IC Fabrication and Circuit Configuration for Linear IC:** Advantages of ICs over discrete components—manufacturing process of monolithic ICs, construction of monolithic bipolar transistors, monolithic diodes, integrated resistors, monolithic capacitors, and inductors. Current mirror and current sources, Current sources as active loads, Voltage sources, Voltage References, BJT Differential amplifier with active loads, general operational amplifier stages, and internal circuit diagrams of IC 741, DC and AC performance characteristics, slew rate, open-loop and closed-loop configurations.	6	
2.	**Applications of Operational Amplifiers:** Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, V-to-I and I-to-V Converters, Adder, Subtractor, Instrumentation Amplifier, Integrator, Differentiator, Logarithmic Amplifier, Anti-logarithmic Amplifier, Comparators, Schmitt Trigger, Precision Rectifier, Peak Detector, Clipper and Clamper, and Low-Pass, High-Pass, and Band-Pass Butterworth Filters.	7	
3.	**Analog Multiplier and PLL:** Analog Multiplier using Emitter Coupled Transistor Pair—Gilbert Multiplier cell—Variable transconductance technique, analog multiplier ICs and their applications, Operation of the basic PLL, closed-loop analysis, voltage-controlled oscillator, Monolithic PLL IC 565, application of PLL for AM detection, FM detection, FSK modulation and demodulation, and Frequency	8	
4.	**Analog to digital and digital to analog converters:** Analog and Digital Data Conversions, D/A converter – specifications - weighted resistor type, R-2R Ladder type, voltage mode, and current mode R2R ladder-type switches for D/A converters, high-speed sample-and-hold circuits, A/D Converters specifications - Flash type - Successive Approximation type - Single Slope type – Dual Slope type - A/D Converter using Voltage-to-Time Conversion - Over-sampling A/D Converters.	9	
5.	**Waveform generators and special function ICs:** Sine-wave generators, multivibrators, and Triangular wave generators, Saw-tooth wave generator, ICL8038 function generator, Timer IC 555, IC Voltage regulators—three-terminal	6	

	fixed and adjustable voltage regulators - IC 723 general purpose regulator Monolithic switching regulator, Switched capacitor filter IC MF10, frequency-to-voltage and voltage-to-frequency converters, audio power amplifier, video amplifier, isolation amplifier, opto-couplers, and fiber optic IC.		

Text Books:

	Title of Book	**Author**	**Publication**
1.	Design with operational amplifiers and analog integrated circuits, 3rd Edition	Sergio Franco	Tata McGraw-Hill, 2007
2.	Linear Integrated Circuits,	D.Roy Choudhry, Shail Jain	New Age International Pvt. Ltd

Reference Books:

S. No.	**Title of Book**	**Author**	**Publication**
1.	System design using Integrated Circuits	B.S. Sonde	New Age Pub, 2nd Edition, 2001
2.	Analysis and Design of Analog Integrated Circuits	Gray and Meyer	Wiley International, 2005.
3.	OP-AMP and Linear ICs	Ramakant A. Gayakwad	Prentice Hall / Pearson Education, 4th Edition, 2001
4.	Operational Amplifier and Linear Integrated Circuits	K Lal Kishore	Pearson Education, 2006

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Name of the program:	**Diploma in Electronics & Communication Engineering**
Semester:	**4**
Course Code:	**DEC474**
Course Title:	**Linear Integrated Circuit Lb**
Course Credit:	**1 (L: 0, T:0, P: 2)**

Course objective:	1. Understand the characteristics and applications of operational amplifiers and timer ICs through practical implementation. 2. Develop skills to design and test analog signal processing circuits such as amplifiers, waveform generators, and active filters using ICs. 3. Gain hands-on experience with digital building blocks, including adders, counters, multiplexers, and decoders. 4. Apply integrated circuit concepts to design data conversion and regulation circuits, including DACs, ADCs, and voltage regulators. 5. Enhance proficiency in analyzing circuit performance, troubleshooting, and verifying theoretical concepts through experiments.
Pre-requisites:	Basics of circuit and network theory and analog electronics.
Course outcomes:	1. Demonstrate the DC and AC characteristics of operational amplifiers and apply them in analog circuit design. 2. Design and implement waveform generators, active filters, and timer-based applications using IC741 and IC555. 3. Construct and analyze digital circuits such as adders, subtractors, counters, multiplexers, and decoders. 4. Implement and test data converter circuits (DAC and ADC) and IC-based voltage regulators for practical applications. 5. Integrate analog and digital IC applications to design, test, and troubleshoot mixed-signal circuits effectively.

Unit/ Module no.	Topic	Nos. of contact hours	Distribution of marks (out of 100)
1.	Operational Amplifiers (IC741)-Characteristics and Application.	2	
2.	Waveform Generation using Op-Amp (IC741).	2	
3.	Applications of Timer IC555.	2	
4.	Design of Active Filters.	2	
5.	Study and application of PLL IC	2	
6.	Design of binary adder and subtractor.	2	
7.	Design of counters.	2	
8.	Study of multiplexers and demultiplexers/decoders.	2	
9.	Implementation of combinational logic circuits.	2	
10.	Study of DAC and ADC 11. Op-Amp Voltage Regulator-IC 723	2	
11.	Make-up/practice lab	2	
12.	Make-up/practice lab	2	

Text Books:

	Title of Book	Author	Publication
1.	Design with operational amplifiers and analog integrated circuits, 3rd Edition	Sergio Franco	Tata McGraw-Hill, 2007
2.	Linear Integrated Circuits,	D.Roy Choudhry, Shail Jain	New Age International Pvt. Ltd

Reference Books:

S. No.	Title of Book	Author	Publication
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3.	OP-AMP and Linear ICs	Ramakant A.Gayakwad	Prentice Hall / Pearson Education, 4th Edition, 2001
4.	Operational Amplifier and Linear Integrated Circuits	K Lal Kishore	, Pearson Education, 2006

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Name of the program:	Diploma in Electronics & Communication Engineering
Semester:	4
Course Code:	DEC405A
Course Title:	Electronic Equipment Maintenance
Course Credit:	4 (L: 3 T: 1 P: 0)

Course objective:	1. Understand the fundamental troubleshooting procedures and fault-finding techniques used in electronic equipment. 2. Develop the ability to test, identify, and analyze faults in passive components such as resistors, capacitors, and inductors. 3. Gain proficiency in diagnosing and testing semiconductor devices and integrated circuits using appropriate tools and instruments. 4. Acquire knowledge of digital circuit troubleshooting, logic IC testing methods, and handling of sensitive integrated circuits. 5. Learn the methods of rework and repair in modern Surface Mount Technology (SMT) assemblies, including safe handling of SMDs and rework stations.
Pre-requisites:	Nil
Course outcomes:	1. Demonstrate the ability to interpret circuit diagrams, identify equipment faults, and follow systematic troubleshooting procedures. 2. Test and evaluate passive components for faults and understand common causes of their failures. 3. Diagnose and troubleshoot semiconductor devices and op-amp circuits using appropriate testing instruments. 4. Analyze and repair faults in digital circuits and logic ICs using logic probes, comparators, and pulse generators. 5. Perform rework and repair of Surface Mount Device (SMD) assemblies using modern rework tools and follow industry safety practices.

Unit/ Module no.	Topic	Nos. of contact hours	Distribution of marks (out of 100)
1.	Fundamental Troubleshooting Procedures Inside An Electronic Equipment: Reading Drawings And Diagrams – Block Diagram, Circuit Diagram, Wiring Diagram; Dis-assembly and re-assembly of equipment, Equipment Failures and causes such as poor design, production deficiencies, careless storage and transport, inappropriate operating conditions, Nature of faults, the fault location procedure, fault-finding aids – Service and maintenance manuals and instruction manuals, Test and Measuring instruments, special tools Troubleshooting techniques, Approaching components for tests, Grounding systems in Electronic Equipment, Temperature sensitive Intermittent problems Corrective actions, Situations where repairs should not be attempted.	8	
2.	Passive Components and Their Testing Passive Components—Resistors, Capacitors, Inductors Failures in fixed resistors, testing of resistors, variable resistors, variable resistors as potentiometers, failures in potentiometers, testing of potentiometers, servicing potentiometers, LDRs and Thermistors Types of capacitors and their performance, Failures in capacitors, testing of capacitors and precautions therein, variable capacitor types, testing of inductors, and inductance measurement.	6	
3.	Testing of Semiconductor Devices: Types of semiconductor devices, Causes of failure in Semiconductor Devices, Types of failure, Test procedures for diodes, special types of diodes, bipolar junction transistors, field effect transistors, thyristors, operational amplifiers, and Fault diagnosis in op-amp circuits.	6	
4.	Logic IC families, Packages in Digital ICs, IC identification, IC pin-outs, Handling ICs, Digital troubleshooting methods—typical faults, testing digital ICs with pulse generators, logic clip, Logic Probe, Logic Pulser, Logic Current Tracer, Logic Comparator, Special consideration for fault diagnosis in digital circuits, Handling precautions for ICs sensitive to static electricity, Testing flip-flops, counters, registers, multiplexers and de-multiplexers, encoders and decoders; Tri-state logic.	8	
5.	Rework and Repair of Surface Mount Assemblies, Surface Mount Technology and surface mount devices, Surface Mount Semiconductor packages – SOIC, SOT, LCCC, LGA, BGA, COB, Flatpacks and Quad Packs, Cylindrical Diode Packages,	8	

	Packaging of Passive Components as SMD Repairing Surface Mount PCBs, Rework Stations.		

Text Books:

S. No.	Title of Book	Author	Publication
1.	Modern Electronic Equipment: Troubleshooting, Repair, and Maintenance	Khandpur	TMH 2006
2.	Electronic Instruments and Systems: Principles, Maintenance and Troubleshooting	R. G. Gupta	Tata McGraw Hill Edition 2001

Reference Books:

S. No.	Title of Book	Author	Publication

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Name of the program:	**Diploma in Electronics & Communication Engineering**
Semester:	**4**
Name of the program:	**Diploma in Electronics & Communication Engineering**
Course Title:	**PC System Technology**
Course Credit:	4 (L: 2 T: 1 P: 0)

Course objective:	1. Understand the architecture and evolution of personal computers, including IBM PC models and various generations of microprocessors and chipsets. 2. Explore the internal components of computer systems, such as the motherboard, buses, memory units, and peripheral interfaces, and their functional interconnections. 3. Gain knowledge of operating systems and system software concepts, including BIOS, POST, booting processes, and common file systems used in modern PCs. 4. Analyze the working principles, specifications, and interfacing of input/output and storage devices, including legacy and modern standards. 5. Acquire understanding of power supply systems, laptops, and portable computing devices with emphasis on SMPS operation, power management, and hardware configuration.
Course outcomes:	1. Acquire an overall knowledge of the BM PC. 2. Acquire a thorough knowledge of operating system standards and features. 3. Classify and identify different categories of storage devices, their uses, and features. 4. Define and differentiate various types of input/output devices and their interfaces. 5. Understand electrical power supply requirements for computers. 6. Differentiate various aspects of desktop and laptop standards.
Pre-requisites:	Nil

Unit/ Module no.	Topic	Nos. of contact hours	Distribution of marks (out of 100)
1	**PC ARCHITECTURE** Block diagram of Computer, Personal Computer history; the IBM PC- PC, PC-XT, PC-AT. Microprocessor types & specifications used in IBM PCs, processor sockets & slots. Different supporting chips & their functions; Concepts of DMA and Interrupts, Chipset. Motherboard- architecture of PC-XT & PC-AT systems, motherboard form factors, peripheral interfacing, concept of bus system & types; Expansion slots. Different types of memory used in a computer: SRAM, DRAM, FPRAM, EDORAM, SIMM, DIMM, RIMM, DDR, etc.	6	
2	**Operating Systems:** Booting procedure, concept of BIOS & POST; CMOS setup, EFI firmware; Introduction to Operating Systems: DOS, Windows, their comparisons. Different versions of Microsoft Windows: their features; Introduction to Operating Systems: DOS, Windows, their comparisons; Description of the system & configuration files.	6	
3	**Storage Devices:** General concepts of storage devices; different technologies, their comparison; Optical drive construction and operation, specifications, their types; Hard disk drive construction and operation; Concepts of cylinders, tracks, sectors, clusters, seek time, disk hardware and software limitations; Other types of storage devices like BluRay, DVD, SSD storage; Interfacing: Features of parallel ATA, serial ATA; ATA devices jumper selections- Master, slave, cable select, ATA cables. Hard disk partitioning-, concepts of FAT, MBR, VBR, NTFS; Types of file systems and their comparison.	8	
4	**I/O interfacing:** Ports: Legacy ports- serial and parallel communication ports, their standards, use; New-generation ports- USB, Fire-Wire. **Input Devices:** Keyboards: Basic construction, different key switches, their features; Pointing devices: Mouse- types and specifications, Joystick, Light Pen, Trackball, Optical Mouse. **Output Devices:** Printers: Features and working of dot matrix, inkjet, laser, line printers, multi-functional printers; Scanner- flatbed, sheeted, handheld- specifications, OCR, TWAIN,	6	

	resolution. Video Display: basics, pixel, resolution, H/V frequency; Display types- CRT display, LED, LCD, and TFT, their features and comparisons; Display Cards/video cards/graphics card: monochrome display adapter, VGA, SVGA, AGP, GPU cards.		
5	**Power Supply:** General power issues, an overview of switched mode; switched mode power supply (SMPS), type of SMPS and their comparison, motherboard integrated power supply; Power line disturbances, power conditioners; UPS- types and features, power management.	6	
6.	**Laptop Computers:** difference between laptop and desktop, types, types of laptops, power settings, SMD components, Laptop components- adapter- types, battery- types, RAM- types, CPU- types, laptop motherboard- block diagram, laptop keyboards, mouse, touchpads, ports.	4	

Textbooks:

S. No.	Title of Book	Author	Publication
1.	IBM PC and Clones: Hardware, Troubleshooting, and Maintenance	B. Govindarajalu	McGraw Hill Education
2.	The Complete PC Upgradation & Maintenance Guide	Mark Minasi	McGraw Hill

References Books:

SL. No.	Title of Book	Author	Publication
1.	Upgrading & Repairing PCs	Scott Muller	Que Publishing
2.	Complete guide to upgrading & repairing PC	Peter Norton	SAMS, United States

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COURSE STRUCTURE

AND

SYLLABUS FOR

DIPLOMA PROGRAMMES

in

Food Processing Technology (FPT)

under

Department of Food Engineering and Technology

Semester IV

(APPLICABLE FROM AY 2024-2025 ADMITTED BATCH ONWARDS)

COURSE STRUCTURE

IV SEM

4th Semester / 2nd Year							
Name of the Programme		**Diploma in Food Processing Technology**					
Name of the Department		**Food Engineering and Technology**					
A.		**Theory Courses**					
Sl No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	**Coordinating Department**
1	DME401	STRENGTH OF MATERIALS	3	1	0	3	ME
2	DIE405	INSTRUMENTATION AND PROCESS CONTROL	3	0	0	3	IE
3	DFE401	ELEMENTS OF FOOD ENGINEERING-II	3	0	0	3	FET
4	DFE402	BASICS OF FOOD CHEMISTRY	3	0	0	3	FET
5	DFE403	FOOD PRODUCT TECHNOLOGY-II	3	0	0	3	FET
Total of A			**15**	**1**	**0**	**16**	
B.		**Laboratory/Project/Seminar Courses**					
Sl No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	**Coordinating Department**
1	DIE475	INSTRUMENTATION AND PROCESS CONTROL LAB	0	0	2	1	IE
2	DFE471	ELEMENTS OF FOOD ENGINEERING-II LAB	0	0	2	1	FET
3	DFE472	BASICS OF FOOD CHEMISTRY LAB	0	0	2	1	FET
4	DFE473	PROFESSIONAL PRACTICE-II	0	1	2	2	FET
Total of B			**0**	**1**	**8**	**5**	
C.		**Audit/Non-credit Courses**					
Sl No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	**Coordinating Department**
1	DHS401	INCEPTION OF INDIAN KNOWLEDGE SYSTEM	2	0	0	0	HSS
Total of C							
Grand Total (A+B+C)			**15**	**2**	**8**	**21**	

DETAILED SYLLABUS

Name of the Programme	Diploma in Food Processing Technology	
Semester	4	
Course Code	DME 401	
Course Title	Strength of Materials	
Course Credit	4 (L: 3 T: 1 P: 0)	
Course objective	The objective of this course is to provide the students with a comprehensive understanding of the physical meaning of stress and strain, the behaviour of different types of beams and structural elements under various shear and bending loads, the effect of torsion on shafts, and the behaviour of columns under different loading conditions.	
Pre-requisites	NA	
Course outcomes	After studying this course, students will be able to • Solve problems on simple stress and strain on materials following Hook's law • Analyse structures and components under various loading conditions, including axial, transverse, shear, and torsional effects. • Determine the principal stresses and strains, as well as the maximum shear stress, using both analytical and graphical methods. • Analyse cantilever and simply supported beams (with or without overhangs) subjected to point loads and uniformly distributed loads. • Understand and compute the moment of inertia for different geometric and structural sections. • Understand and apply the concept of simple bending to analyse stress distribution and flexural strength in different beam sections. • Understand and evaluate stress distribution in columns subjected to direct and eccentric loads. • Calculate the power transmission for solid and hollow shafts subjected to torsion.	
Unit/Module No.	**Topic**	**Contact hours**
1	**Simple stress and strain:** Concept of stress & strain, types of stress–tensile and compressive, elastic limit, Hooke's law, Young's Modulus; Stress–Strain curve for ductile & brittle material; Stress and strain in straight, stepped and taper bars of circular cross section; Thermal stresses in homogeneous sections; Shear load, shear stress & shear strain, Modulus of Rigidity; Longitudinal and lateral strains, Poisson's ratio, Volumetric strain, Bulk modulus, Relation between modules of elasticity, bulk modulus & modulus of rigidity.	10
2	**Principal stress and strain:**	7

	Introduction to principal stress, normal and tangential stresses on oblique planes, resultant stress, Analytical and Graphical methods (Mohr's circle) to calculate principal stresses.	
3	**Shear Force and Bending Moment:** Definition - shear force (S.F.) and bending moment (B.M.), types of beams, types of loads acting on beams, sagging & hogging bending moment and its importance, sign convention to draw the S.F. and B.M. diagrams, concept of maximum bending moment, point of contraflexure & its importance; SFD and BMD for cantilever and simply supported beams subjected to point load and uniform distributed load (U.D.L.).	8
4	**Moment of Inertia:** Basic concept of moment of inertia (M.I.), radius of gyration, perpendicular & parallel axis theorem of M.I., M.I. of rectangular, circular, semi-circular, triangular, hollow rectangular, symmetrical I-section, channel section, Tee & angle sections.	7
5	**Theory of Simple Bending and Columns:** Simple Bending: Concept of simple bending, theory of simple bending, neutral axis, bending stress distribution diagram; Moment of resistance & application of flexural formula for solid rectangular & circular section, I-section, hollow rectangular & circular section. Columns: Concept of direct & eccentric loads; Stress distribution in symmetrical columns with eccentric loading about one axis.	8
6	**Torsion:** Introduction to Torsion, angle of twist, polar moment of inertia, Torsion equation, Power transmitted by solid and hollow circular shafts subjected to Torsion.	5

Text Books and References:

1. Timoshenko, S., Strength of Materials, Vol. I, CBS Publishers and Distributors Pvt. Ltd., 3rd Edition, 2021.
2. Punmia, B. C., Jain, A.K., and Jain, A.K., Strength of Materials, Laxmi Publications, 10th Edition, 2018.
3. Beer F.P., Johnston, E.R., DeWolf, J.T., Mazurek, D.F., and Sanghi, S., Mechanics of Materials, McGraw-Hill, 8th Edition, 2020.
4. Goodno, B.J., and Gere J.M., Mechanics of Materials, Cengage Learning, 9th Edition, 2022.
5. Ramamurtham, S. and Narayanan, S., Strength of Materials, Dhanpat Rai and Sons, New Delhi, 16th Edition, 2012
6. Bansal, R. K., Strength of Materials, Laxmi Publications, 6th Edition, 2018.

Name of the Programme:	Diploma in Food Processing Technology
Semester:	4

Course Code:	DIE405
Course Title:	Instrumentation and Process Control
Course Credit:	**3 (L: 3 T: 0 P: 0)**

Course objective:	1. To introduce the basic principles of Instrumentation and Process Control Systems used in various industries to the students. 2. To make the students understand the principles of automatic control systems used in Process Industries.
Pre-requisites:	NA
Course outcomes: *	Upon successful completion of the course, students are expected to be able to- 1. Evaluate and select the most appropriate sensors and transducers for specific measurement applications in an industrial setting. 2. Have an understanding of the static and dynamic characteristics of various instruments used in industries and apply the knowledge for specific requirements. 3. Have the ability to understand, analyze and design various control techniques required for automatic process control systems.

Unit/ Module no.	Topic	Nos. of contact hours	Distribution of marks (out of 100)
1	**Instruments and Measurement Systems:** Introduction to Measurement Systems, Functions of instruments and measurement systems, Elements of measurement systems, Classification of Instruments.	**6**	**15**
2	**Performance Characteristics of Instruments:** Static and Dynamic characteristics of Instruments.	**4**	**15**

3	**Transducer Elements:** Introduction to sensors and transducers. Different types of transducers- primary/secondary, analog transducers (electromechanical and opto-electrical types) and digital transducers (frequency generating types and digital encoder types), active and passive transducers.	**5**	**15**
4	**Signal Conditioning and Data Presentation Elements:** Introduction to Amplifiers, Compensators, Filters, A/D and D/A converters, Indicating and Recording Instruments.	**5**	**15**
5	**Process Parameter Measurements:** Measurement of displacement, force, torque, pressure, temperature, flow, level, humidity, pH etc…	**8**	**20**
6	**Process Control:** Elements of generalized process control, types of control systems, types of controller modes, final control elements and actuators, Instrumentation and Control in food processing industries.	**8**	**20**

Books/References:

1. B C Nakra and K K Chaudhary, Tata McGraw Hill: Instrumentation Measurement and Analysis
2. S K Singh, Tata McGraw Hill: Industrial Instrumentation and Control

** In the context of accreditation, a course outcome (CO) is a specific, measurable statement that describes what students should know, understand, and be able to do after completing a course. The maximum number of outcomes for a course is expected to be around 6 as per NBA document. COs should reflect on the measurable outcomes towards attaining the outcomes of the Programme.*

Name of the Programme:	Diploma in Food Processing Technology
Semester:	4

Course Code:	DFE401
Course Title:	Elements of Food Engineering-II
Course Credit:	3 (L: 3 T: 0 P: 0)

Course objective:	1) To learn the basic concepts of fluid mechanics, fluid flow behaviour, Bernoulli's equation, viscosity, fluid rheology, Newtonian and non-Newtonian fluids, Fanning's equation and Hagen-Poiseuille's equation 2) To understand Navier Stoke's equation, the basic concepts of fluid transportation, transportation devices, pressure drop in fluid flow, the basics of pumps and valves 3)To understand the basics of diffusion, diffusivity, mass transfer operations in food industries and mass transfer coefficient 4) To learn humidity, relative humidity, dry bulb and wet bulb temperatures, psychometric chart and water activity of foods
Pre-requisites:	NA
Course outcomes:*	After completion of this course 1. Students will be able to understand the basics of fluid mechanics, fluid rheology, Bernoulli's equation, different types of fluid flow and friction losses in laminar flow and turbulent flow 2. They will be able to learn the flow characteristics of viscous fluids, fluid transportation phenomena, pressure drop behaviour and applicability of pumps and valves in food processing industries 3. They will understand diffusion and diffusivity, mass transfer phenomenon and mass transfer coefficient 4. Students will be able to understand the process of humidity, humidification, relative humidity, dry and wet bulb temperatures, psychometric chart and its applicability and water activity of foods

Unit/ Module no.	Topic	Nos. of contact hours	Distribution of marks (out of 100)
1	Physical Properties of fluids	**10**	**30**
	Classification of fluid flow		
	Concept of Reynolds's number & its application		

	Continuity equations		
	Bernoulli's equation & its application		
	Steady State flow equation		
	Concept of viscosity and Rheological behaviour of fluid		
	Newtonian & non-Newtonian fluids and Power Law Equation		
	Friction losses in laminar flow and Hagen-Poiseuille's equation		
	Friction losses in turbulent flow and Fanning's equation		
2	Navier Stoke's equation	**10**	**25**
	Flow through parallel plates & circular pipes		
	Concept of fluid transportation		
	Fluid transportation devices & accessories.		
	Pipe, pipe flow and losses of pipe fittings		
	Pressure drop in turbulent flow through non circular conduits		
	Pressure drop in flow through porous media		
	Pumps, types of pumps		
	Selection and application of pumps		
	Valves & joints		
3	Diffusion and diffusivity	**10**	**25**
	Fick's Law of diffusion		
	Role of concentration difference in diffusion		
	Diffusion in liquids		
	Basic concepts of mass transfer operation		
	Interphase mass transfer		
	Mass transfer coefficient		
	Overall mass transfer coefficient		
	Simultaneous heat & mass transfer		
	Mass transfer operations in food processing industries		
4	Humidification and dehumidification	**10**	**20**
	Humidity, Relative humidity, Dew point, Humid volume and Humid heat		
	Dry bulb and wet bulb temperature		
	Psychometrics: properties of air water vapor mixture		

	Use of psychometric chart/ humidity chart of air water vapor mixtures and psychometric calculations		
	Humidifier, dehumidifier and water coolers		
	Principles of humidity control for food processing operations		
	Water relations of foods and water activity		
	Water activity and shelf stability of foods		

Text Books:

1.D.G. Rao., PHI Publication: Fundamentals of Food Engineering

2. Akash Pare and B.L. Mandhyan, New India Publishing Agency , Food Process Engineering & Technology

3. Chandra Gopala Rao, BS Publications, Essentials of Food Process Engineering

4. Toledo, R.T., CBS Publication: Fundamentals of Food Engineering

Reference Books:

1. S.Ghosal, S. Sanyal and S.Dutta, TMH, Introduction to Chemical Engineering

2. Earle, R. L. Pergamon press, NY, Unit operations in Food Processing -.

3. Brennan, J. G. Elsevier Applied Science, Amsterdam, Food Engineering Operations

4. Held man, R. R. & R. P. Singh, CBS Publication, Food Process Engineering

** In the context of accreditation, a course outcome (CO) is a specific, measurable statement that describes what students should know, understand, and be able to do after completing a course. The maximum number of outcomes for a course is expected to be around 6 as per NBA document. COs should reflect on the measurable outcomes towards attaining the outcomes of the Programme.*

Name of the Program:	Diploma in Food Processing Technology
Semester:	4

Course Code:	DFE402
Course Title:	Basics of Food Chemistry
Course Credit:	3 (L: 3 T:0 P: 0)

Course objective:	Introduce the fundamental concepts of food chemistry. Explain the role and importance of food chemists. Describe the structure, properties, and functions of various food components and their interactions during food processing and storage. Discuss the chemistry of enzymes, pigments, and additives used in foods.
Pre-requisites:	NA

Course outcomes: *	After completion of this course students will 1. Explain the role of food chemistry and the responsibilities of a food chemist in the food industry. 2. Describe the chemical structure, properties, and functions of major food constituents — carbohydrates, proteins, lipids, vitamins, minerals, and water. 3. Interpret the structural and functional aspects of carbohydrates, proteins, and lipids and their behavior during food processing. 4. Explain the chemistry, sources, and physiological roles of vitamins and minerals, including the effects of deficiencies. 5. Understand the classification, nomenclature, and mechanisms of enzyme action, as well as factors affecting enzyme activity in food systems.

Unit/ Module no.	Topic	Nos. of contact hours	Distribution of marks (out of 100)

1	Introduction, role of food chemistry and chemist in food industries. Importance of different food constituent. Water: structure, properties, types of liquid water and ice, mineral water. Water activity and storage stability of food.	**10**	**25**
2	Carbohydrate: nomenclature and classification, structure, physical and chemical properties of mono & Polysaccharides (cellulose, starch, fructose, galactans, hemi cellulose, pectic substances) and their functions. Proteins: Classification and properties of amino acids, chemical properties of proteins, structure of amino acids, essential and non-essential amino acid, isolation of amino acids.	**10**	**30**
3	Lipids: structure, physical and chemical properties, acidity, reversion, introduction to hydrogenation and its importance. Vitamins: types (water and fat soluble), chemistry and functions, source and deficiency disease. Minerals in foods: calcium, phosphorus, iron, copper, lead, tin, zinc and arsenic.	**10**	**25**
4	Food Enzymes: classifications, nomenclature, activation energy, factors effecting enzymes actions. Food additives: Properties and function. Plant pigments: structure and properties of chlorophyll, anthocyanins and arytenoids, chemical changes during processing. Emulsions and emulsifiers, mechanism of emulsification.	**10**	**20**

References:

Name of the Programme:	Diploma in Food Processing Technology
Semester:	4

Course Code:	DFE403
Course Title:	Food Product Technology-II
Course Credit:	3 (L: 3 T:0 P: 0)

1. Food Chemistry - L.H. Meyer, CBS, New Delhi.
2. Food Chemistry - Fennama, CRC.
3. Principles of Biochemistry - Lehnninger, CBS, New Delhi..

Course objective:	1. To impart in depth understanding of the bakery principle and technology of various bakery products. 2. To disseminate the knowledge of extrusion principle, its types and application in extruded product formation. 3. To Familiarize the students with the different types of confectionery products, their manufacturing technology. 4. To give better understanding of the quality parameters of various ingredients and their role in bakery, extrusion, confectionery respectively. 5. To impart knowledge on the processing of sugar, breakfast cereals and snack foods.
Pre-requisites:	NA
Course outcomes:	After completion of this course students will be able to 1. Explain the principle of baking, extrusion and confectionery product technology and formulations. 2. Identify the raw ingredients and their functions in different bakery products, extrusion and confectionery respectively. 3. Analyse the quality attributes of bakery, extruded and confectionery items. 4. Describe the process of processing of breakfast cereals and sugar.

Unit/ Module no.	Topic	Nos. of contact hours	Distribution of marks (out of 100)
1	Bakery technology: baking principle, raw materials and quality parameters, dough chemistry, technology of manufacturing of bakery products such as bread, cakes, biscuits, cookies etc. Equipment used in bakery industry.	10	30

2	Extrusion technology: Extrusion principle, extruder components, types of extruders, advantage and disadvantage of extrusion processes, extruded products.	8	20
3	Confectionery industry, cocoa processing, confectionery ingredients, sugar and chocolate confectionery processing technology of manufacturing of confectionery products, equipment used in confectionery industry.	10	30
4	Production and processing of cane sugar. Breakfast cereals, snack foods.	8	20

Reference Books:

1. Fellows, P.J. (2009). Food Processing Technology: Principles and Practices. Woodhead Publishing, Oxford. 3rd edition.
2. Srilakshmi, B. (2003). Food science. New Age International.
3. Potter, N. N (2007) Food Science. CBS publishers and Distributors.
4. Bakery Technology and Engineering by Samuel a. Matz, CBS Publications.
5. Cereals as Food and Feed by Samuel A.Matz, CBS Publications
6. Industrial Chocolate Manufacture by Beckette.

Name of the Programme	Diploma in Food Processing Technology
Semester	4
Course Code	DIE 475
Course Title	Instrumentation and Process Control Lab
Course Credit	1 (L: 0 T: 0 P: 2)
Course objective	1. To introduce the basic principles of Instrumentation and Process Control Systems used in various industries to the students. 2. To make the students understand the principles of automatic control systems used in Process Industries.
Pre-requisites	NA
Course outcomes	Upon successful completion of the course, students are expected to be able to- 1. Evaluate and select the most appropriate sensors and transducers for specific measurement applications in an industrial setting. 2. Have an understanding of the static and dynamic characteristics of various instruments used in industries and apply the knowledge for specific requirements. 3. The ability to understand, analyze and design various control techniques required for automatic process control systems.

Sl. No.	**Title of the Experiment**	Nos. of contact hours
1	To Study and Plot the Temperature versus e.m.f curves/characteristics for a thermocouple and determine its sensitivity.	2
2	To Study and plot the Temperature versus Resistance characteristics of thermistors and determine its sensitivity.	2
3	To study and Plot the temperature versus resistance characteristics of RTD and determine its sensitivity.	2
4	To study the Displacement Measurement technique using Inductive Transducer (LVDT), Plot Input-Output Characteristics, determine its linearity range and finally observe its 180^0 phase shift between two voltages of secondary windings.	2

5	To calibrate the pH Meter using the given standard buffer solution and to measure the pH of the given sample solution using the calibrated pH Meter.	2
6	Study of Strain measurement using strain gauges and cantilever assembly and Determine its (i) Linear Range of operation and (ii) Sensitivity of the Trainer.	2

Name of the Program:	Diploma in Food Processing Technology
Semester:	4

Course Code:	DFE471
Course Title:	Elements of Food Engineering-II Lab
Course Credit:	1 (L: 0 T: 0 P: 2)

SL No	Title of the Experiment	Nos. of contact hours
1	To study the use of Venturimeter as flow meter.	2
2	To study the types of flow.	2
3	To measure the velocity of flow at different points in a pipe.	2
4	To study the losses due to friction in pipe.	2
5	To study the flow of liquid through orifice and the mouth piece.	2
6	To verify the Bernoulli's equation experimentally.	2
7	To measure the discharge through Nozzle meter.	2
8	Study of centrifugal pump characteristics.	2

Name of the Program:	Diploma in Food Processing Technology
Semester:	4

Course Code:	DFE472
Course Title:	Basics of Food Chemistry Lab
Course Credit:	1 (L: 0 T: 0 P: 2)

SL No	Title of the Experiment	Nos. of contact hours
1	Determination of moisture in food sample.	2
2	Determination of protein in food sample.	2
3	Determination of ash in food sample.	2
4	Determination of crude fat in food sample.	2
5	Determination of titratable acidity of food and beverages.	2
6	Determination of pH in food and beverages.	2
7	Determination of total sugar of food samples.	2
8	Determination of non-reducing and reducing sugars of confectionary items.	2
9	Determination of vitamin C in food sample.	2
10	Determination of Crude fiber in food sample.	2

Reference Books:

1. S.Rangnna. *Handbook of Analysis and Quality Control for Fruits and Vegetable Products.* New Delhi, Tata Mcgrawhill, 2007.

Name of the Programme:	Diploma in Food Processing Technology
Semester:	4

Course Code:	DHS401
Course Title:	Inception of Indian Knowledge System
Course Credit:	2 (L: 2 T: 0 P: 0)

Course objective:	This Foundation course is designed to present an overall introduction to all the streams of IKS relevant to the 3 yrs in Diploma program. It would enable students to explore the most fundamental ideas that have shaped Indian Knowledge Traditions over the centuries.
Pre-requisites:	
Course outcomes:*	To provide a tribune of our rich culture and traditions of Indian knowledge system to students of various discipline. To develop over all understanding of the various components of Indian knowledge system. To spread awakening about scientific and eternal knowledge of the Indian knowledge system. To promote advance study and inter disciplinary research on all aspects of Indian knowledge system. Adding career, professional and business opportunities to the students of various discipline.

Unit/ Module no.	Topic	Nos. of contact hours	Distribution of marks (out of 100)
1	Introduction to Indian Knowledge System:- Basic knowledge and scope of IKS, Archaeological Sources of IKS- Pre historic period's evidences, Indus Valley Civilization, Various aspects of Vedic civilization, Indian Knowledge System vs Indigenous Traditional Knowledge, Characteristics and components of Indigenous Traditional Knowledge. Historical background: Traditional Knowledge Systems during the PreColonial and Colonial Period, Ancient Monuments, India and the British Imperialism, Unfair	**7**	**20**

	Trade, Colonialism and Cultural imperialism.		
2	Indian Traditional Knowledge System:- Water harvesting systems, shipping and ship building, forest management, farming techniques, mathematics, Logic and Linguistics, Folk Sciences, Ritual of Knowledge transmitters.	**7**	**25**
3	Traditional Medicine:- Ayurveda, 3 great and lesser classics of Ayurveda, branches & Concept of ayurveda. Yoga – Health of body & Mind, Alchemy &Yoga, Unani System, Budhism & Medicine, Yoga and Meditation etc. Life Sciences – Life science in Plants, Anatomy, Physiology, Ayurveda, Medicine, Microbiology, Surgery.	**9**	**25**
4	Indian Knowledge systems and the contemporary world:- Biopiracy, Controversial patent cases involving Traditional Knowledge and genetic resources, Traditional Production and Construction Technology:- Social conditions & Technological Progress, Social needs and Technological Applications, Cultural Mores and Technological Innovation, Protection of Indian Knowledge/Traditional Knowledge.	**9**	**30**

Suggested Textbooks / Reference Books:

1. Traditional Knowledge System in India by Amit Jha, Pub. Atlantic publishers & Distributions(p) Ltd., New Delhi.
2. Indian Knowledge System: Nature, Philosophy, Character in Indian Knowledge System, by Kapoor, K. (2021), vol. 1, Pub. Indian Institute of Advanced Studies, Shimla.
3. Introduction to Indian Knowledge System: Concepts and Applications by B. Mahadevan et al.
4. Indian Knowledge System by Kapil Kapoor and Avadhesh Kumar Singh

COURSE STRUCTURE

AND

SYLLABUS FOR

DIPLOMA PROGRAMMES

in

Control and Instrumentation (CAI)

under

Department of Instrumentation Engineering

Semester IV

(APPLICABLE FROM AY 2024-2025 ADMITTED BATCH ONWARDS)

Diploma 4th Semester Courses:

Course Code	Course Title	L	T	P	C	Contact Hours
DEE401	Electrical Machines	3	0	0	3	3
DIE401	Electronics Devices and Circuits-II	3	0	0	3	3
DIE402	Transducers & Signal Conditioning	3	0	0	3	3
DIE403	Microprocessor	3	0	0	3	3
DIE404	Control Systems	3	0	0	3	3
DEE471	Electrical Machines Lab	0	0	2	1	2
DIE471	Electronics Devices and Circuits-II Lab	0	0	2	1	2
DIE472	Transducers & Signal Conditioning Lab	0	0	2	1	2
DIE473	Microprocessor Lab	0	0	2	1	2
DIE474	Control Systems Lab	0	0	2	1	2
DHS401	IKS (Common for all)	2	0	0	0	2
		Total			**20**	

Course Name: Electrical Machines **Course Code: DEE401** **Credit: 03**

Total contact hours: 36 **L-T-P: 3-0-0**

Course Objectives:

1. To provide a basic introduction to Electrical Machines.
2. To provide mathematical model of Electrical Machines

Module1: DC MACHINES **(10 hours)**

Introduction to DC machines, study and drawing of various parts of a DC machine, DC generators, EMF equation, lap and wave winding (very briefly), shunt, series and compound generators, losses and efficiency studies, armature reaction (introduction only)

Principle of DC motor, electromagnetic torque, Back EMF, shunt, series and compound motors, losses and efficiency studies, motor characteristics studies, speed control of DC motors, DC motor starters, Industrial applications of DC machines, Electric braking, Permanent magnet DC motors, etc.

Module2: TRANSFORMERS **(8 hours)**

Introduction, construction and working principles, Ideal transformer, EMF equation, voltage transformation ratio, practical transformer on no-load and on–load, equivalent circuits, shifting impedances, transformer's tests, voltage regulation, losses and efficiency studies, autotransformer, applications of transformers.

Module3: INDUCTION MOTOR **(8 hours)**

Introduction, construction, types and working principle, slip, torque under starting and running conditions, torque-slip curve, losses and efficiency studies, starting methods, speed control, industrial applications in different areas.

Module4: SPECIAL MACHINES **(10 hours)**

Single-phase induction motor, Hysteresis motor, reluctance motor, two-phase servo motor, DC tachometers, stepper motor,

Text Books:

1. B.L. Theraja and A.K. Theraja , A Text Book of Electrical Technology (Vol. 2) by, S. Chand Publishing, 2005.
2. D. P. Kothari and I. J. Nagrath, Electric Machines, McGraw Hill Education, 5th Edition, 2017.
3. Dr. P.S. Bimbhra, Electrical Machinery, Khanna Publishing, 1st Edition, 2021.

Course Outcomes:

1. Students can have a basic knowledge of Electrical Machines.
2. Students can analyze the mathematical model of Electrical Machines

Course Title: Electronics Devices and Circuits-II **Course Code: DIE401**
Credit: 03 **Total contact hours: 36** **L-T-P: 3-0-0**

Course Objectives:

1. To introduce the concepts of feedback in amplifier circuits for improved performance of systems.
2. To explain the use of various circuit elements for producing oscillatory signals of desired frequency and gain stability.
3. To familiarize the concepts of tuned amplifier, operational amplifier and multivibrator circuits.
4. To impart the knowledge of using proper electronic components and circuits for different practical applications.

Module 1: Feedback Amplifiers (8 Hours)

Principle of feedback amplifier, Classification of feedback amplifiers, advantages of negative feedback amplifier- gain stability, decreased distortion, increased bandwidth, Principles of operation of four types of feedback amplifiers (voltage series, voltage shunt, current series and current shunt), Gain and impedances in feedback amplifiers.

Module 2: Oscillators (7 Hours)

Basic theory of oscillator, Classification of oscillators, Idea of resonant frequency, Operation of Colpitts and Hartley Oscillators, RC phase shift oscillators, Wien bridge oscillator, Crystal oscillator.

Module 3: Tuned Amplifiers (7 Hours)

Introduction, Classification of Tuned Amplifiers, Relationship between Q-factor, bandwidth and resonant frequency, Single turned amplifiers, FET tuned amplifiers, Double tuned amplifier, Stagger tuned amplifiers, large signal tuned amplifiers, Oscillations in tuned amplifier.

Module 4: Operational Amplifiers (8 Hours)

Introduction, Op-amp Symbol and terminals, Ideal op-amp, Block diagram of op-amp, Ideal and real op-amp characteristics, Op-amp parameters, Open loop configuration of op-amp, Closed loop configuration of op-amp, Op-amp IC 741, Realistic simplifying assumptions, op-amp applications- inverting amplifier, non-inverting amplifier, voltage follower, Summing amplifier, Difference amplifier, Integrator, Differentiator

Module 5: Multivibrators (6 Hours)

Introduction, multivibrators, astable multivibrator, monostable multivibrator, bistable multivibrator, comparison between different multivibrators.

Books / References:

1. Electronics Devices and Circuits by J.B. Gupta, S.K. Kataria and Sons publication.
2. Electronics Devices and Circuit Theory by Robert L. Boylestad and Louis Nashelsky, Pearson publication
3. Microelectronic Circuits, Theory and Applications by Adel S. Sedra and Kenneth C. Smith, Oxford publications
4. Electronic Devices and Circuits by Jacob Millman, Mcgraw hill

Course Outcomes: After completion of this course the Students will be able to

1. Understand the use of feedback in different configurations for various desired outcomes.
2. Construct oscillator circuits of required frequency
3. Learn the fundamentals of op-amps and their applications
4. Develop different types of pulse signals for various applications.

Course Title: Transducer and Signal Conditioning
Course Code: DIE402 **Credit: 03**
Total contact hours: 36 **L-T-P: 3-0-0**

Course Objective:

1. To introduce students with the role of transducers in an instrumentation system.
2. To familiarize students with the basic principle of working, selection criteria, advantages, disadvantages and applications of different transducers.
3. To acquaint students about signal conditioning circuit for a particular type of transducer.

Course Outcome:

1. Students will know about the role of transducer and signal conditioning in an instrumentation system.
2. Students will know about the salient features and working of a transducer.
3. Students will able to select signal conditioning circuit for a particular transducer.

Module 1: Introduction **(4 Hours)**

Fundamental block diagram of instrumentation/measurement system, basic concepts of sensors and transducers, classification and selection of transducers

Module 2: Resistive Transducers **(7 Hours)**

Construction, working principle, selection criteria, advantages, disadvantages and application of potentiometer, strain gauge, load cell, hot wire anemometer, photo resistors, RTD, thermistors and resistive accelerometer.

Signal conditioning circuits for resistive transducers

Module 3: Inductive Transducers **(7 Hours)**

Construction, working principle, selection criteria, advantages, disadvantages and application of electromagnetic pick up, linear variable differential transformer (LVDT), synchronous transmitter and receivers. Signal conditioning circuits for inductive transducers.

Module 4: Capacitive Transducers **(6 Hours)**

Construction, basis principle, selection criteria, advantages, disadvantages and application of capacitive transducer, differential capacitive transducer, capacitive microphone.

Signal conditioning circuits for capacitive transducers.

Module 5: Piezoelectric and Optical Transducer **(6 Hours)**

Construction, basic principle, selection criteria, advantages, disadvantages and application of piezoelectric Transducer and seismic transducers.

Signal conditioning circuits for piezoelectric transducers

Construction, basic principle, selection criteria, advantages, disadvantages and application of optical transducer: photoconductive, photovoltaic, photodiode and photo transistor.

Signal conditioning circuits for optical transducers.

Module 6: Other Transducers (6 Hours)

Construction, basic principle, selection criteria, advantages, disadvantages and application of Hall effect and ultrasonic transducers. Signal conditioning circuit for Hall effect and ultrasonic transducers.

Construction, basic principle, selection criteria, advantages, disadvantages and application of digital transducer: single shaft encoder and techo generator.

Books / References:

1. Curtis D Johnson, Process Control and Instrumentation, PHI, 7TH edition, 2005
2. D Patranabis, Sensors and Transducers, PHI, 2nd ed., 2003.
3. D.V.S. Murty, Transducers and Instrumentation, PHI, 1995.
4. A K Sawhney: A course on electrical and electronic measurements and instrumentation,
   Dhanpat Rai & Co, 2005
5. Bentley, J.P., Principles of measurement systems. Pearson education, 2005.

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Course Title: Microprocessor
Course Code: DIE403 Credit: 03
Total contact hours: 40 Hour L-T-P: 3-0-0

Course Objective

- To introduce the fundamentals of microprocessor systems with a focus on the Intel 8085 architecture and programming.
- To develop students' skills in assembly language programming, including arithmetic operations, code conversions, and 16-bit data handling.
- To provide an understanding of timing, control, and interrupt mechanisms in microprocessors.

- To enable students to interface the 8085 with memory, I/O devices, AD/DA converters, and programmable peripheral chips.
- To prepare students to design, program, and troubleshoot simple microprocessor-based applications.

Course Outcomes

- Understand the architecture, pin configuration, internal structure, and memory interfacing of the Intel 8085 microprocessor.
- Write and execute assembly language programs using loops, delays, stacks, and subroutines.
- Describe and analyze machine cycles, including opcode fetch, memory operations, timing signals, and interrupt handling.
- Use 8085 instruction sets to perform arithmetic operations, BCD arithmetic, code conversion, and 16-bit data processing.
- Design and implement interfacing circuits for I/O devices, AD/DA converters, and programmable chips such as 8255A and 8253.

Module 1: Microprocessors Based Systems (4 hours)

Microprocessors, microcomputers and assembly language, introduction to 8085 assembly language programming.

Module 2: Introduction to 8085 Assembly Language Programming (6 hours)

The 8085 programming model, instruction classification, instruction, data format and storage, overview of the 8085 instruction set.

Module 3: Architecture of 8-bit Microprocessor (5 hours)

Intel 8085Amicroprocessor, Pin description and internal architecture, memory interfacing, interfacing input & output devices.

Module 4: Operation and Control of Microprocessor (6 hours)

Timing and control unit, Opcode fetch machine cycle, memory read/write machine cycles, I/O read/write machine cycles, interrupt acknowledge machine cycle, state transition diagram.

Module 5: Programming the 8085 (8 hours)

Introduction to 8085 programming, programming techniques, counters and time delays, stack and subroutines.

Module 6: Code Conversion, BCD Arithmetic, 16- bit Data Operations (5 hours)

BCD to Binary code conversion, Binary to BCD to seven-segment LED code conversion, BCD Addition and Subtraction introduction to advanced instruction and Application, Multiplication and subtraction with carry

Module7: Basic Interfacing Concept (6 hours)

Interfacing input Keyboard, Memory-mapped I/O, 8085 interrupt, D-A and A-D Convertor, 8255A programmable peripheral Interface, 8253 Programmable interval Timer, Basic concept of Serials I/O, software controlled Asynchronous serial I/O, SID, SOD, Hardware – controller serial I/O using Programmable chips.

Textbooks/References:

1. *Microprocessors Architecture, programming and Applications With 8085 - R. Gaonkar, Penram International Publishing Pvt. Ltd.*
2. *Fundamentals of Microprocessor and Microcontrollers, B. Ram, Dhanpat Rai Publications.*
3. *8085 microprocessor : programming and interfacing, N. K. Srinath, PHI Learing.*
4. *The 8085 Microprocessor: Architecture, Programming and Interfacing, K. Udaya Kumar, Pearson Education India.*

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Course Title: Control Systems

Course Code: DIE404 **Credit: 03**

Total contact hours: 36 **L-T-P: 3-0-0**

Course Objectives:

1) To introduce the fundamentals concepts of control systems and Laplace transform.

2) To provide and understanding of basic concepts of block diagram reduction, transfer function representation and signal flow graph.

3) To prepare students to understand time response analysis and analyze different methods of stability analysis.

Course Outcomes: At the end of the course students will able

1) To learn the concept of control system.

2) To understand the concept of block diagram and signal flow graph

3) To learn the concept of time response and stability analysis.

Module1: BASICS OF CONTROL SYSTEMS, LAPLACE TRANSFORM, SYSTEM COMPONENTS (8 Hours)

a. Introduction to the history and development of the Systems approach concept and history of the Control systems concept Examples from Industrial application and human systems.

b. Definition of other types of classification of Control Systems:- (i) linear and Nonlinear Systems (ii) Single Input – Single Output System (SISO) and Multi Input (MIMO) system (iii) Continuous and Discrete System (iv) Analog and Digital Systems.

c. Open loop control system and Close loop control system, terminology, Feedback control systems, Advantages and Disadvantages.
d. Overview of Electrical systems and Thermal systems.

e. Introduction to Laplace Transforms and Inverse Laplace Transform, and its application.

Module2: PHYSICAL REALISATION OF MECHANICAL SYSTEMS, TRANSFER FUNCTION (7 Hours)

a. Comparison and Analysis of Mechanical, Translational and rotational motions, Equivalence representation using R, L, C networks. Introduction to Modelling of simple First order Industrial Processes i.e. Heat Exchange, Level in a single and multiple interconnected tanks.
b. Control System representation: Transfer function, Type and Order of systems, characteristic equation and its properties.
c. Examples

Module3: BLOCK DIAGRAM REPRESENTATION AND SIGNAL FLOW DIAGRAM TECHNIQUES (6 Hours)

a. Block Diagram, Reduction techniques
b. Definition and introduction to Signal Flow Diagram, Masons Gain Formula.
c. Examples

Module4: TIME RESPONSE ANALYSIS: (8 Hours)

a. Time Response Analysis: Standard Test Signals – Step, Ramp, Pulse, Sinusoidal types of inputs, Concept of Type and Order of a transfer function. Poles and Zeroes of Open Loop and Closed Loop transfer functions. Time Response of first and second order systems, Time constant concept, Transient and Steady State Response, Second order response specification (Over shoot, Damping Ratio, Rise time, Peak time Settling time)and its applications to systems(No derivation of Second order systems) Examples of Steam Jacketed heating system,
b. Initial and Final value Theorem Steady State errors and Error constants.
c. Examples.

Module5: STABILITY ANALYSIS IN TIME AND FREQUENCY DOMAIN (7 Hours)

a. Concept of Stability and its Analysis using Routh Hurwitz stability criteria,
b. Root Locus Method of analysis. Angle and Magnitude criteria,
c. Introduction to frequency response methods of analysis: Polar Plot, Bode Plot, Phase and Gain Margin.
d. Examples

Textbooks/References:

1. Linear Control Systems by B S Manke, Khanna Publishers.
2. Control Systems by A. Anand kumar , EEE, PHI
3. Advanced Control theory by I.J. Nagrath and M. Gopal, New Age International publishers.
4. Video lectures from IIT Kharagpur, IIT Delhi NPTEL

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Course Name: Electrical Machines Lab Course Code: DEE471 Credit: 01

Total contact hours: 2/week **L-T-P: 0-0-2**

Course Objectives:

1. To provide a basic knowledge of how to handle Electrical Machines.
2. To provide knowledge of how to calculate different parameters of Electrical Machine

List of experiments to be performed by the students for Electrical Machines Lab

3. Open circuit characteristics of a DC shunt generator
4. Speed control of DC shunt motor
5. Ratio and polarity test on single-phase transformer
6. Open and short circuit test on single-phase transformer
7. Load test of single-phase induction motor
8. Study of various parts of three phase induction motor
9. Connecting a three phase IM with three phase supply through 3-phase autotransformer
10. Reversing the direction of rotation of a 3-phase induction motor
11. Study of various parts of single phase induction motor (ceiling fan and water pump motors)

Course Outcomes:

1. Students can have a basic hands-on experience of Electrical Machines.
2. Students can find out the correct mathematical model of an Electrical Machine.

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Course Title: Electronics Devices and Circuits-II Lab **Course Code: DIE471**
Credit: 01 **Total contact hours: 2/week** **L-T-P: 0-0-2**

Course Objectives:

1. To train the students for conducting design, observation and analysis of feedback amplifier circuits.
2. To familiarize the study the output response of oscillator circuits
3. To introduce the students with the design and study of op-amp and multivibrator circuits.

List of experiments to be performed

1. To study the effects of feedback on the amplifier characteristics (gain, bandwidth, input and output impedance)
2. To study the operation of Hartley and Colpitts oscillator.
3. To study the frequency response characteristics and resonance behavior of tuned amplifier.
4. To design and study an Inverting and a Non-inverting OP-AMP based voltage Amplifier with some specific gain.
5. To study OP-AMP based summer and subtractor circuit.
6. To study an OP-AMP based Differentiator and Integrator circuit.
7. To design an OP-AMP based Differential amplifier and study its voltage Amplification factor.
8. To design an OP-AMP based Inverting/Non-inverting amplifier and study its frequency response of the amplifier.
9. To design a LM-555 based Astable Multivibrator and study its various waveform parameters.
10. To design a LM-555 based Monostable and Bistable Multivibrator and study its various waveform parameters.

Course Outcomes: After completion of this course the Students will be able to

1. Design and analyze the feedback amplifier circuits.
2. Design and study the output response of oscillator circuits
3. Design and study the different configurations of op-amp for various applications.
4. Design and study the different configurations of multivibrator circuits.

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Course Title: Transducer and Signal Conditioning Lab
Course Code: DIE472 **Credit: 01**
Total contact hours: 2/week **L-T-P: 0-0-2**

Course Objective:

1. To acquaint students with practical experiments to validate the theories associated with different transducers.
2. To acquaint students about practical implementation of some selected transducers.

Course Outcome:

1. Students will able to perform experiments with selected transducers, collect data and plot graphs between input-output parameters.
2. Students will able to relate the experimental results with the theories.

List of experiments to be performed by the students for Transducer and Signal Conditioning Lab

1. To study LDR and plot the graph of its I-V characteristics response.

2. To study photodiode and plot its I-V characteristics response.

3. To study phototransistor and plot its I-V characteristics response.

4. To study strain gauge and plot its corresponding response between weight versus strain. Also find its sensitivity.

5. To study LVDT and plot its corresponding response between displacement versus output voltage. Also find its sensitivity.

6. To study RTD and its signal conditioning circuit using Wheatstone bridge. Also, plot the response curve between temperature and output voltage.

7. To study Thermistor and its signal conditioning circuit. Also, plot the response curve between temperature and output voltage.

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Course Title: Microprocessor Lab

Course Code: DIE473

Credit: 01

L-T-P: 0-0-2

Course Objectives

- To help students understand the basic architecture and operations of the 8085 microprocessors.
- To develop skills in writing and testing simple assembly language programs.
- To learn basic data transfer, data conversion, and hardware interfacing.

Course Outcomes

After completing the lab, students will be able to:

- Explain the basic functions of the 8085, including register and memory operations.
- Write, test, and debug assembly programs for arithmetic, logical, branching, and subroutine operations.

Laboratory Experiments

1. **Introduction to 8085 Kit**
    - Learn basic kit operations: viewing/changing data in registers and memory, and executing instructions.
2. **Data Transfer Instructions**
    - Practice load/store instructions, different addressing modes, and block data movement.
3. **Logical Instructions**
    - Perform operations like AND, OR, XOR, rotate, and masking using the accumulator.
4. **Arithmetic Instructions**
    - Write programs for addition, subtraction, multiplication, division, and 16-bit/multi-byte arithmetic.
5. **Jump & Call Instructions**
    - Understand flags and implement conditional jumps, loops, subroutines, and return instructions.

6. **Comparison & Decision Making**
    - Compare data, find minimum/maximum values, sort arrays, and search for elements.
7. **Stack Operations**
    - Learn how the stack works and use it in jump, call, and return instructions.

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Course Title: Control Systems Lab

Course Code: DIE474 **Credit: 01**

Total contact hours: 2/week **L-T-P: 0-0-2**

Course Objective: This course will enable students

1) To introduce the fundamentals concepts of Transfer Function and Laplace transform.

2) To provide and understanding of basic concepts of block diagram.

3) To understand time response analysis.

4) To understand stability analysis

Course Outcomes: At the end of the course students will able

1) To learn the principle of transfer function and laplace transform

2) To learn the concept of time response and stability analysis.

List of experiments:

1. To define the given Transfer Function.
2. To find the Laplace and Inverse Laplace Transform.
3. To reduce the given block diagram and obtain the overall Transfer Function and verify results theoretically.
4. To obtain the Unit Step, Unit Ramp, Unit Impulse and Unit Parabolic response of a first order system.
5. To obtain the Unit Step, Unit Ramp, Unit Impulse and Unit Parabolic response of a second order system.

6. To find the step response of second order system for different values of ε.
7. The open-loop transfer function of a unity-feedback system will be given, determine K_p, K_v, K_a and e_{ss} for each case.
8. To obtain the Unit-step response for the given second order system. Also determine the rise time, peak time, peak overshoot and settling time. Also verify results theoretically.
9. To obtain the Root locus plot for the system having open loop transfer function.
10. To obtain the Bode plot for a control system for a given open loop transfer function.

COURSE STRUCTURE

AND

SYLLABUS FOR

DIPLOMA PROGRAMMES

in

Animation and Multimedia Technology (AMT)

under

Department of Multimedia Communication and Design

Semester IV

(APPLICABLE FROM AY 2024-2025 ADMITTED BATCH ONWARDS)

AMT Diploma 4th Semester Course Structure & Syllabus

(In line with AICTE / NEP)

Semester – 4

Sl. No.	Course Code	Course Name	L	T	P	C
01.	DHS401	Indian Knowledge System	2	0	0	0
02.	DMD401	Introduction to New Media Technology	2	0	0	2
03.	DMD402	Fundamentals of Rigging	2	0	0	2
04.	DMD403	Introduction to 3D Animation	2	0	0	2
05.	DMD404	Concept of Lighting & Rendering	2	0	0	2
06.	DMD471	Introduction to New Media Technology Lab	0	0	4	2
07.	DMD472	Fundamentals of Rigging Lab	0	0	4	2
08.	DMD473	Introduction to 3D Animation Lab	0	0	6	3
09.	DMD474	Concept of Lighting & Rendering Lab	0	0	6	3
10.	DMD475	Concept Art Lab	0	0	4	2
	Contact Hours: 34		**10**	**0**	**24**	**20**

Course Title: Indian Knowledge System **L-T-P-C: 2-0-0-0**

Course Code: DHS401

To be prepared by Dept. of HSS

Course Title: Introduction to New Media Technology **L-T-P-C: 2-0-4-4**
Course Code: DMD401 / DMD471

DESCRIPTION: To match with today's digital world, this course is introduced to students to give them the knowledge and understanding of how New Media evolved with the evolution of technology. Students will learn about the fundamental principles, history and various applications of New Media in this course.

OBJECTIVE: The objective of this course is to teach students the theoretical part of New Media including history to understand the subject, as well as studio exercise on application of New Media through –

- Installation art – by using different forms of new media
- Digital media exploration
- TV, cinema as modern era communication media etc.

Course Content:

UNIT 1: Introduction to New Media

- Evolution of New Media - History to modern era
- Technology in New Media
- New Media culture – conventions and technique of old media

UNIT 2: Principles of New Media

- Discrete representation
- Numerical representation
- Automation
- Variability

UNIT 3: Concept of New Media

- Changing relationship of representation.
- Database as genre of new media.
- Logic of remediation.
- Concept of digital dialectic.
- Digital Cinema and the history of moving Image.
- The new language of cinema.

UNIT 4: Forms of New Media

- Installations - Sound art, Net art.
- Free software movement and open source.
- New media art installation and cross-media practice.
- Interactivity and interface: Models of interactive systems.

STUDIO EXERCISE

Students will be taught to understand the basic concept of New Media and how it is being used in different areas. Also, students will have to perform small projects using New Media forms and different types of installations.

Text books / Reference books:

1. R. Grusin and J. D. Bolter, *Remediation: Understanding New Media,* MIT Press, 2000.
2. L. Manovich, *The Language of New Media*, MIT Press, 2001.
3. P. Lunenfeld (ed.), *The Digital Dialectic: New Essays on New Media*, MIT Press, 1999.
1. N. Wardrip-Fruin and N. Montfort (eds.), *The New Media Reader,* MIT Press, 2003.

Course Title: Fundamentals of Rigging **L-T-P-C: 2-0-4-4**
Course Code: DMD402 / DMD472

Introduction to Rigging-What is rigging and why it is needed, Character rigging in a 3D production. Basic concepts needed for Rigging: pivot, Parenting v/s Grouping, Constraints, types of constraints. Maya Skeletons-Understanding joints, Bone set-up, importing character in Maya, setting up bones for biped character, managing hierarchies. Kinematics: introduction and overview of IK and FK.

Character set-up-Anatomy study: Study of human skeleton, starting to rig a character (biped): Setting up the skeleton, rigging the leg and the feet using reverse foot, rigging the hand in IK and FK (IK/FK switch), Deformers

Practical practices based on the theory part demonstrated and guided by the Course Instructor as per requirement of the course.

Text/Reference Books

1. "*Understanding 3D Animation using Maya*"by John Edgar Park.
2. "*An Essential Introduction to Maya Character Rigging*" by Cheryl Cabrera.
3. *Inspired 3D Advanced Rigging and Deformations* by Brad Clark, John Hood & Joe Harkins; Course Technology PTR; 1 edition (March 25, 2005), ISBN-10: 1592001165.
4. *Rig it Right! Maya Animation Rigging Concepts*, by Tina O'Hailey; 3rd Edition, Routledge, 2018.
5. *Digital Creature Rigging: Wings, Tails & Tentacles for Animation & VFX* by Stewart Jones, CRC Press, 2019.
6. *3D Character Development Workshop: Rigging Fundamentals for Artists and Animators* by Erik Van Horn, Mercury Learning & Information, 2018.
7. *Mastering 3D Animation Paperback* by Peter Ratner; Allworth Press, U.S., 2000.

Course Title: Introduction to 3D Animation **L-T-P-C: 2-0-6-5**
Course Code: DMD403 / DMD473

Animation Techniques-Types of Animation Techniques and Principles of Animation. Posing-Pose, Primary function of pose, Line of action, reversing the line of action, Uses of vertical line of action, Flow lines, Proper weight in posing and staging, Silhouette. Keyframe- Keys, Extremes, Breakdowns, in-betweens, Blocking, Graph editor, Cleanup and In-between, Understanding key frames, Non-Linear Animation – Motion Path Animation –Deformers, Motion trail, Turntable.

Practical practices based on the theory part demonstrated and guided by the Course Instructor as per requirement of the course.

Reference Books:

1. "Animation Survival Kit" by by Richard Williams.
2. "Understanding 3D Animation using Maya." by John Edgar Park.
3. "Tony White's Animator's Notebook" by Tony White.
4. "Acting for Animators" by Ed Hook.

Course Title: Concept of Lighting & Rendering **L-T-P-C: 2-0-6-5**
Course Code: DMD404 / DMD474

Basics of Lighting, Colour theory, Direct and Indirect Light, Types of Lights in Maya, 3-point Lighting, Light attributes, Shadows, Shadow Maps, Working with Layers, Rendering in Layers, Rendering in passes, Lighting Passes, Depth of Field, Cameras, Basics of Caustics, Mental Ray, Photons, Global Illumination, Raytracing, Final Gather, Basic Lighting Techniques, Indoor and Outdoor lighting Techniques, Special Lighting Techniques, Materials and Rendering Algorithms.

Practical practices based on the theory part demonstrated and guided by the Course Instructor as per requirement of the course.

Text/Reference Books

1. "Digital Lighting and Rendering", 3rd Edition - by Jeremy Birn.
2. "Essential CG Lighting Techniques" - by Darren Brooker.
3. "Advanced Lighting and Materials with Shaders" - by Kelly Dempski and Emmanuel Viale.

Course Title: Concept Art **L-T-P-C: 0-0-4-2**
Course Code: DMD475

Prop Designing, Layout and Planning, Perspective drawings, Background Design-Interior and Exterior, Character Design, Model sheet- turnaround, Expression and Posing, Anthropomorphic character design, Building background story and Concept Art.

Practical practices based on the theory part demonstrated and guided by the Course Instructor as per requirement of the course.

Text/Reference Books

1. "Character Mentor" by Tom Bancroft.
2. "Mastering Fantasy Art: Drawing Dynamic Characters" by John Stanko.
3. "The Art of Perspective" by Phil Metzger.
4. "Dream Worlds: Production Design for Animation" by Hans P Bacher.