केन्द्रीय प्रौद्योगिकी संस्थान कोकराझार
CENTRAL INSTITUTE OF TECHNOLOGY KOKRAJHAR
DEEMED TO BE UNIVERSITY, MHRD, GOVT. OF INDIA
KOKRAJHAR, ASSAM-783370
Website: www.cit.ac.in

COURSE STRUCTURE

AND

SYLLABUS FOR

DIPLOMA PROGRAMMES

in

Civil Engineering

Semester V

(APPLICABLE FROM AY 2024-2025 ADMITTED BATCH ONWARDS)

COURSE STRUCTURE

5th Semester /3rd 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	DCE501	Concrete Technology	3	0	0	3	CE
2	DCE502	Geotechnical Engineering	3	0	0	3	CE
3	DCE503	Transportation Engineering	3	0	0	3	CE
4	DCE504	Design of RCC Structures	3	1	0	4	CE
	DCE51*	Elective-I	3	0	0	3	CE
5	DCE511	Water Supply & Sanitary					
6	DCE512	Total Station and GPS Survey					
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	DCE571	Concrete Technology Lab	0	0	2	1	CE
2	DCE572	Geotechnical Engineering Lab	0	0	2	1	CE
3	DCE573	Transportation Engineering Lab	0	0	2	1	CE
4	DCE574	Professional Practices	0	0	2	1	CE
Total of B			**0**	**0**	**8**	**4**	
C.		**Audit/Non-credit Courses**					
Sl No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	**Coordinating Department**
Total of C							
Grand Total (A+B+C)			**15**	**1**	**8**	**20**	

Paper Code:	DCE501
Paper Name:	Concrete Technology
Credit:	03
L-T-P:	3-0-0
Total Contact hours:	36

Course Objectives:	• To develop an understanding of the properties and behavior of concrete and its constituents. • To expose students to the latest concrete materials, production methods, and quality control practices. • To familiarize students with advanced concrete types and sustainable practices. • To impart knowledge about testing, durability, and digital technologies in concrete construction.
Pre-requisites:	NIL
Course Outcomes:	After completion of this course, students will be able to: 1. Explain the properties and role of ingredients of concrete and their influence on strength and durability. 2. Apply knowledge of mix design, workability, and rheology for producing quality concrete. 3. Perform and interpret standard laboratory tests on fresh and hardened concrete. 4. Identify and use suitable admixtures, special concretes, and sustainable alternatives in construction. 5. Demonstrate awareness of modern developments in concrete technology such as self-healing concrete, geopolymer concrete, and digital construction tools.

Module No.	Topic	Nos. of contact hours
1	**Introduction to Concrete and Its Ingredients:** Definition, importance, and applications of concrete in modern construction. Cement: Types, properties, hydration, and tests as per IS codes. Fine and coarse aggregates: Classification, properties, grading, deleterious materials, and tests. Water: Quality requirements and its effect on concrete properties. Concept of Green Cement and Recycled Aggregates.	4

2	**Fresh Concrete and Rheology:** Workability and its measurement (slump, compaction factor, Vee-Bee, flow table tests). Rheology of concrete – concept of flow behaviour and factors affecting it. Mixing, transportation, placing, compaction, and curing of concrete. Modern curing methods: steam curing, membrane curing, self-curing agents. Ready Mix Concrete (RMC) and site-mixed concrete – comparison and field control	**6**
3	**Hardened Concrete and Strength Parameters:** Strength properties: compressive, tensile, and flexural strength. Stress-strain characteristics, modulus of elasticity, creep, and shrinkage. Durability of concrete: factors affecting, permeability, chemical attack, and preventive measures. Non-destructive testing (NDT) of concrete – Rebound hammer, Ultrasonic Pulse Velocity, core test introduction.	**6**
4	**Mix Design and Admixtures:** Basic principles of mix design – IS 10262 methods. Concept of water-cement ratio and its influence. Chemical admixtures – plasticizers, superplasticizers, retarders, accelerators, air-entraining agents. Mineral admixtures – fly ash, silica fume, GGBS, metakaolin, rice husk ash. Sustainable concrete design: use of industrial and construction waste materials.	**8**
5	**Special and Advanced Concretes:** High Strength and High-Performance Concrete (HPC). Self-Compacting Concrete (SCC). Fiber Reinforced Concrete (FRC). Geopolymer Concrete and Recycled Aggregate Concrete. Self-healing and 3D-printed Concrete (introduction). Smart materials and nanotechnology in concrete.	**6**
6	**Quality Control, Testing, and Sustainability:** Quality control during batching, mixing, and placement. Field testing and laboratory testing as per IS codes. Role of digital tools and sensors in concrete quality monitoring. Life cycle assessment (LCA) and carbon footprint of concrete. Green building and sustainable construction practices.	**6**

Textbooks:

1. Shetty, M. S., *Concrete Technology – Theory and Practice*, S. Chand.
2. Gambhir, M. L., *Concrete Technology*, Tata McGraw-Hill.
3. Varghese, P. C., *Building Materials and Concrete Technology*, PHI.
4. Mehta, P. K. and Monteiro, P. J. M., *Concrete: Microstructure, Properties, and Materials*, McGraw Hill

References:

1. Neville, A. M., *Properties of Concrete*, Pearson Education.
2. Santhakumar, A. R., *Concrete Technology*, Oxford University Press.
3. IS: 456–2000, IS: 10262–2019, IS: 383–2016, IS: 9103–2019.
4. RILEM and BIS Publications on Sustainable and Advanced Concrete

Course Code:	DCE502
Course Title:	Geotechnical Engineering
Course Credit:	03
L-T-P:	3-0-0
Total contact hours:	36

Course objectives:	The course is designed to achieve the following objectives: • Understanding the Basic Soil Properties and Classification a) Learn about different types of soils. b) Study physical and engineering properties of soil (e.g., texture, density, moisture content, Atterberg limits). c) Classify soil based on grain size and plasticity. • Basics of Soil Mechanics a) Understand the principles of effective stress. b) Learn about permeability, seepage, and flow through soil. c) Study the shear strength behaviour of soil. • Soil Compaction and Consolidation a) Understand the process of compaction and its importance in construction. b) Study the settlement behaviour of soil due to consolidation.
Pre-requisites:	Basics of Mechanics of Materials and fluid mechanics
Course outcomes:	After completion of this course students will be able to: 1. Understand and apply soil classification. 2. Analyse physical properties through laboratory tests. 3. Evaluate permeability, compaction, and shear strength through lab tests. 4. Interpret results to assess strength behaviour of soil under various loading conditions. 5. Calculate effective stress due to loads. 6. Analyse time rate and magnitude of settlement using consolidation theory.

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

1	**Introduction:** Origin and types of soil, regional soil deposits of India, phase relationship, index properties, Identification and classification of soils, clay mineralogy.	**8**
2	**Compaction:** Principle of compaction, mechanism of compaction, factors effecting compaction, compaction tests, effect of compaction on physical and engineering properties of soils.	**6**
3	**Effective stress, capillarity and Permeability:** Principle and physical meaning of effective stress, soil-water capillary phenomena, Darcy's law of permeability, determination of Co-efficient of permeability, Equivalent permeability for stratified soil, seepage force, downward flow, upward flow and quick sand condition.	**6**
4	**Compressibility and Consolidation of soil:** Compressibility, Terzaghi's theory of one-dimensional consolidation, primary consolidation, secondary consolidation, estimation of consolidation settlement.	**8**
5	**Shear strength of soils:** Mohr Circle of stress, mechanism of shear resistance, Mohr-Coulomb failure criterion, measurement of shear strength, unconfined compression, shear strength of clay and sand, strength parameters, types of shear tests in the laboratory based on drainage conditions.	**8**

Textbooks:

1. Basic and Applied Soil Mechanics by Gopal Ranjan & Rao, New Age International Publishers.
2. Geotechnical Engineering by SK Gulhati & M Dutta, Tata McGraw-Hill Publishers.
3. Soil Mechanics and Foundation by B.C. Punmia, Ashok Kr. Jain & Arun Kr. Jain

References:

1. Introduction to Soil Mechanics by BM Das, Galgotia Publication.
2. Soil Mechanics by Whitman &Lambe, John Willey.
3. Soil Mechanics & Foundation Engg by VNS Murthy, Dhanpat Rai & Sons

Course Code:	UCE503
Course Title:	Transportation Engineering-II
Course Credit:	03
L-T-P:	3-0-0
Contact Hours:	36

Course objective:	• To analyze and design the geometric elements and infrastructure components of railway systems. • To plan and design the layout, runways, and essential facilities for airports. • To understand the planning, design, and operational principles of docks and harbors, including their protective structures. • To describe and evaluate various tunneling methods, construction techniques, and safety requirements for different ground conditions. • To introduce the fundamental components and technologies constituting modern Intelligent Transport Systems (ITS).
Pre-requisites:	Basic knowledge of surveying and Highway Engineering
Course outcomes:	After completion of this course students will be able to: 1. Analyze and geometrically design all components of permanent railway track structures. 2. Plan and design the layout and functional components of airports. 3. Decide various protective structures required for docks and harbors. 4. Evaluate and select suitable methods for tunnel excavation, lining, and ventilation. 5. Apply ITS technologies for effective traffic management and safe transportation planning

Module no.	**Topic**	**Nos. of contact hours**
1.	**Traffic Engineering:** Road user, vehicle and traffic characteristics – Speed, volume, parking and accident studies. Concepts of PCU,	8

	capacity and level of service. Traffic signs and road markings - objectives, classification and uses. Principles of design of at-grade intersections –channelized, rotary and signal intersections, Grade separated intersections	
2.	**Railway Planning:** Comparison of Road, Rail, Air and Water transports – Elements of permanent way – Rails, Sleepers, Ballast, rail fixtures and fastenings, – Track Stress, coning of wheels, creep in rails, defects in rails – Route alignment surveys – Geometric design of railways, gradient, super elevation, widening of gauge on curves- Points and Crossings.	10
3.	**Railway Construction and Maintenance:** Earthwork – Stabilization of track on poor soil, Calculation of Materials required for track laying – Construction and maintenance of tracks – Modern methods of construction & maintenance	4
4.	**Airport Planning and Design:** Airport classification, airport planning: objectives, components, layout characteristics, and socioeconomic characteristics of the catchment area, criteria for airport site selection and ICAO stipulations, typical airport layouts, Parking and circulation area. Runway Design: Orientation, Wind Rose Diagram, Runway length, Problems on basic and Actual Length, Geometric design of runways, Configuration and Pavement Design Principles, Elements of Taxiway Design, Airport Zones, Passenger Facilities and Services, Runway and Taxiway Markings and lighting.	6
5.	**Harbour, Dock and Tunnel Engineering:** Definition of Basic Terms: Planning and Design of Harbours: Requirements, Classification, Location and Design Principles – Harbour Layout and Terminal Facilities. Harbor docks, Wet docks, Repair docks, Lift docks, Floating docks, Slipways. Introduction, size and shape of the tunnel, tunneling methods in soils, tunnel lining, tunnel drainage and ventilation.	4
6.	**Intelligent Transportation Systems:** Introduction, Data collection techniques, Telecommunications in ITS, ITS functional areas, ITS User Needs and Services.	4

Textbooks:

1. Veeraragavan. A, Khanna. K and Justo. C.E.G. Highway Engineering, Nem Chand & Bros Publishers
2. Railway Engineering, Satish Chandra and M.M. Agarwal, second Edition, Oxford University Press, New Delhi.
3. Airport Planning and Design, S. K. Khanna, M. G. Arora and S. S. Jain, Nemchand and Brothers, Roorkee
4. Transportation Engineering, Volume II: Railways, Airports, Docks and Harbours, Bridges and Tunnels, C Venkatramaiah, Universities Press.

References:

1. Partha Chakroborty and Animesh Das Principles of Transportation Engineering, PHI Learning Pvt. Ltd.
2. Airport Planning and Design, S. K. Khanna, M. G. Arora and S. S. Jain, Nemchand and Brothers, Roorkee
3. R. Srinivasa Kumar., Textbook of Highway Engineering, Universities Press (India).
4. Subhash C Saxena, Textbook of Highway and Traffic Engineering. CBS Publishers.
5. Kadiyali. L. R. Principles and Practice of Highway Engineering, Khanna Technical Publications, Delhi.
6. M A Chowdhary and A Sadek. Fundamentals of Intelligent Transportation systems planning. Artech House Inc., US
7. Subramanian K.P., Highways, Railways, Airport and Harbour Engineering, Scitech Publications (India)

Course Code:	DCE504
Course Title:	Design of RCC Structure
Credit:	04
L-T-P:	3-1-0
Total Contact hours:	48

Course Objectives:	• To Develop an understanding and appreciation for basic concepts in the behaviour and design of reinforced concrete systems and elements. • Differentiate between working stress design and limit state design. • Understand the basic concepts for reinforced concrete sectional design mainly in accordance with ultimate strength. • Assess the structural and material behaviour for the design of reinforced concrete systems and elements.
Pre-requisites:	Basic knowledge of Engineering Mechanics and Strength of Materials.
Course Outcomes:	After completion of this course, students will be able to: 1. The students will be well aware of the basic design philosophies of Working Stress Design and Limit State Design of RCC Structures. 2. The students will be able to design RCC beams –Singly and doubly reinforced rectangular beams, Flanged beams, based on specifications in IS 456-2000. 3. The students will be able to design one- and two-way slabs; continuous beams and slabs, based on specifications in IS 456-2000. 4. The students will be able to design RCC columns – Axially loaded columns, Short columns under axial load and moments, Slender columns, based on specifications in IS 456-2000 5. The students will be able to design isolated and combined footings of column.

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

1	**Introduction:** Objective of structural design-Steps in RCC Structural Design Process, Type of Loads on Structures and Load combinations, Code of practices and Specifications, Concept of Working Stress Method, Ultimate Load Design and Limit State Design Methods for RCC , Properties of Concrete and Reinforcing Steel, Analysis and Design of Singly reinforced Rectangular beams by working stress method, Limit State philosophy as detailed in IS code, Advantages of Limit State Method over other methods, Analysis of singly and doubly reinforced rectangular beams by Limit State Method	10
2	**Design of Beams:** Design of singly and doubly reinforced rectangular beams by Limit State Method, Behaviour of RC members in Shear, Bond and Anchorage, Design requirements as per current code, Behaviour of rectangular RC beams in shear and torsion, Design of RC members for shear.	10
3	**Design of Slabs:** Analysis and design one-way, two-way slabs and continuous slabs.	10
4	**Design of Columns:** Types of columns, Axially Loaded columns, design of short Rectangular, Square and circular columns; Design of Slender columns; Design for Uniaxial and Biaxial bending using Column Curves.	10
5	**Design of Footings:** Introduction, Design of isolated and combined footings for column.	8

Textbooks:

1. Jain and Jaikrishna, Plain and Reinforced Concrete, Vol. I, Nemchand Brothers (ISBN8185240086/978-8185240084).
2. V. L. Shah and Karve, Limit State Design - Reinforced Concrete Structures Publications. (ISBN9788190371711/8190371711).
3. Reinforced Concrete Design, S U Pillai / Devdas Menon, Tata McGraw Hill, New Delhi
4. Reinforced Concrete Design, S.N. Sinha, Tata McGraw Hill, New Delhi
5. Design of RCC Structures, M L Gambhir, Macmillan India Ltd, Delhi
6. Reinforced Concrete, S.K. Mallick & A P Gupta, Oxford & IBH, New Delhi
7. Reinforced Concrete, Behaviour, Analysis and Design, P. Purushotham, Tata McGraw Hill, New Delhi
8. RCC Structures, B C Punmia, Ashok K Jain, and Arun K Jain, Laxmi Publications, Delhi
9. Design of Reinforced Concrete Structures, N. Subramanian, Oxford University Press, New Delhi

References:

1. P. Dayaratnam, Design of Reinforced Concrete Structures, Oxford & IBH. (ISBN9789386479785/9386479788).

2. T.Y. Lin, Design of Prestressed Concrete Structures, John Wiley and Sons Inc., 2010. (ISBN9788126528035/978-8126528035).
3. P.D. Arthur and V. Ramkrishnan, Ultimate Strength Design for Structural Concrete, Wheeler &Co. Pvt Ltd. (ISBN- 0273403230, 978-0273403234).
4. B.P. Hughes, Limit State Theory for Reinforced Concrete Design, Pitman. (ISBN-0273010239, 978-0273010234).
5. IS 456 (2000), Plain and Reinforced Concrete.
6. IS 875 (1987), Part I- Design Loads (Other than earthquake) for Buildings and Structures (Dead Loads).
7. IS 875 (1987), Part II- Design Loads (Other than earthquake) for Buildings and Structures (Imposed Loads)
8. IS 875 (2015), Part III- Design Loads (Other than earthquake) for Buildings and Structures (Wind Loads)
9. IS 875 (1987), Part IV- Design Loads (Other than earthquake) for Buildings and Structures (Snow Loads).

Course Code:	DCE511
Course Title:	Water Supply and Sanitary Installation
Course Credit:	03
L-T-P:	3-0-0
Total Contact Hours:	36

Course objective:	The objective of this course is to impart knowledge on: • Different sources of water supply, methods of construction. • Collection of surface water and its conveyance. • Systems of sewerage, septic tank and imhoff tank. • Water supply and sanitary fittings, rural water supply and sanitation
Pre-requisites:	Nill
Course outcomes:	After completion of this course students will be able to 1. Identify different sources of water supply and their method of construction. 2. perform layout distribution system and appurtenances in distribution system. 3. Design sewerage system, septic tank, etc 4. Understand and apply rural water supply and sanitation.

Module no.	Topic	Nos. of contact hours
1	**Sources of water supply:** Surface runoff, precipitation, measurement of rainfall, types of sources, surface source, underground sources, wells, tube wells and method of construction, types of pumps with fittings.	7
2	**Collection of surface water and its conveyance through pipes:** Canal intake, reservoir intake, river intake, portable intake, type of pipes, methods of layout of pipes, corrosion in pipes and their remedial measures, appurtenances in distribution system.	8
3	**Sanitary systems:** Conservancy and water carriage systems, systems of sewerage, construction and maintenance of privies, Septic tanks, imhoff tanks	7
4	**Sewers:** Materials for sewers, shapes of sewers, joints in sewers, laying and testing of sewers, ventilation of sewers, cleaning of sewers, sewer appurtenances.	7

5	**Plumbing equipments and operations:** Water supply and sanitary fittings, house drainage, concepts of rural water supply and sanitation.	7

Textbooks:

1. A.C. Panchdhari, Water Supply And Sanitary Installations, New Age International, 2005.
2. RANGWALA,Water Supply And Sanitary Engineering, Charotar Publishing House Pvt. Ltd.; 29th Edition (1 January 2016).

Recommended Readings:

1. S.K. Husain, Water Supply and Sanitary Engineering, CBS PUBLISHERS AND DISTRIBUTORS PVT LTD; Third Edition (30 April 2017).

Course Code:	DCE512
Course Title:	Total Station and GPS Survey
Course Credit:	3 (L: 3 T: 0 P: 0)
L-T-P:	3-0-0
Total Contact Hours:	36

Course objective:	The main objectives of this course are to: • Introduce the principles and components of Total Stations and GPS receivers. • Train students in field procedures for data collection, transfer, and processing. • Ensure proficiency in operating the equipment independently and accurately. • Apply theoretical knowledge to solve real-world civil engineering problems (e.g., construction layout, topographical mapping).
Pre-requisites:	Basic knowledge of surveying
Course outcomes:	Upon successful completion of the course, students will be able to: 1. Set up and operate Total Stations and GPS receivers and perform various surveys (traversing, topographical, setting out) efficiently. 2. Explain the fundamentals and positioning methods of GPS surveying. 3. Generate simple survey maps and technical reports using CAD/mapping software.

Module no.	Topic	Nos. of contact hours
1	**Introduction to Surveying:** Fundamentals of surveying and geometry, Principles of maps and coordinates, Basic surveying instruments.	7
2	**Total Station Surveying:** Fundamentals: Principles of electronic distance measurement (EDM), angular measurement, and modern theodolites, Working principles: Operation, setting up, leveling, and calibration, Measurements: horizontal and vertical angles, distances, and coordinates, Field procedures: traversing, calculating coordinates,	8

	and adjusting traverses, Applications: Detailed local surveys, stake-outs, and construction layout	
3	**GPS Surveying:** Fundamentals: GPS segments (space, control, user), satellite orbits, and signal structure, Working principles: Handheld and geodetic receivers, data processing techniques, Field procedures: GPS positioning, data collection, and processing for applications like traversing and triangulation, Applications: Large-scale mapping and data collection	7
4	**Digital Surveying and Mapping:** Digital data processing: Reducing field data and handling digital data manipulation, Digital mapping: Creating digital maps and plans using survey data, Application of GIS. Project work.	7
5	**Practical Application:** Practical training on performing surveys using total stations and GPS, Data analysis: Processing and analyzing field data using software, Application: Hydrographic surveys, transmission line surveys, and railway line surveys, Drawing: Preparing site plans, contour maps, and CAD drawings	7

Textbooks:

1. Rueger, J.M. Electronic Distance Measurement, Springer-Verlag, Berlin, 4th Edition,1996.
2. Satheesh Gopi, R Sathish Kumar, N. madhu, ― Advanced Surveying, Total Station GPS and Remote Sensing ― Pearson education, 2nd Edition,2017.
3. Gunter Seeber , Satellite Geodesy, Walter De Gruyter, Berlin, 2nd Edition, 2003

References:

1. R. Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012.
2. Laurila, S.H. Electronic Surveying in Practice, John Wiley and Sons Inc, 1983
3. Guocheng Xu, GPS Theory, Algorithms and Applications, Springer – Verlag, Berlin, 3rd edition,2016.
4. Alfred Leick, GPS satellite surveying, John Wiley & Sons Inc., 4th Edition, 2015.

Course Code:	DCE571
Course Title:	Concrete Technology Lab
Credit:	01
L-T-P:	0-0-2
Total Contact hours:	24

Course Objectives:	The objectives of this practical course are: • To develop hands-on skills in testing materials and concrete as per IS standards. • To understand the behavior of fresh and hardened concrete through laboratory investigations. • To enable students to carry out mix design and evaluate performance parameters. • To familiarize students with modern testing instruments, admixtures, and sustainable concrete materials.
Pre-requisites:	Basic Knowledge of Concrete Technology
Course Outcomes:	After completing this course, students will be able to: 1. Conduct standard tests on cement, aggregates, and concrete as per BIS specifications. 2. Determine workability and quality of fresh concrete through rheological and field tests. 3. Evaluate strength, durability, and microstructural characteristics of hardened concrete. 4. Perform mix design using standard guidelines and assess its performance. 5. Demonstrate awareness of sustainable materials and advanced concrete testing methods

Module No.	Topic	Nos. of contact hours
1	Determination of fineness, consistency, setting time, and soundness of cement (as per IS 4031).	
2	Determination of specific gravity, bulk density, and water absorption of fine and coarse aggregates.	

3	Sieve analysis and grading of aggregates – plotting grain size distribution curve.	**24**
4	Determination of workability of fresh concrete by slump cone, compaction factor, and flow table tests.	
5	Preparation and curing of concrete cubes and determination of compressive strength at 7 and 28 days.	
6	Determination of split tensile strength and flexural strength of concrete specimens.	
7	Study on the effect of water-cement ratio and admixtures on workability and strength of concrete.	
8	Mix design of concrete as per IS 10262:2019 (manual calculation or using software tools).	
9	Non-destructive testing (NDT) of hardened concrete using rebound hammer and ultrasonic pulse velocity apparatus.	
10	Demonstration / mini project on special concrete – e.g., self-compacting concrete, geopolymer concrete, or fiber reinforced concrete	

Textbooks:

1. Shetty, M. S., *Concrete Technology – Theory and Practice*, S. Chand.
2. Gambhir, M. L., *Concrete Technology*, Tata McGraw-Hill.
3. Varghese, P. C., *Building Materials and Concrete Technology*, PHI.
4. Santhakumar, A. R., *Concrete Technology*, Oxford University Press.

References:

1. Neville, A. M., *Properties of Concrete*, Pearson Education.
2. Mehta, P. K. & Monteiro, P. J. M., *Concrete: Microstructure, Properties, and Materials*, McGraw Hill.
3. IS: 456–2000, IS: 10262–2019, IS: 383–2016, IS: 516–2018, IS: 9103–2019.
4. RILEM and BIS Handbooks on Modern Concrete Testing.

Course Code:	DCE572
Course Title:	Geotechnical Engineering Lab
Credit:	01
L-T-P:	0-0-2
Total contact hours:	24

Course objectives:	The objectives of this course are to provide: • Hands-on experience in evaluating the physical properties of soil. • Practical experience in applying theoretical concepts from geotechnical engineering to real-world problems.
Pre-requisites:	Basic theoretical knowledge of Geotechnical Engineering
Course outcomes:	After completion of this course students will be able to: 1. Classify soils using systems like the Unified Soil Classification System (USCS) or AASHTO classification based on test data. 2. Experimentally determine important soil properties. 3. Familiar with the use and maintenance of geotechnical testing equipment. 4. Develop competency in collecting, recording, analysing, and presenting geotechnical data in technical reports.

Module no.	**Topic**	**Nos. of contact hours**
1	Determination of moisture content (by oven drying) and specific gravity of soil.	24
2	Determination of liquid limit of soil.	
3	Determination of plastic limit of soil.	
4	Particle size analysis of soil using dry and wet sieving.	
5	Determination of filed density using and core cutter method.	
6	Determination of filed density using sand replacement.	
7	Determination of MDD and OMC using Standard Proctor Test.	

8	Determination of coefficient of permeability using constant head and falling head test.	
9	Determination of compressive strength of soil using unconfined compression test.	

Textbooks:

1. Basic and Applied Soil Mechanics by Gopal Ranjan & Rao, New Age International Publishers.
2. Geotechnical Engineering by SK Gulhati & M Dutta, Tata McGraw-Hill Publishers.

Recommended readings:

1. Geotechnical testing Lab manual, Indian Institute of Technology Gandhinagar, https://research.iitgn.ac.in/stl/wp/labmanual/

Course Code:	DCE573
Course Title:	Transportation Engineering Lab
Credit:	01
L-T-P:	0-0-2
Total Contact Hours:	24

Course objective:	• To conduct standard tests to determine the mechanical strength properties of road aggregates. • To determine the physical and geometrical properties of aggregates for pavement construction. • To measure the various rheological properties (consistency, temperature susceptibility) of bituminous binders. • To evaluate the strength of subgrade soil for pavement design using the CBR test. • To design and analyze bituminous mixes using the Marshall Stability method.
Pre-requisites:	Basic knowledge of highway engineering
Course outcomes:	After completion of this course students will be able to: 1. Determine the crushing, impact, and abrasion resistance of aggregates. 2. Evaluate the shape, size, specific gravity, and water absorption of aggregates. 3. Characterize bitumen by its penetration, ductility, softening, and flash point. 4. Perform the California Bearing Ratio (CBR) test for subgrade evaluation. 5. Calculate the optimum binder content and stability of a bituminous mix.

Module no.	Topic	Nos. of contact hours
1	Determination of aggregate crushing value.	24
2	Determination of aggregate impact value.	
3	Determination of aggregate abrasion value.	
4	Determination of flakiness index and elongation index of aggregates.	
5	Determination of specific gravity and water absorption test on aggregates.	
6	Determination of CBR value.	

7	Determination of specific gravity of Bitumen.	
8	Determination of penetration value of Bitumen.	
9	Determination of ductility value of Bitumen.	
10	Determination of softening point of Bitumen.	
11	Determination of flash and fire point of Bitumen.	
12	Determination of viscosity value of Bitumen	
13	Marshall Stability test.	
14	Traffic studies	

Textbooks:

1. Veeraragavan. A, Khanna.K and Justo.C.E.G. Highway Engineering, Nem Chand & Bros Publishers.
2. Khanna.S. K., Justo.C.E.G and Veeraragavan A. Highway Materials and Pavement Testing, Nem Chand and Bros., Roorkee.

Recommended Readings:

1. Kadiyali. L. R. Principles and Practice of Highway Engineering, Khanna Technical Publications, Delhi.
2. Sharma. S. K Principles, Practices and Design of Highway Engineering, S. Chand and Company Ltd.
3. R. Srinivasa Kumar, Textbook of Highway Engineering, Universities Press (India).
4. Subhash C Saxena, Textbook of Highway and Traffic Engineering. CBS Publishers.
5. C. Venkatramaiah, Transportation Engineering-Highway Engineering, Universities Press (India).

Course Code:	DCE574
Course Title:	**Professional Practices**
Credit:	1
L-T-P:	0-0-2
Total Contact Hours:	24

Course objective:	The objective of this course is to develop: • general confidence, ability to communicate, engineering aptitude, and professional attitude in students • technological concepts in students through Industrial and/or project site visits, expert lectures, seminars on technical topics and group discussion
Pre-requisites:	Basic knowledge of construction materials, building construction techniques, structural analysis
Course outcomes:	After completion of this course students will be able to: 1. Acquire information and data related to a civil engineering project from different sources. 2. Prepare technical notes and reports on a given topic or an expert lecture. 3. Present a given topic in a seminar. 4. Interact with peers to disseminate concepts and thoughts. 5. Prepare a report on industrial visit.

Module no.	Topic	Nos. of contact hours
1	**Student Activities and Seminar:** Students will be organized in groups of three to four, and each group will perform any one of the following activities and present the same in a seminar. i) Market survey of building materials ii) Study of availability of local construction materials including timbers iii) Study of traditional and sustainable civil engineering structures (houses, dongs, etc.) of the region, iv) Study of large civil engineering structures existing in the neighbourhood of the Institute or elsewhere, such as road or river bridges, tall and/or large-span reinforced cement concrete or structural steel buildings, overhead water tanks, high retaining walls, dykes, embankments and flood control structures, irrigation canal system and canal structures, etc. v) Any other relevant field selected by teachers or the course coordinator	6
2	**Group discussion:** Students will discuss in a group of six to eight, and each group will write a brief report on the same as a part of term work. Two topics for group discussions may be selected by teachers or the course coordinator. Some of the suggested topics are:	4

	i) A topic of national or international importance related to civil engineering. ii) Current trends and developments in civil engineering. iii) The role of diploma engineers in the progress of the nation. iv) Use of internet/mobile in accomplishing engineering tasks at project sites. **v)** Any other relevant field selected by teachers or the course coordinator.	
3	**Guest Lectures :** Lectures by Professional/Industrial Expert/Alumni in any two of the following areas: i) Recent development of building materials, ii) Recent developments in construction tools and techniques, iii) Safety, Health and Environment (SHE), Firefighting/Safety precautions/First aid/Safety audit, etc., iv) Quality control and inventory management in large projects, v) Career opportunities. vi) Building Bye-Laws. vii) Social responsibilities of Civil Engineer. viii)Any other topic as decided by teachers or the course coordinator. Each student will prepare an individual report on the findings/learnings from Guest Lectures.	4
4	**Industrial or project site visit:** Structured industrial or project site visit shall be arranged, and each student will prepare an individual report on any two of the following: i) Nearby thermal or hydroelectric power generation plant, ii) Nearby Petroleum Refinery, iii) Nearby Brick manufacturing plant or kiln, iv) Nearby irrigation project, v) Nearby stone query, vi) Nearby highway or bridge construction site, vii) Nearby Cement factory, viii)Any other relevant industry, factory or project site as suggested or decided by teachers or the course coordinator.	4
5	**Information search and Assignment submission:** Students will search information related to civil engineering and allied fields on any one of the following topics from manufacturer's catalogue, websites, magazines, books etc. and each student will prepare an individual report as a High Order Thinking (HOT) assignment describing the findings/learnings i) Modern methods of large-scale surveying based on UAVs etc. ii) Modern methods of Irrigation water delivery by robotic systems, Surveying by total station. iii) Retrofitting of structures. iv) Ready mix concrete. v) Non-Destructive Testing. vi) Seismic considerations and seismic performance of RCC building. vii) Green buildings and recent developments in developing the same. viii)Impacts of climate change in civil engineering. ix) Any other topic as suggested or decided by teachers or the course coordinator.	6

Textbooks: No specific textbook is required. A textbook may be considered depending on a topic selected for an activity.

References:

1. Khanna, P.N. (2012), Indian Practical Civil Engineers Handbook, UBS Publishers Distributors, 500 pages.
2. Khanna, P.N. and Tara Publishers (2020), Tara's Handbook of Civil Engineering, Tara Publishers, Birla Publications Pvt. Ltd.
3. The B1M YouTube videos on civil engineering marvels of the world as available on the

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COURSE STRUCTURE

AND

SYLLABUS FOR

DIPLOMA PROGRAMMES

in

Computer Science and Engineering

Semester V

(APPLICABLE FROM AY 2024-2025 ADMITTED BATCH ONWARDS)

5TH SEMESTER DIPLOMA

COURSE CODE	COURSE NAME	L	T	P	C
DCS501	Introduction to e-Governance	2	1	0	3
DCS502	Internet of Things	2	1	0	3
DCS503	Computer Networks	3	0	0	3
DCS504	Fundamentals of Artificial Intelligence	3	0	0	3
DCS51*	**Elective-1**	3	0	0	3
DCS573	Computer Networks Lab	0	0	2	1
DCS574	Artificial Intelligence Lab	0	0	2	1
DCSSI1	Summer Internship-1	0	0	2	2
DCS591	Minor Project	0	0	6	3
		Total			**22**

DCS51*	**Elective-1**
DCS511	Multimedia Technologies
DCS512	Mobile Computing
DCS513	Fundamentals of Data Science and Statistics
DCS514	Cyber Security

Course Code	Course Name	L	T	P	C
DCS501	Introduction to e-Governance	2	1	0	3

Course Learning Objectives:

To cover the concepts of e-Governance and to understand how technologies and business models shape the contours of government for improving citizen services and bringing in transparency.

Course Content:

UNIT 1: Exposure to emerging trends in ICT for development; Understanding of design and implementation of e-Government projects, e-governance lifecycle.

UNIT 2: Need for Government Process Re-engineering (GPR); National e-Governance Plan(NeGP) for India; SMART Governments & Thumb Rules

UNIT 3: Architecture and models of e-Governance, including Public Private Partnership (PPP); Need for Innovation and Change Management in eGovernance; Critical Success Factors; Major issue including corruption, resistance for change, e-Security and Cyber laws

UNIT 4: Focusing on Indian initiatives and their impact on citizens; Sharing of case studies to highlight best practices in managing e-Governance projects in Indian context. Visits to local e-governance sites (CSC, eSeva, Post Office, Passport Seva Kendra, etc) as part of Tutorials.

UNIT 5: Mini Projects by students in groups – primarily evaluation of various e-governance projects.

Reference Books:

1. Managing Transformation –Objectives to Outcomes. J Satyanarayana, Prentice Hall India

2. The State, IT and Development. Kenneth Kenniston, RK Bagga and Rohit Raj Mathur, Sage Publications India Pvt Ltd.

3. e-Government -The Science of the Possible. J Satyanarayana, Prentice Hall, India

4. http://www.csi-sigegov.org/publications.php

5. https://negd.gov.in

6. https://www.nisg.org/case-studies-on-e-governance-in-india

Course outcomes:

Through exposure to introductory ideas and practices followed in a selected number of e-Governance initiatives in India, the course will help students to understand and appreciate the essence of e-Governance.

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Course Code	Course Name	L	T	P	C
DCS502	Internet of Things	2	1	0	3

Course Learning Objectives:

Internet of Things (IoT) is presently an important technology with wide ranging interest from Government, academia and industry. IoT cuts across different application domain verticals ranging from civilian to defense sectors which includes agriculture, space, health care, manufacturing, construction, water, mining, etc. Today it is possible to build different IoT solutions such as shopping system, infrastructure management in both urban and rural areas, remote health monitoring and emergency notification systems, and transportation systems. Therefore, it is very important to learn the fundamentals of this emerging technology.

Course Content:

UNIT 1: Introduction to IoT; Sensing; Actuation

UNIT 2: Basics of IoT Networking, Communication Protocols, Sensor networks

UNIT 3: Introduction to Arduino programming, Integration of Sensors/Actuators to Arduino

UNIT 4: Implementation of IoT with Raspberry Pi; Data Handling Analytics

UNIT 5: Case Studies: Agriculture, Healthcare, Activity Monitoring

Reference Books:

1. https://nptel.ac.in/noc/individual_course.php?id=noc17-cs22

2. “The Internet of Things: Enabling Technologies, Platforms, and Use Cases”, by Pethuru Raj and Anupama C. Raman (CRC Press)

3. Internet of Things by Dr. Jeeva Jose, Khanna Publishing House (Edition 2017)

4. “Internet of Things: A Hands-on Approach”, by Arshdeep Bahga and Vijay Madisetti (Universities Press)

5. Internet of Things: Architecture and Design Principles, Raj Kamal, McGraw Hill

6. Research papers

Course outcomes:

Students will have good understanding of various aspect of IoT, know some tools and have basic implementation skills.

****

Course Code	Course Name	L	T	P	C
DCS503	Computer Networks	3	0	0	3

Course Learning Objectives:

Understand functioning of computer networks and popular networking protocols

Course Content:

UNIT 1: Introduction to computer networks; Network Models- OSI Reference Model, TCP/IP Model.

UNIT 2: Transmission Media – principles, issues and examples; Wired Media – Coaxial, UTP, STP, Fiber Optic Cables; Wireless Media – HF, VHF, UHF, Microwave, Ku Band; Network topologies; Data Link Layer – design issues, example protocols (Ethernet, WLAN, Bluetooth); Switching Techniques.

UNIT 3: Network Layer - design issues, example protocols (IPv4); Routing - principles/issues, algorithms (Distance-vector, Link-state) and protocols (RIP, OSPF).

UNIT4: Transport Layer - design issues, example protocols (TCP); Application Layer Protocols (SMTP, DNS).

UNIT 5: Functioning of Network Devices – NIC, Hub, Switch, Router, WiFi Devices; Network Management System and example protocol (SNMP).

Reference Books:

1. Computer Networks, 4th Edition (or later), Andrew S. Tanenbaum, PHI
2. TCP/IP Illustrated, Volume-1, W. Richard Stevens, Addision Wesley
3. Data and Computer Communications, William Stallings, PHI
4. An Engineering Approach to Computer Networking, S. Keshav, Addision Wesley/Pearson
5. An Integrated Approach to Computer Networks, Bhavneet Sidhu, Khanna Publishing House
6. Computer Networks: A Top-Down Approach, Behrouz A. Forouzan, Firouz Musharraf, McGrawHill

Course outcomes:

Understanding of computer networks, issues, limitations, options available. ii. Understanding of the care that needs to be taken while developing applications designed to work over computer networks iii. Able to configure basic LAN and connect computers to it.

****

Course Code	Course Name	L	T	P	C
DCS504	Fundamentals of AI	3	0	0	3

Course Learning Objectives:

To introduce students to the domain of Artificial Intelligence.

Course Content:

UNIT 1: Introduction

Overview and Historical Perspective, Turing test, Physical Symbol Systems and the scope of Symbolic AI, Agents.

UNIT 2: Search

Heuristic Search: Best First Search, Depth First Search, Hill Climbing, Beam Search, Tabu Search Randomized Search: Simulated Annealing, Genetic Algorithms, Ant Colony Optimization.

UNIT 3:

Finding Optimal Paths: Branch and Bound, A*, IDA*, Divide and Conquer approaches, Beam Stack Search.

Problem Decomposition: Goal Trees, AO*, Rule Based Systems, Rete Net. Game Playing: Minimax Algorithm, AlphaBeta Algorithm, SSS*.

UNIT 4:

Planning and Constraint Satisfaction: Domains, Forward and Backward Search, Goal Stack Planning, Plan Space Planning, Graph plan, Constraint Propagation.

UNIT 5:

Logic and Inferences: Propositional Logic, First Order Logic, Soundness and Completeness, Forward and Backward chaining.

Reference Books:

1. Deepak Khemani. A First Course in Artificial Intelligence, McGraw Hill Education (India)
2. https://nptel.ac.in/courses/106106126/
3. Stefan Edelkamp and Stefan Schroedl. Heuristic Search, Morgan Kaufmann.
4. Pamela McCorduck, Machines Who Think: A Personal Inquiry into the History and
5. Prospects of Artificial Intelligence, A K Peters/CRC Press
6. Elaine Rich and Kevin Knight. Artificial Intelligence, Tata McGraw Hill.
7. Stuart Russell and Peter Norvig. Artificial Intelligence: A Modern Approach, Prentice Hall
8. M.C. Trivedi, A classical approach to Artificial Intelligence, Khanna Publishing House

Course outcomes: Student will have general idea about Artificial Intelligence, will be able to explore AI tools effectively.

Course Code	Course Name	L	T	P	C
DCS573	Computer Networks Lab	0	0	2	1

Course Learning Objectives:

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

Course Content:

S.No.	Topics for Practice
1	Showing various types of networking cables and connectors, identifying them clearly
2	Looking at specifications of cables and connectors of various companies on Internet, find out differences.
3	Making patch cords using different types of cables and connectors - crimping, splicing, etc
4	Demonstration of different type of cable testers, using them for testing patch cords pre- pared by the students in Lab and standard cables prepared by professionals
5	Configuring computing devices (PC, Laptop, Mobile, etc) for network, exploring different options and their impact – IP address, gateway, DNS, security options, etc
6	Showing various networking devices – NICs, Hub, Switch, Router, WiFi access point, etc.
7	Looking at specifications of various networking devices various companies on Internet, find out differences.
8	Network simulation tool (e.g., Cisco Packet Tracer)
9	Setting up a small wired LAN in the Lab
10	Setting up a small wireless LAN in the Lab

Reference Books:

1. Cisco press books on CCNA
2. User manual of networking devices available in the lab
3. Wiki pages on networking devices

Course outcomes:

i. Understanding of computer networks, issues, limitations, options available.

ii. Able to configure basic small LAN and connect computers to it.

****

Course Code	Course Name	L	T	P	C
DCS574	Artificial Intelligence Lab	0	0	2	1

Course Learning Objectives:

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

1. Introduction of various python libraries used for AI.
2. Write a Program to implement Uninformed Search Technique: Breadth First Search
3. Write a Program to implement Uninformed Search Technique: Depth First Search
4. Write a Program to implement Informed Search Technique: A* Algorithm
5. Write a Program to implement Informed Search Technique: AO* Algorithm
6. Write a Program to implement Local Search Technique: Hill Climbing Algorithm
7. Write a Program to implement Game Playing Algorithms: Minimax and Alpha Beta Pruning
8. Write a Program to implement a simple Genetic Algorithm (bit-string)
9. Program to implement 8-Puzzle, N Queens Problem using Python
10. Program to implement Missionaries-Cannibals Problems using Python

Reference Books:

1. *Artificial Intelligence with Python* — by Prateek Joshi (PACKT Publishing)
2. *Artificial Intelligence Building Intelligent Systems* — by Parag Kulkarni, Prachi Joshi, Publisher:PHI Learning

Course outcomes:

i. Understanding of the different searching algorithms and their comparison and utilities.
ii. Able to apply Alpha-Beta Pruning to reduce the search space.
iii. Learn to apply Genetic Algorithm in different situations.

****

Course Code	Course Name	L	T	P	C
DCS511	Multimedia Technologies	3	0	0	3

Course Learning Objectives:

To introduce students to the domain of Multimedia Technologies, which explain the technologies underlying digital images, videos and audio contents, including various compression techniques and standards, and the issues to deliver multimedia content over the Internet.

Course Content:

UNIT 1: Introduction to Multimedia

Multimedia Foundation and Concepts: Multimedia Hardware, Multimedia Software, Multimedia operating systems, Multimedia communication system

UNIT 2: Basic Compression Techniques

Video and Audio Data Compression Techniques – Lossy and Lossless. Example algorithms/standards: Huffman, RLE, JPEG, MPEG, MP3, MP4, LZMA, FLAC, ALAC, ITU G.722, H.261, H.265

UNIT 3: Content Development and Distribution

Desktop publishing (Coral Draw, Photoshop, Page maker) Multimedia Animation & Special effects (2D/3D animation, Flash)

UNIT 4: Introduction to Digital Imaging

Basics of Graphic Design and use of Digital technology, Definition of Digital images, Digital imaging in multimedia

Reference Books:

1. An Introduction to Multimedia Authoring, A. Eliens

2. Fundamentals of Multimedia, Prentice Hall/Pearson, Ze-Nian Li & Mark S. Drew.

3. Multimedia and Animation, V.K. Jain, Khanna Publishing House, Edition 2018

4. Fundamentals of Multimedia, Ramesh Bangia, Khanna Book Publishing Co., N. Delhi (2007)

Course outcomes: Student will be able to build multimedia content and applications and also multimedia enables Web applications and mobile applications.

****

Course Code	Course Name	L	T	P	C
DCS512	Mobile Computing	3	0	0	0

Course Learning Objectives:

To teaches how to build mobile apps for Android. Students are expected to work on a project as part of the course.

Course Content:

UNIT 1:

A brief history of Mobile, Types of mobile phone generations, The Mobile Ecosystem, Types of Mobile Applications, Mobile Information Architecture Android Versions, Features of Android, Android Architecture, Installing Android SDK Tools, Configuring Android in Eclipse IDE, Android Development Tools (ADT), Creating Android Virtual Devices (AVD)

UNIT 2:

Creating first android application, Anatomy of android application, Deploying Android app on USB connected Android device, Android application components, Activity life cycle, understanding activities, Exploring Intent objects, Intent Types, linking activities using intents

UNIT 3:

Fragments life cycle, Interaction between fragments, Understanding the components of a screen (Layouts), Adapting to display orientation, Action Bar, Views (UI Widgets)-Button, Toast, Toggle Button, Checkbox, Radio Button, Spinner, WebView, Edit Text, Date Picker, Time Picker, List View, Progress- Bar, Analog and Digital clock, Handling UI events, List fragment, Dialog fragment

UNIT 4:

Menus-Option, Context, Popup, Images-Image View, Image Switcher, Alert Dialog, Alarm manager,

SMS, E-mail, Media Player, using camera, recording video, Handling Telephony Manager

UNIT 5:

Storing the data persistently-Data Storage Options: preferences, Internal Storage, External Storage, Content Provider, The SQLite database, connecting with SQLite database and operations-Insert, Delete, Update, Fetch, publishing android applications, Deploying APK files

Reference Books:

1. Wei-Meng Lee, Beginning Android 4 Application Development, Wiley Publishing, Inc.

2. Pradeep Kothari, “Android Application Development Black Book”, DreamTech Press

3. James C. Sheusi, “Android Application Development for Java Programmers”, Cengage Learning

4. Mark L Murphy, “Beginning Android”, Wiley India Pvt Ltd

5. Sayed Y Hashimi and Satya Komatineni (2009), “Pro Android”, Wiley India Pvt Ltd

6. Reto Meier, Professional Android 4 Application Development, Wiley India Pvt Ltd

Course outcomes: Will be able to develop and deploy basic mobile applications.

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Course Code	Course Name	L	T	P	C
DCS513	Fundamentals of Data Science and Statistics	3	0	0	0

Course Learning Objectives:

Student will understand the basic concepts of data science, including data representation, machine learning as well as essential statistical concepts and probability.

Course Content:

UNIT 1:
Introduction to Data Science, Evolution of Data Science, Data Science Roles, Stages in a Data Science Project, Applications of Data Science in various fields, Data Security Issues.

UNIT 2:
Machine Learning, Supervised Machine Learning, Unsupervised Machine Learning, Semi-Supervised Machine Learning, Reinforcement Machine Learning, Applications of Machine Learning.

UNIT 3:
Sampling Techniques, Data Classification, Tabulation, Frequency and graphic Representation, Measures of Central Tendency, Measures of Variation, Quartiles and Percentiles, Moments, Skewness and Kurtosis.

UNIT 4:
Scatter Diagram, Karl Pearson's Correlation Coefficient, Rank Correlation, Correlation Coefficient for Bivariate Frequency Distribution, Regression Coefficients, Fitting of Regression Lines.

UNIT 5:
Random Experiment, Sample Space, Events, Axiomatic Definition of Probability, Addition Theorem, Multiplication Theorem, Baye's Theorem, Applications.

Reference Books:

1. Cryptography & Network Security Hardcover – by Behrouz A. Forouzan
2. Cryptography and Network Security: Principles and Practice Hardcover – by William Stallings
3. Applied Cryptography: Protocols, Algorithms, and Source Code in C Paperback – by Bruce Schneier

Course outcomes: Acquire the basic knowledge of statistics for data science and various data science approaches. Acquire the basic knowledge of Machine learning.

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Course Code	Course Name	L	T	P	C
DCS514	**Cyber Security**	**3**	**0**	**0**	**0**

Course Learning Objectives:

Understand the fundamental concepts of cryptography, including encryption, decryption, keys, and basic mathematical concept for cryptography. Understand the basic cryptographic algorithm.

Course Content:

UNIT 1:
Information Security understanding, Security goals, Security attacks, Security services, security mechanisms.

UNIT 2:
Modular arithmetic, linear congruence, Algebraic structure, checking of primeness, quadratic congruence.

UNIT 3:
Symmetric cipher model, substitution ciphers, transposition ciphers, steganography.

UNIT 4:
Modern block ciphers, modern stream ciphers, Data Encryption standard, advanced encryption standard, Electronic code book mode, CBC, cipher feedback mode, output feedback mode.

UNIT 5:
Introduction to Public Key Cryptosystems, Prime Number, Galois Field, Euler Theorem, Euler Totient Function, RSA Key Generation, Encryption and Decryption using RSA, Digital Signature, Digital Certificate.

UNIT 6:
Introduction to Hashing, Hashing Functions, Properties of Hashing Function, Application of Hashing Functions, Secure Hash Algorithm, HMAC, Message Authentication Code.

Reference Books:

1. The Art of Data Science — Roger D. Peng & Elizabeth Matsui
2. Data Science From Scratch: First Principles with Python by Joel Grus, O'Reilly publication
3. Principles of Data Science - Third Edition by Sinan Ozdemir, Packt

Course outcomes: Understand the basic concepts, goals, and terminology of cryptography. Explain classical and modern encryption techniques and their applications.

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COURSE STRUCTURE

AND

SYLLABUS FOR

DIPLOMA PROGRAMMES

in

Electronics and Communication Engineering

(ECE)

Semester V

(APPLICABLE FROM AY 2024-2025 ADMITTED BATCH ONWARDS)

5th Semester / 3rd 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	DEC501	Embedded Systems	3	0	0	3	ECE
2	DEC502	Power Electronics	3	0	0	3	ECE
3	DEC503	Computer Networking and Data Communication or	3	0	0	3	ECE
4	DEC513	A. Industrial Automation B. Control System and PLC	3	0	0	3	ECE
5	DEC514	A. Internet of Things B. Optical Communication and Networking	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	DEC571	Embedded Systems Lab	0	0	2	1	ECE
7	DEC572	Power Electronics Lab	0	0	2	1	ECE
8	DEC573	Computer Networking and Data Communication Lab or	0	0	2	1	ECE
9	DEC591	Summer Internship-II (6 weeks) after 4th Semester	0	0	4	2	ECE
Total of B						**5**	
Grand Total (A+B)						**20**	

Semester:	**5**
Name of the program:	**Diploma in Electronics & Communication Engineering**
Course Title:	**Embedded Systems**
Course Credit:	3 (L: 3 T: 0 P: 0)

Course objective:	1. To get acquainted with embedded computing systems. 2. To understand the design flow of an embedded product life cycle. 3. Understanding the basics RTOS mechanism and available open source RTOS. 4. Develop the embedded firmware for small scale embedded systems. 5. Know how to solve the real world problems: modelling to prototype.
Course outcomes:	
Pre-requisites:	Microcontroller & C-Programming

Unit/ Module no.	**Topic**	**Nos. Of contact hours**	**Distribution of marks (out of 100)**
1	**Introduction to Embedded Systems:** i. Core of the embedded system, Memory, Sensors and Actuators, Communication Interface, Embedded firmware; Examples: Smart card, ECU, ADAS, Smart Watch ii. Characteristics and quality attributes (Design Metric) of	9	

	embedded systems. Real-time system's requirements, real-time issues, interrupt latency, Safety, Reliability, Robust Design. iii. Embedded Product development life cycle, life-cycle models. Program modeling concepts: UML: DFG, CDFG, FSM, Petri-net		
2.	**Embedded Hardware and Design:** i. Embedded RISC Processors: The ARM Design Philosophy, ARM Processor Families, Core Extensions, Architecture Revisions, ARM Cortex-M4 Processor. ii. Hardware accelerators- CPUs and accelerators, accelerator system design. iii. Memory Systems: RAM, ROM, types of RAM and ROM, Flash memory. Timing Analysis of Memory, Concepts of Caching iv. Sensors/Actuators/RF Modules	9	
3.	**Buses and I/O, Networking:** i. Onboard communication interfaces-I2C, SPI, CAN, parallel interface; ii. External communication interfaces-RS232 and RS485, USB, infrared, Bluetooth, Wi-Fi, ZigBee, GPRS, GSM iii. Study of basic communication protocols like SPI, SCI (RS232, RS485), I2C, CAN, LIN, Field-bus (Profibus), USB (v2.0), Bluetooth, Zig-Bee, BLE	9	
4.	**Embedded Firmware & RTOS Concepts:** i. Basic embedded C programs/applications, C Programs involving 8-bit AVR microcontrollers; Serial data transmission/ reception; programming with interrupts; SPI/I2C programming for EEPROM, ADC, DAC, RF Module. ii. Real-time Kernels & Operating System: Need for RTOS in Embedded System Software, types of operating systems, tasks, processes, and threads, multiprocessing and multitasking, task scheduling: Non-Preemptive and pre-emptive scheduling; task communication-shared memory, message passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/ Synchronization Issues, Task Synchronization Techniques. Event-driven programming. iii. Test and Debug: strategies for test and debug, JTAG, Scan, etc.	9	

Text Books:

S. No.	Title of Book	Author	Publication
1.	Embedded Systems	Frank Vahid	Wiley India, 2002
2.	Embedded System Design: A Unified Hardware/Software Introduction.	Frank Vahid & Tony Givargis,	Third Edition, John Wiley & Sons Inc., Reprint 2010
3.	Microcontrollers (ARM) & Embedded Systems	G.H. Raghunathan,	Cengage Learning

References Books:

SL. No.	Title of Book	Author	Publication
1.	Introduction to Embedded Systems	Shibu K. V	TMH
2.	Embedded Microcomputer Systems- Real-Time Interfacing	Jonathan W. Valvano	Cengage Learning; Third or later edition
3.	ARM System-on-Chip Architecture	Steve Furber	Second Edition, Pearson Education, India ISBN: 9788131708408, 8131708403, 2015
4.	A Beginner's Guide to Designing Embedded System Applications on Arm Cortex-M Microcontrollers	Ariel Lutenberg, Pablo Gomez, Eric Pernia	Arm Education Media, 2022

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Semester:	**5**
Name of the program:	**Diploma in Electronics & Communication Engineering**
Course Title:	**Embedded Systems lab**
Course Credit:	1 (L: 0 T: 0 P: 2)

Course objective:	
Course outcomes:	
Pre-requisites:	Nil

Unit/ Module no.	**Topic**	**Nos. of contact hours**	**Distribution of marks (out of 100)**
1		6	
2		6	
3		8	
4		6	
5		6	

6.		4	

Textbooks:

S. No.	Title of Book	Author	Publication
1.			
2.			

References Books:

SL. No.	Title of Book	Author	Publication
1.			
2.			

Semester:	**5**
Name of the program:	**Diploma in Electronics & Communication Engineering**
Course Code	**DEC502**
Course Title:	**Power Electronics**
Course Credit:	3 (L:3 T: 0 P: 2)

Course objective:	
Course outcomes:	7.
Pre-requisites:	Nil

Unit/ Module no.	**Topic**	**Nos. of contact hours**	**Distribution of marks (out of 100)**
1		6	
2		6	
3		8	
4		6	
5		6	

6.		4	

Textbooks:

S. No.	Title of Book	Author	Publication
1.			
2.			

References Books:

SL. No.	Title of Book	Author	Publication
1.			
2.			

Semester:	**5**
Name of the program:	**Diploma in Electronics & Communication Engineering**
Course Title:	**Power Electronics Lab**
Course Code	**DEC572**
Course Credit:	1 (L: 0 T: 0 P: 2)

Course objective:	
Course outcomes:	8.
Pre-requisites:	Nil

Unit/ Module no.	**Topic**	**Nos. of contact hours**	**Distribution of marks (out of 100)**
1		6	
2		6	
3		8	
4		6	

5		6	
6.		4	

Textbooks:

S. No.	Title of Book	Author	Publication
1.			
2.			

References Books:

SL. No.	Title of Book	Author	Publication
1.			
2.			

Semester:	**5**
Name of the program:	**Diploma in Electronics & Communication Engineering**
Course Code	**DEC503**
Course Title:	**Computer Networking and Data Communication**
Course Credit:	3 (L: 3 T: 0 P: 2)

Course objective:	
Course outcomes:	
Pre-requisites:	Nil

Unit/ Module no.	**Topic**	**Nos. of contact hours**	**Distribution of marks (out of 100)**
1		6	
2		6	
3		8	
4		6	
5		6	
6.		4	

Textbooks:

S. No.	Title of Book	Author	Publication
1.			
2.			

References Books:

SL. No.	Title of Book	Author	Publication
1.			
2.			

Semester:	**5**
Name of the program:	**Diploma in Electronics & Communication Engineering**
Couse Code:	**DEC573**
Course Title:	**Computer Networking and Data Communication Lab**
Course Credit:	1(L 0: T 0: P 2)

Course objective:	
Course outcomes:	9.
Pre-requisites:	Nil

Unit/ Module no.	**Topic**	**Nos. of contact hours**	**Distribution of marks (out of 100)**
1		6	
2		6	
3		8	
4		6	
5		6	

6.		4	

Textbooks:

S. No.	Title of Book	Author	Publication
1.			
2.			

References Books:

SL. No.	Title of Book	Author	Publication
1.			
2.			

Semester:	**5**
Name of the program:	**Diploma in Electronics & Communication Engineering**
Course Code:	**DEC513A**
Course Title:	**Industrial Automation**
Course Credit:	3(L 3: T 0: P 0:)

Course objective:	
Course outcomes:	10.
Pre-requisites:	Nil

Unit/ Module no.	**Topic**	**Nos. of contact hours**	**Distribution of marks (out of 100)**
1		6	
2		6	
3		8	
4		6	

5		6	
6.		4	

Textbooks:

S. No.	Title of Book	Author	Publication
1.			
2.			

References Books:

SL. No.	Title of Book	Author	Publication
1.			
2.			

Semester:	**5**
Name of the program:	**Diploma in Electronics & Communication Engineering**
Course Title:	**Control systems and PLC**
Course Code:	**DECE513B**
Course Credit:	3(L 3:T 0:P 3)

Course objective:	
Course outcomes:	11.
Pre-requisites:	Nil

Unit/ Module no.	**Topic**	**Nos. of contact hours**	**Distribution of marks (out of 100)**
1		6	
2		6	
3		8	
4		6	
5		6	
6.		4	

Textbooks:

S. No.	Title of Book	Author	Publication
1.			
2.			

References Books:

SL. No.	Title of Book	Author	Publication
1.			
2.			

Semester:	**5**
Name of the program:	**Diploma in Electronics & Communication Engineering**
Course Title:	**Internet of Things**
Course Code:	**DEC514A**
Course Credit:	3(L 3:T 0:P 3)

Course objective:	
Course outcomes:	12.
Pre-requisites:	Nil

Unit/ Module no.	**Topic**	**Nos. of contact hours**	**Distribution of marks (out of 100)**
1		6	
2		6	
3		8	
4		6	

5		6	
6.		4	

Textbooks:

S. No.	Title of Book	Author	Publication
1.			
2.			

References Books:

SL. No.	Title of Book	Author	Publication
1.			
2.			

Semester:	**5**
Name of the program:	**Diploma in Electronics & Communication Engineering**
Couse Code:	**DEC514B**
Course Title:	**Optical Communication and Networking**
Course Credit:	3(L 3: T 0: P 0)

Course objective:	
Course outcomes:	13.
Pre-requisites:	Nil

Unit/ Module no.	**Topic**	**Nos. of contact hours**	**Distribution of marks**

			(out of 100)
1		6	
2		6	
3		8	
4		6	
5		6	
6.		4	

Textbooks:

S. No.	**Title of Book**	**Author**	**Publication**
1.			
2.			

References Books:

SL. No.	**Title of Book**	**Author**	**Publication**
1.			
2.			

COURSE STRUCTURE

AND

SYLLABUS FOR

DIPLOMA PROGRAMMES

In FPT

Semester V

(APPLICABLE FROM AY 2024-2025 ADMITTED BATCH ONWARDS)

COURSE STRUCTURE

V SEM

5th Semester / 3rd 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	DFE501	FOOD ENGINEERING OPERATION-I	3	0	0	3	FET
2	DFE502	FOOD PRODUCT TECHNOLOGY-III	3	0	0	3	FET
3	DFE503	FOOD STORAGE AND PACKAGING	3	0	0	3	FET
4	DFE504	FOOD QUALITY CONTROL	3	0	0	3	FET
5	DFE505	INTRODUCTION TO MICROBIOLOGY	3	0	0	3	FET
6	DFE511	ELECTIVE-I BASICS OF FOOD PROCESSING WASTE MANAGEMENT	2	0	0	2	FET
Total of A			**17**	**0**	**0**	**17**	
B.		**Laboratory/Project/Seminar Courses**					
Sl No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	**Coordinating Department**
1	DFE571	FOOD PRODUCT TECHNOLOGY-II LAB	0	0	2	1	FET
2	DFE572	FOOD QUALITY CONTROL LAB	0	0	2	1	FET
3	DFE573	FOOD ENGINEERING LAB-I	0	0	2	1	FET
Total of B			**0**	**0**	**6**	**3**	
C.		**Audit/Non-credit Courses**					
Sl No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	**Coordinating Department**
Total of C							
Grand Total (A+B+C)			**17**	**0**	**6**	**20**	

DETAILED SYLLABUS

Name of the Programme:	Diploma in Food Processing Technology
Semester:	5

Course Code:	DFE501
Course Title:	FOOD ENGINEERING OPERATIONS – I
Course Credit:	3 (L: 3 T:0 P: 0)

Course objective:	1. To introduce the basic principles and classification of food processing unit operations. 2. To understand material and energy balance concepts applied in food processes. 3. To provide knowledge on equipment used for material handling and raw material preparation. 4. To demonstrate the principles and machinery involved in size reduction and size separation. 5. To familiarize with pasteurization, homogenization, emulsification, and filtration techniques in food systems.
Pre-requisites:	• Basic knowledge of food science • Elementary physics and chemistry • Introduction to food processing fundamentals
Course outcomes: *	Upon successful completion, students will be able to: 1. Explain the classification and role of various unit operations in food industries. 2. Apply material and energy balance concepts to different food processing operations. 3. Select proper material handling equipment depending on product characteristics. 4. Describe the working principle and applications of size reduction and separation equipment. 5. Identify and explain thermal and mechanical operations such as pasteurization, homogenization, emulsification and filtration used in food processing.

Unit/ Module no.	Topic	Nos. of contact hours	Distribution of marks (out of 100)
Unit I	**Introduction** • Introduction to Unit Operations — Concept of primary, secondary & tertiary operations in food processing	04	
Unit II	• Laws of conservation of energy, Material & energy balance for the processes,	08	
Unit III	• Material Handling: Conveyors, elevators; cleaning & handling of raw materials; selection & design of handling equipment	08	
Unit IV	• Size Separation, Equipment's for Solid-solid size separation. • Size Reduction — Laws of size reduction, Equipment for size reduction.	12	
Unit V	• Pasteurization, Homogenization, and Emulsification • Filtration, Filter media, filter beds, types of filter cake.	09	

References and Text Books

1. ***A. Chakraverty (2019),*** *Post-Harvest Technology of Cereals, Pulses and Oilseeds, 3rd Editio, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.*
2. ***Singh, K.K. & Sahay, A.K.-*** *Unit Operations of Agricultural Processing, (Latest Edition), Vikas Publishing House, New Delhi.*
3. ***D. G. Rao (2010).*** *Fundamentals of Food Engineering. PHI Learning Pvt. Ltd., New Delhi.*
4. ***Akash Pare & B. L. Mandhyan,*** *Food Process Engineering and Technology, Daya Publishing House / Astral International Pvt. Ltd., New Delhi.*

5. ***N. L. Kent; A. D. Evers (1994),*** *Technology of Cereals: An Introduction for Students of Food Science and Agriculture, 4th Edition., Pergamon Press (an imprint of Elsevier).*

6. ***R. P. Singh & D. R. Heldman*** *– Introduction to Food Engineering (Indian edition available)*

7. ***Toledo, R. T. (2018).*** *Fundamentals of Food Process Engineering (4th Edition), Springer, Cham.*

8. ***McCabe, W. L., Smith, J. C., & Harriott, P. (2005).*** *Unit Operations of Chemical Engineering (7th Edition). McGraw-Hill International Edition, New York.*

Name of the Programme:	Diploma in Food Processing Technology
Semester:	5

Course Code:	DFE502
Course Title:	Food Product Technology-III
Course Credit:	3 (L: 3 T:0 P: 0)
Course objective:	• Provide fundamental knowledge on the types and composition of market milk and methods for assessing milk quality in dairy plants. • Explain the principles and operations involved in milk processing techniques such as cream separation, pasteurization, homogenization, and UHT treatment. • Familiarize students with the production processes of various market milk types and recombined/reconstituted milks. • Develop understanding of the processing steps and technological aspects involved in manufacturing major dairy products like butter, cheese, paneer, condensed milk, and ice cream.
Pre-requisites:	-
Course outcomes:	After completion of this course, students will be able to • Describe the composition, classification, and quality parameters of market milk used in dairy processing. • Demonstrate understanding of milk processing operations and their influence on product quality and shelf life. • Differentiate between various types of processed and value-added milk products based on their composition and processing techniques. • Apply knowledge of dairy processing principles to outline the production steps of major dairy products and evaluate their quality attributes.

Unit/ Module no.	Topic	Nos. of contact hours
1	Types of market milk; Chemical composition; Receiving and quality assessing of liquid milk in dairy industry	10
2	Milk processing: Cream separation, Pasteurization- Batch Pasteurization, HTST Pasteurization, UHT processing. Homogenization of milk.	12
3	Production of different milk types: whole, standardized, toned, double-toned, and skim milk. Recombined, reconstituted, and flavored milks.	10
4	Processing of dairy products – cream, butter, cheese, paneer, condensed milk, evaporated milk, Ice cream, milk powder.	8

Text Books:

1. *S. De (2018). Outlines of Dairy Technology (44 th Ed.). Oxford University Press.*
2. *E. Spreer (2005). Milk and dairy product technology. New York: Marcel Dekker.*

Reference Books:

7. *H. D. Goff (2013). Dairy product processing equipment. In M. Kutz (Ed.), Handbook of farm, dairy and food machinery engineering (2nd ed., pp. 199–221). Elsevier.*
8. *R. P. Aneja, B. N. Mathur, R. C. Chandan, & A. K. Banerjee (2002). Technology of Indian milk products. New Delhi: A Dairy India Publication.*

Name of the Programme:	Diploma in Food Processing Technology
Semester:	5

Course Code:	DFE503
Course Title:	Food Storage and Packaging
Course Credit:	3 (L: 3 T:0 P: 0)

Course objective:	1. To understand food spoilage, shelf life and to reduce food spoilage 2. Brief preservation techniques and packaging functions 3. Selection of appropriate packaging techniques for different food, packaging material & machinery 4. Ensuring food safety, quality & complying with regulations
Pre-requisites:	---NA--
Course outcomes:*	After completion of this course students will 1. Understand preservation techniques & principles of packaging functions 2.Understand relationship between processing, packaging & food safety/quality and how to reduce food spoilage/wastage 3.Understand how packaging & preservation extend shelf life of food and maintain product integrity

Unit/ Module no.	Topic	Nos. of contact hours	Distribution of marks (out of 100)
1	Introduction to Food packaging, Deteriorative reactions in food, Shelf life of food, Food Storage, importance of scientifically devised storage systems to minimize loses of food	10	20
2	Functions of packaging and packaging materials, properties of different types of packaging materials: paper, plastics, metal, natural materials etc. and their application. Packaging requirements: Packaging requirements and their selection of various processes, viz. canning, dehydration etc. Packaging evaluation: WVTR, GTR, bursting strength, tensile strength, tearing strength drop test. Packaging environment: Inert gas, vacuum, aseptic, CAP and MAP. Packaging Machinery: Bottling, canning, form to fill and seal machines, bags and their manufacturing and closing	15	30

3	Aseptic packaging, Active and Intelligent packaging, Packaging of horticulture products, flesh food, dairy products, cereals, snacks, confectionary, beverages	15	40
4	Legislative aspects and environment impact of packaging	5	10

References:

1. Gordon L Robertson (2006): Food Packaging Principles and practice. CRC Press.
2. Hall C.W (1970): Handling and storage of food grains in tropical and subtropical areas. FAO Publications, Oxford and IBH Publication Company Pvt. Ltd.
3. Albert Lloyd Ryall and Wamer Flipton Ryall (1979): Handling, Transportation and Storage of Fruits and Vegetables. Avi Publishing Company.
4. Multon J.L (1989): Preservation and storage of grains, seeds and their by-products. CBS Publishers and distributors.
5. Mahadeviah M & R.V Gowramma (1996): Food packaging materials. Tata Mc Graw Hill Pub. Co. Ltd.

Name of the Programme:	**Diploma in Food Processing Technology**
Semester:	**5**

Course Code:	DFET504
Course Title:	Food Quality Control
Course Credit:	3 (L: 3 T:0 P: 0)

Course objective:	• To understand the basic concepts of **quality, quality control, and quality assurance** in the food industry. • To learn the **principles, functions, and attributes** (qualitative, hidden, and sensory) of food quality. • To comprehend the concept of **subjective and objective quality evaluation** and their applications. • To understand the **principles, benefits, and implementation of HACCP** (Hazard Analysis and Critical Control Points) in food safety management • To gain knowledge of food adulteration and **learn** simple and rapid methods for adulteration detection. • To learn the **principles and procedures for estimating** major food constituents such as **moisture, crude fat, protein, crude fiber, and ash**. • To understand the principles and objectives of sensory quality control in food evaluation. • To gain knowledge of Total Quality Management (TQM) and Total Quality Control (TQC**)** in food industries. • To acquaint with food quality management systems, food standards, regulations, specifications.
Pre-requisites:	Codes of the courses which may be listed as pre-requisites for this course (preferably from the earlier semester's curricula of the programme).
Course outcomes: *	After completion of this course students will **CO1:** Explain the fundamental concepts of **quality, quality control, and quality assurance** in food industries, and describe the principles, attributes, and significance of HACCP in ensuring food safety. *(Module 1)*

	CO2: Demonstrate understanding of **food analysis techniques**, identify common **food adulterants**, and perform basic estimations of **moisture, fat, protein, fiber, and ash** in food materials. *(Module 2)* **CO3:** Apply appropriate **sampling techniques and procedures** for different food materials and evaluate **physico-chemical and mechanical properties** influencing food quality. *(Module 3)* **CO4:** Conduct **sensory evaluation** using proper panel selection and interpret sensory data statistically for quality control applications. *(Module 4)* **CO5:** Explain the principles of **Total Quality Management (TQM)** and **Total Quality Control (TQC)** and describe the **objectives, requirements, and benefits of national and international food regulations and standards** (BIS, AGMARK, PFA, FPO, FAO, CODEX, WHO, ISO) *(Module 4)*

Unit/ Module no.	Topic	Nos. of contact hours	Distribution of marks (out of 100)
1	Introduction: Concept of quality, quality control and assurance, principles and functions of quality control, quality attributes (qualitative, hidden and sensory), plan and method of quality control within and outside the industry. Subjective and objective quality, HACCP; its benefits and application.	10	
2	Food Analysis: Objective and purposes of food analysis, food adulteration and simple and quick method of adulteration detection, methods and purpose of estimation of moisture, crude fat proteins, crude fiber and ash.	10	
3	Definition of sampling, purpose, sampling techniques requirements and sampling procedures for liquid, powdered and granular material. Physico-chemical and mechanical properties: Colour, flavour, consistency, viscosity, texture and their relationship with food quality.	10	
4	Sensory quality control: Definition, objectives, panel selection, Interpretation	10	

	of sensory results in statistical quality control, TQM and TQC. Food Regulations: Objectives, requirements and benefits of food grades and standards (BIS, AGMARK, PFA, FPO, FAO, CODEX, WHO, ISO).		

Textbooks:

T1.Quality Control in Food Industry (Vol.I& II) - Kramer &Twigg, AVI.
T2. Handbook of Analysis F&V products - Rangana, McGraw-Hill Publishing Co.
T3. Modern method of analysis - Stewart and Whittaker, Springer
T4. Sensory Evaluation Techniques - Morten, C. et.al.
T5. Food Analysis principle & technique - Dieter W., Geuwedit & Whitaker.
T6. Food Analysis: Theory and Practice – Pomeranz & Meloan, Springer.**2.**

References:

R1. R.L. Earle with M.D. Earle "Unit Operations in Food Processing", Web Edition, 2004.
R2. Caleb Ramirez, Kai Peters "Extraction Techniques for Food Processing", 2018.

E-Learning Courses for Reference:

E1.https://www.rpaulsingh.com/course/lectures/psychro2.html (Dr. R. Paul Singh, Distinguished Professor)
E2.https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=iWHzbXYGExXDS52DSnAzdQ== (e-PG Pathshala, Subject-Food Technology (329))

Name of the Programme:	Diploma in Food Processing Technology
Semester:	5

Course Code:	DFE505
Course Title:	Introduction to Microbiology
Course Credit:	3 (L: 3 T: 0 P: 0)

Course objective:	• To inculcate clear understanding of microorganisms with their primary structural and functional properties • To gain the primary concepts on microbial culture, growth, and how these are influenced by various factors • To acquire knowledge on primary applications and importance of microorganisms in nature, particularly in food sector • To develop a primary understanding on control and/or elimination of microorganisms
Pre-requisites:	NA
Course outcomes:*	After completion of this course, the students will – • have the concepts on primary structures and functions of microorganisms. • be able to discern the factors affecting microbial growth and survival. • possess a clear understanding the primary relevance of microorganisms in nature, in our society, and particularly in food sector.

Unit/ Module no.	Topic	Nos. of contact hours	Distribution of marks (out of 100)
1	Introduction to Microbiology: Definitions; history of microbiology; branches (food, industrial, medical, environmental); scope and significance in food processing. Overview of prokaryotes vs eukaryotes; morphology, structure and function of bacterial, fungal (yeasts & moulds), algal, protozoan cells; viruses (basic).	**8**	**20**

2	Microbial Nutrition, Growth & Metabolism Nutritional requirements of microorganisms; culture media types; methods of isolation & maintenance of pure cultures; microbial growth curve phases (lag, log, stationary, death); factors affecting microbial growth (intrinsic & extrinsic in food matrices).	**10**	**25**
3	Microbial Spoilage of Foods & Foodborne Pathogens: Sources of microorganisms in food; microbial flora associated with various food groups; spoilage mechanisms for cereals, pulses, dairy, fruits/vegetables; important foodborne pathogens (e.g., Salmonella, Listeria, Clostridium, viruses) and their control.	**10**	**25**
4	Microbial Control & Beneficial Microorganisms in Food Processing: Methods of microbial control: physical (heat treatment, irradiation, refrigeration), chemical (preservatives, sanitizer), pasteurization, sterilization, high-pressure processing; hurdle technology; beneficial microbes in fermentation (yoghurt, cheese, probiotics) and industrial food microbiology.	**10**	**30**

Suggested Textbooks / Reference Books:

1. Food Microbiology by W.C. Frazier & D.C. Westoff – Tata McGraw-Hill.
2. Modern Food Microbiology by J.M. Jay – Chapman & Hall.
3. Basic Food Microbiology by G.J. Banwart – CBS Publishers.

** 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 Engineering and Technology
Semester:	5

Course Code:	DFE511
Course Title:	Basics of Food Processing Waste Management
Course Credit:	2 (L: 2 T:0 P: 0)
Course objective:	1. To provide knowledge to identify the type and sources of waste generated from various sectors of food processing industry. 2. To impart knowledge on the characteristics of food processing wastes and their impact on the environment. 3. To learn various treatment processes of food industry effluents and solid waste and their final safe disposal methods. 4. To disseminate knowledge on the valorization of waste to convert them into valuable products. 5. To learn about the environmental regulations and standards for effluents and solid waste management.
Pre-requisites:	NA-
Course outcomes:	After completion of this course students will be able to 1. Identify types and sources of waste from food processing industries. 2. Characterize the waste in terms of various parameters. 3. Understand the treatment process of food waste effluents and solid food waste managements. 4. Explore utilization and value addition of wastes. 5. Understand and corelate legal and statutory requirements for food waste handling, treatment and disposal.

Unit/ Module no.	Topic	Nos. of contact hours	Distribution of marks (out of 100)
1	**Introduction to Food Waste:** Definition of waste, scope and importance of food processing waste management, classification of waste, sources of waste across various food processing sectors. Magnitude of food processing waste generation, social, economic, environmental challenges and opportunities related to food waste.	6	20
2	**Waste characterization:** Physical, chemical and biological characteristics of wastewater. Standards for emission or discharge of environmental pollutants from	5	15

	food processing industries covered under EPA Act., 1986. Waste management stages, waste prevention, minimization etc.		
3	**Wastewater treatment processes:** Overview of liquid waste generations in food processing industries, Preliminary treatment: screening, comminution, grit removal, flow equalization, floatation; primary treatment: sedimentation, coagulation, flocculation; secondary treatment: activated sludge process, lagoons, trickling filters, RBC, UASB, etc. and tertiary treatment: nitrogen and phosphorus removal, membrane process, electrodialysis, disinfection. Sludge management: Handling, treatment and disposal of sludge.	8	30
4	**Solid waste management:** Characteristics, types, treatment processes: composting, vermicomposting, thermal treatment, landfilling etc. regulatory requirements for treatment and disposal.	6	20
5	**Utilization of waste:** Valorization and value addition of wastes from different food processing sectors.	5	15

Reference Books:

1. Syed E. Hasan; Introduction to Waste Management, Wiley 2022
2. V.K. Joshi & Satish Sharma; Food Processing Waste Management: Treatment and Utilization Technology.
3. By- products from food industries: utilization and disposal by AFSI(I)

Name of the Program:	Diploma in Food Processing Technology
Semester:	5

Course Code:	DFE571
Course Title:	Food Product Technology-II Lab
Course Credit:	1 (L: 0 T:0 P: 2)

SL No	Title of the Experiment	Nos. of contact hours
1	To study about the cream separator.	2
2	Preparation of Paneer.	2
3	Preparation of Kalakand.	2
4	Preparation of Rasgulla.	2
5	Preparation of sweetened condensed milk.	2
6	Preparation of curd.	2
7	Determination of gluten content in flour.	2
8	Preparation of biscuits.	2
9	Preparation of bread.	2
10	Preparation of cake.	2

Name of the Program:	Diploma in Food Processing Technology
Semester:	5

Course Code:	DFET 572
Course Title:	Food Quality Control Lab
Course Credit:	1 (L: 0 T:0 P: 2)

SL No	Title of the experiment	Nos. of contact hours
1	Determination of pH and titratable acidity of non-alcoholic beverages.	2
2	Determination of total carbohydrate content in fruit and vegetable products.	2
3	Determination of moisture content fruit and vegetable products.	2
4	Viscosity Testing of Fruit and Vegetable Juices and Purees.	2
5	Colorimetric analysis of fruit and vegetable products.	2
6	Texture analysis of fruit and bakery products.	2
7	Determination of adulteration of food sample.	2
8	Crude fiber analysis of bakery products.	2
9	Dietary fiber analysis of processed food products.	2
10	Sensory quality analysis of processed food products.	2

Reference Books:

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

** 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:	5

Course Code:	DFE573
Course Title:	Food Engineering Lab-I
Course Credit:	1 (L: 0 T:0 P: 2)

SL No	Title of the Experiment	Nos. of contact hours
1	To study the operation of jaw crusher.	2
2	To study the operation of hammer mill.	2
3	To study the operation of roll crusher.	2
4	To study the operation of ball mill.	2
5	To study the operation of vibrating screen.	2
6	To study the construction and operation of plate and frame filter press.	2
7	To study the construction and operation of homogenizer.	2
8	To study the drying efficiency of hot oven drier, vaccum drier.	2

COURSE STRUCTURE

AND

SYLLABUS FOR

DIPLOMA PROGRAMMES

in

Control and Instrumentation (CAI)

under

Department of Instrumentation Engineering

Semester V

(APPLICABLE FROM AY 2024-2025 ADMITTED BATCH ONWARDS)

5th Semester Courses:

Course Code	Course Title	L	T	P	C	Contact Hours
DIE501	Process Control	3	0	0	3	3
DIE502	Electrical & Electronic Measurements	3	0	0	3	3
DIE503	Power Electronics	3	0	0	3	3
DIE504	Industrial Instrumentation-I	3	0	0	3	3
DIE505	Biomedical Instrumentation	3	0	0	3	3
DIE51X (PE)	Telemetry	3	0	0	3	3
	Optical Instrumentation	3	0	0		3
	Industrial Drives	3	0	0		3
DIE571	Process Control Lab	0	0	2	1	2
DIE572	Electrical & Electronic Measurements Lab	0	0	2	1	2
DIE573	Power Electronics Lab	0	0	2	1	2
		Total			**21**	

Course Name: Process Control

Course Code: DIE501 **Credit: 03**

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

The objective of this course is to:

1. **COB1:** Introduce the fundamental concepts of process control, control loop components, and instrumentation used in industrial automation.
2. **COB2:** Develop an understanding of different controllers, control strategies, and final control elements used in process industries.
3. **COB3:** Enable students to analyze process dynamics, model industrial processes, and apply controller tuning methods.
4. **COB4:** Familiarize students with advanced and modern control techniques including DCS, SCADA, safety systems, and multivariable process control.

Course Outcomes (COs)

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

1. **CO1:** Explain the basic principles of process control, control loop components, and instrument characteristics.
2. **CO2:** Select and apply suitable controllers (P, PI, PD & PID) and evaluate their performance for various industrial processes.
3. **CO3:** Analyze the dynamic behavior of processes, perform controller tuning, and design appropriate control strategies such as cascade, feedforward, and ratio control.
4. **CO4:** Demonstrate understanding of digital control systems, smart sensors, DCS, SCADA, and modern industrial automation architectures.

Detailed Syllabus

Introduction and Basic Control Concepts (6 Hours)

An introduction to Process Control, Control history, Manual control, Advantages of Process Control, Introductory concepts, Process Control and Process Management. P&ID symbols, SAMA representation of Control loops. Functional Structure of Feedback Control;

Sensors and Transmission Systems; Time constant, Accuracy, Precision, Sensitivity, Repeatability, Turndown, Transportation delay; Digital fieldbus; Smart Sensors.

Process Feedback Controllers (8 Hours)

Controllers, Two-position controller, Proportional controller, Integral control action, Derivative control action, PID controller, Reverse-acting and Forward-acting controller, Electronic PID controller.

Final Control Element (4 Hours)

Control valves, Actuators and Positioners; Linear stem valves; Flow characteristics; Rotary valves; Control valve sizing and selection; Control valve dynamic performance; Power fail-safe actions.

Process Dynamics and Control (6 Hours)

First-order lags; Interacting and Non-interacting stages; Closed-loop and Open-loop response. Tuning control systems – Process Reaction Method, Open-loop Method.

Special Purpose Concepts in Control (6 Hours)

Cascade, Ratio, and Dead-time control; Feedforward and Multivariable control; Override control; Selective control; Split-range control Industrial applications – Drum level control, Dahlin Algorithm. Statistical quality control, Hazardous area classification, Intrinsic safety.

Modern Control System Architecture (5 Hours)

Computers in process control, Digital control, Data logging (DAS), DCS, SCADA.

Prescribed Books / References

1. **Murrill, P.** *Fundamentals of Process Control Theory*. 3rd ed., ISA, 2000.
2. **Bhanot, S.** *Process Control: Principles and Applications*. Oxford University Press, 2008.
3. **Krishnaswamy, K.** *Process Control*. New Age International Publishers.
4. **Johnson, C. D.** *Process Control Instrumentation Technology*. 8th ed., Pearson Education, 2006.
5. **Anderson, N. A.** *Instrumentation for Process Measurement and Control*. 3rd ed., CRC Press, 1997.
6. **Stephanopoulos, G.** *Chemical Process Control: An Introduction to Theory and Practice*. Prentice Hall, 1984.
7. **Love, J.** *Process Automation Handbook*. Springer, 2007.

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Course Title: Electrical and Electronic Measurements **Course Code: DIE502**

Credit: 03 **Total contact hours: 36** **L-T-P: 3-0-0**

Course Objectives:

1. To introduce the fundamental principles and methods for measurement of electrical quantities.
2. To familiarize the idea of supports, control and damping in electromechanical instruments.
3. To provide the knowledge of different methods for measurement of different ranges of resistances and other electrical quantities such as inductance, capacitance and frequency.
4. To introduce the construction and working principle of electronic measuring instruments.

Module 1: Measurement of Voltage and Current (10 Hours)

Introduction to Electrical Instruments: Operating forces, constructional details, types of support, control and damping systems.

Galvanometers: Types of Galvanometers Construction, basic principles of working, errors, advantages and disadvantages.

Voltmeters and Ammeters: Construction, basic principle of working, errors, advantages and disadvantages of moving coil, moving iron (attraction and repulsion type), dynamometer type and electrostatic type instruments, True RMS meter.

Module 2: Measurement of Power and Energy (4 Hours)

Electrodynamometer type wattmeter: Basic principle of working, construction, errors, advantages and disadvantages.

Single Phase Induction type energy meter: Basic principle of working, construction, errors, advantages and disadvantages.

Module 3: Measurement of Resistance (7 Hours)

Measurement of low and medium resistance: Ammeter-voltmeter method, Substitution method, Wheatstone bridge method, Bridge sensitivity, Kelvin's Bridge method and Kelvin's double bridge method

Measurement of high resistance: Direct deflection methods, Loss of charge method and Megohm bridge method, Megger.

Module 5: Measurement of Impedance (7 Hours)

Measurement of inductance: Maxwell's bridge, Hay's bridge and Anderson's bridge.

Measurement of capacitance: De Sauty's and Schering Bridge.

Measurement of mutual inductance: Heaviside Mutual Inductance Bridge

Measurement of frequency: Wien's Bridge

Module 5: Electronic Instruments **(8 Hours)**

Analog and Digital Electronic Ammeters, Voltmeters and Function generator.

Cathode Ray Oscilloscope (CRO): study of oscilloscope subsystems and measurements, Digital Storage Oscilloscope (DSO).

Text Books:

1. A. K. Sawhney, 'A Course in Electrical and Electronic Measurements and Instrumentation', Dhanpat Rai & Co. (Pvt.) Ltd.
2. P. Purkait, B. Biswas, C. Koley, 'Electrical and Electronics Measurements and Instrumentation', McGraw Hill (India) Pvt. Ltd., 2017.
3. J. B. Gupta, 'A Course in Electrical and Electronic Measurements & Instrumentation', S. K. Kataria & Sons, Delhi.
4. David A Bell, 'Electronic Measurements and Instrumentation', Prentice-Hall of India Private Limited.

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

1. Learn the working of electrical measuring instruments, their advantages and disadvantages.
2. Understand the methods for measurement of different ranges of resistances.
3. Understand the principle and working of electronic instruments.

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COURSE NAME: POWER ELECTRONICS

COURSE CODE: DIE503

SEMESTER-V

Total Contact Hours: 36 Hours **L-T-P: 3-0-0**

Course Objectives:

1. To provide the students a basic understanding of power semiconductor devices and related circuits and their applications in power electronics system.
2. To familiarize students with the principles of operation, design, and synthesis of various power conversion circuits like rectifiers, inverters, and choppers.

Course Outcomes: Upon successful completion of the course, students are expected to be able to-

1. Describe the basic operation of power semiconductor devices and analyze their performance in various switching circuits.
2. Analyze and design power converter circuits, and select suitable power electronic devices based on application requirements.
3. Analyze the performance of single-phase and three-phase rectifiers, DC-DC converters, inverters and AC-AC converters for different types of loads.

Course Contents:

Module1- Power Semiconductor Devices: (6 Hours)

Introduction to Power Electronics System, Construction and working of Semiconductor switches (Diode, Power BJT, Power MOSFET and IGBT), Diode rectifier circuits with different types of load.

Module 2- Thyristor family: (12 Hours)

Construction and working of SCR and other pnpn devices from thyristor family (TRIAC, GTO, PUT, SCS etc…), Thyristor gate characteristics, Thyristor protection, SCR commutation techniques, SCR firing circuits (R, R-C and UJT triggering circuits).

Module 3- Phase Controlled Rectifiers: (5 Hours)

Principle of operation of single-phase half-wave controlled rectifiers with R, R-L, R-L with freewheeling diode and R-L-E loads.

Module 4- Choppers: (4 Hours)

Principle of operation, control strategies, step-up choppers and types of choppers circuits based on quadrant of operation.

Module5- Inverters and Power Supplies: (9 Hours)

Principle of operation, classification of inverters based on nature of input source and wave shape of output voltage, single-phase bridge inverter with R, R-L and R-L-C loads, methods of voltage control. D.C and A.C power supplies, Switched mode power supplies, resonant power supplies.

Books/References:

1. Power Electronics, Circuit Devices and Applications, by M. H. Rashid, PHI, 2017
2. Power Electronics by P.C. Sen, Tata McGraw Hills, 2017
3. Power Electronics, by Dr. P. S. Bhimbra, Khanna Publishing, 2022

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Course Title: Industrial Instrumentation – I Course Code: DIE504

Credits: 03 L-T-P: 3-0-0 Contact Hours: 36

Course Objectives (COB)

The objectives of this course are to:

COB1: Provide fundamental knowledge of various industrial process variables and their measurement techniques.

COB2: Explain the construction, working principles, and applications of mechanical, electrical, and electronic instruments used for force, torque, speed, acceleration, vibration, pressure, and temperature measurement.

COB3: Develop the ability to select appropriate transducers and measurement systems for industrial applications.

COB4: Familiarize students with calibration methods and standards for ensuring accuracy and reliability in industrial measurements.

Course Outcomes (COs)

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

CO1: Describe various process variables and explain the working principles of primary sensing elements used in industrial measurement systems.

CO2: Analyze and compare different instruments used for force, torque, speed, acceleration, vibration, pressure, and temperature measurement.

CO3: Select suitable measurement devices and interpret instrument characteristics for specific industrial requirements. **C**

O4: Apply calibration techniques and evaluate measurement accuracy for various industrial transducers and instruments.

Introduction (2 Hours)

Introduction to different process variables in industry, Construction and working of elastic elements: spring, bellow, diaphragm, bourdon tube, cantilever

Measurement of Force and Torque (5 Hours)

Force: Definition and unit, Load cell and its types: strain gauge, hydraulic, pneumatic, magnetoelastic and piezoelectric load cells

Torque: Definition and its unit, Torque meters and its types: mechanical, electrical and strain gauge torque meters

Measurement of Speed, Acceleration and Vibration (8 Hours)

Speed/Velocity: Definition and unit, Linear velocity measurement: electromagnetic transducers, Angular velocity measurement: tachometers: photoelectric, capacitive, inductive, drag cup type, stroboscope, D.C. and A.C tachogenerators.

Acceleration: Definition and its unit, Accelerometer and its types: potentiometric, LVDT, piezoelectric, strain gauge and capacitive accelerometers, mechanical type vibration instruments, seismic instruments as accelerometer, vibration sensor, calibration of vibration pickups.

Measurement of Pressure (9 Hours)

Pressure: Definition and its unit, classification of pressure measuring instruments with respect to pressure range. High pressure measurement: Bridgman gauge and pressure gauges or pressure transducers with bourdon tube and diaphragm. Medium pressure measurement: pressure gauges or pressure transducers with different elastic elements. Low pressure measurement: Direct methods: pressure gauges or pressure transducers with bourdon tube and diaphragms, manometers; Indirect methods: McLeod gauge, Thermal conductivity gauge, Ionization gauge; Calibration of pressure gauges: Dead weight tester.

Measurement of Temperature (9 Hours)

Temperature: Definition and its unit, Classification of thermometers: mechanical, electrical and optical thermometers. Mechanical thermometer: bimetallic thermometer, fluid filled in system thermometers: liquid filled, gas filled and vapour pressure; source of error and its compensation

in liquid filled system. Electrical thermometers: RTD-3 lead and 4 lead RTDs, Thermistor, Thermocouple and fabrication of industrial thermocouples. Optical thermometers: Radiation methods of temperature measurement, Total radiation pyrometer, optical pyrometer and fiber optic sensor for temperature measurement.

Measurement of pH (2 Hours)

pH: Definition, reference and glass electrodes, pH meter

Reference Books

1. **D. Patranabis**, *Principles of Industrial Instrumentation*, 3rd Edition, Tata McGraw-Hill Education, 2008.
2. **R. K. Jain**, *Mechanical and Industrial Measurements*, 12th Edition, Khanna Publishers, 2014.
3. **A. K. Sawhney**, *A Course in Mechanical Measurements and Instrumentation*, Dhanpat Rai Publications, 2015.
4. **E. O. Doebelin and D. N. Manik**, *Measurement Systems: Application and Design*, 5th Edition, McGraw-Hill, 2007.
5. **B. G. Lipták**, *Instrument Engineers' Handbook: Process Measurement and Analysis*, 4th Edition, CRC Press, 2003.
6. **John P. Bentley**, *Principles of Measurement Systems*, 4th Edition, Pearson Education, 2005.

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Course Title: Biomedical Instrumentation **Course Code: DIE505**

Credit: 03 **Total contact hours: 36** **L-T-P: 3-0-0**

Course Objectives:

1. To impart basic knowledge of human physiological systems and their analogy with electrical, mechanical, and biochemical signals.
2. To familiarize students with biopotential electrodes, transducers, and sensors used in medical diagnostics and therapeutic applications.
3. To explain the design and working of medical equipment such as ECG, EEG, EMG, blood pressure monitors, and patient monitoring and therapeutic systems.
4. To create awareness of safety standards and regulations required for biomedical instruments to ensure patient and operator protection.

Module 1: Introduction to Biomedical Instrumentation (4 Hours)

Basic concepts, Introduction to Man-Instrumentation System, Components of Man-Instrumentation System, Physiological systems of the body, Problems encountered in measuring a living system.

Module 2: Human Cell – Action Potential (6 Hours)

Cells and their structures, Characteristics of living organisms, General characteristics of a human cell, Resting and action potentials, Propagation of action potentials, The bioelectric potentials-ECG, EEG, EMG, EOG, ERG, EGG, Evoked potential and their applications.

Module 3: Biopotential Electrodes and Amplifiers (6 Hours)

Electrode Theory, The electrode – electrolyte interface, Electrode types- surface electrode, needle electrode, microelectrodes, Difference amplifier, Isolation amplifier, Instrumentation amplifier.

Module 4: Transducers and its selection criteria in the biomedical application (6 Hours)

Classification of transducer, selecting a transducer, general features of a biomedical instrumentation system, Transducers for parameters in biomedical applications: Displacement, Position and Motion transducer; Pressure transducer; Transducer for body temperature measurement; Photoelectric transducer; Optical fiber sensors; Biosensors; Smart sensors.

Module 5: The Cardiovascular System and Cardiovascular Measurements (7 Hours)

The heart and cardiovascular system, Blood pressure, Characteristics of blood flow, Heart sound, Electrocardiography - ECG waveform, 12 standard lead configurations and its block diagram , ECG recorder, Holter. Measurement of blood pressure, Measurement of blood flow and cardiac output, Plethysmography, Pulse oximetry, Measurement of heart sounds,

Module 6: Diagnostic and Therapeutic Equipment (6 Hours)

Generation of ionizing radiation, X-rays and radiography, X-ray computed tomography, Defibrillators, Pacemakers, Ventilators, Diagnostic ultrasound, Physics of ultrasonic waves, Medical ultrasound, and Basic pulse echo apparatus.

Books / References:

1. C. Raja Rao, and Sujoy K. Guha. Principles of medical electronics and biomedical instrumentation. Universities press, 2001.
2. Raghbir Singh Khandpur,. Handbook of biomedical instrumentation. McGraw-Hill Education, 1987.
3. Leslie Cromwell,. "Biomedical Instrumentation and Measurements, 2 Education, Feb.

1980. Ed."
4. Mandeep Singh,. Introduction to biomedical instrumentation. PHI Learning Pvt. Ltd., 2014.

Course Outcomes (CO):

After the completion the course students will able to

1. Understand the man-instrumentation system and .Demonstrate the use of different electrical instruments.
2. Identify and interpret various physiological signals (ECG, EEG, EMG, etc.) and understand their relevance.
3. Explain the working principles, components required in major biomedical instruments used for diagnosis, monitoring, and therapy.

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Course Title: Telemetry **Course Code: DIE511** **Credit: 03**
Total contact hours: 36 **L-T-P: 3-0-0**

Course Objectives:

- Understand basics of Telemetry Systems
- Analyze the Frequency and Time Division Multiplexed Systems
- Understand Satellite Telemetry
- Understand Optical Telemetry
- Know the Telecontrol techniques

Module 1: Introduction to Telemetry Principles (8 Hours)

Purpose of telemetry, basic scheme, voltage, current and frequency telemetry, line length limitations.

Symbols and codes-Bits and symbols, time function pulses, line and channel coding.

Module 2: Signals and Transmission Basics (7 Hours)

Introduction, Signals, Transmission Fundamentals, Amplitude Modulation, Frequency and Phase Modulations, Bandwidth.

Module 3: Multiplexing in Telemetry Systems (8 Hours)

FDM systems, IRIG standards, FM circuits, Phase modulation circuits, Phase Locked Loop, Mixers.

TDM systems- TDM- PAM, PAM- PM, TDM- PCM systems, differential PCM, PCM reception.

Module 4: Digital Modulation Techniques (7 Hours)

Modems, Digital modulation and Shift-keying, FSK, PSK, DPSK, QPSK, QAM.

Module 5: Satellite and Fiber Optic Telemetry (6 Hours)

Basics of satellite Telemetry- Satellite telemetry, TT and C services, subsystems, the earth station. Introduction to Fiber optic Telemetry

Books / References:

1. D. Patranabis, Telemetry Principles, TMH, New Delhi
2. Modern Digital and Analog Communication Systems by B.P. Lathi
3. Introduction to Analog and Digital Communication by Simon Hykin.

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

- Explain the concept of Basic System, Classification, non-electrical telemetry systems, Voltage and current Telemetry systems, Frequency Telemetering, Power line carrier communication.
- Design Phase Locked Local Loop, Mixers. Time Division Multiplexed System – TDM/PAM system.
- Understand satellite telemetry principles.
- Understand optical telemetry principles.
- Appreciate the application of different telemetry systems and control to any process.

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Course Title: Optical Instrumentation **Course Code: DIE512**

Credit: 03 **Total contact hours: 36** **L-T-P: 3-0-0**

Course Objectives:

1. To provide fundamental knowledge of light, optical principles, and optical components used in measurement and instrumentation systems.
2. To develop understanding of optical sources and detectors, including their characteristics, selection criteria, and applications in instrumentation.
3. To familiarize students with various optical instruments and devices such as spectrometers, interferometers, microscopes, and fiber-optic tools.
4. To introduce the principles and construction of optical fibers, including propagation, losses, and basic fiber-optic communication concepts.

MODULE 1: Fundamentals of Optics and optical fiber (5 Hours)

Nature and properties of light, Phenomena of: reflection, refraction. Mirrors, lenses. Optical materials and coatings, Introduction to fiber optics; Physical nature of optical fiber; types, numerical aperture, acceptance angle, Lasers: characteristics, types, applications.

MODULE 2: Photometry and Radiometry (4 Hours)

Concepts of luminous flux, intensity, illumination, Photometric units: lumen, lux, candela, Radiometric quantities: irradiance, radiance, Photometric sensors and their applications

MODULE 3: Optical Sources and Detectors (6 Hours)

Optical Sources: LEDs, laser diodes – construction, characteristics, Broadband sources, lamps (tungsten, xenon, halogen), Detectors: Photodiodes (PIN, Avalanche), Phototransistors, Photomultiplier tubes, CCD & CMOS image sensors, Performance parameters

MODULE 4: Optical Components and Instruments (7 Hours)

Lenses, prisms, filters, beam splitters, gratings, Interferometry: Michelson, Fabry–Perot interferometers, Polarizers and optical isolators, Spectrometers & monochromators – working and applications, Optical microscopes, telescopes and magnifiers

MODULE 5: Fiber-Optic Sensors (8 Hours)

Fiber construction and characteristics, Fiber-optic connectors, splices, and couplers, Optical communication basics: attenuation, dispersion, Fiber-optic sensors: Intensity-modulated sensors, Interferometric sensors, Fiber Bragg Grating (FBG) sensors, Applications in industry, healthcare & instrumentation.

MODULE 6: Measurement of optical properties (6 Hours)

Measurement of wavelength, power, intensity, Refractometry and colorimetry, Optical time-domain reflectometry (OTDR), Laser-based measurements: distance, velocity (Doppler), alignment.

Course Outcomes (CO): After the completion the course students will able to

CO1: Explain the fundamental principles of optics, optical materials, and light propagation used in optical measurement systems.

CO2: Describe the construction, characteristics, and operation of optical sources and detectors such as LEDs, laser diodes, photodiodes, and CCD/CMOS sensors.

CO3: Demonstrate an understanding of optical fiber structure, types, losses, and basic fiber-optic communication concepts.

CO4: Apply optical measurement techniques

Course Title: Process Control Lab **Course Code: DIE571** **Credit: 01**

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

List of experiments to be performed by the students for Process Control Lab

1. To study and Plot the Resistance-Temperature characteristics of RTD.
2. To study and Plot the Resistance-Temperature characteristics of Thermistors.
3. To study and Plot the Temperature-e.m.f Curves for Thermocouples.
4. To study the Input and Output Characteristics of LVDT. Determine the Sensitivity of LVDT. Also Measure the phase difference between two windings of LVDT.
5. To study the Strain Measurement using Strain Gauge and Cantilever Beam.
6. To calibrate the pH Meter using Buffer Solution and determine the PH Value of the given unknown solution.
7. Light Dependent resistor (LDR) characteristics.
8. To study the different controller characteristics.
9. To Control temperature, pressure, flow, level using PC with the help of different control modes.
10. To verify the operation of Control valves.
11. To Study the characteristics of a flapper nozzle Amplifier.
12. To verify the operation of I/P and P/I converters.

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Course Title: Electrical and Electronic Measurements Lab **Course Code: DIE572**
Credit: 01 **Total contact hours: 2/week** **L-T-P: 0-0-2**

Course Objectives:

1. To familiarize the study of electromechanical instruments.
2. To introduce the study the bridges for measurement of unknown electrical quantities
3. To familiarize the use of CRO and DSO for measurements and analysis of signals.

List of experiments to be performed

1. To study the working of PMMC and MI instruments.
2. To study the error and calibration in measuring instruments.
3. Measurement of unknown resistance using Wheatstone bridge.
4. Measurement of unknown resistance using Kelvin's bridge.
5. Measurement of unknown inductance using Maxwell's bridge.
6. Measurement of unknown capacitance using De Sauty's and Schering bridges.
7. Measurement of frequency using Wien's bridge.
8. Measurement of power using electrodynamometer type wattmeter.
9. Measurement of amplitude and frequency of voltage waveform using DSO.
10. Study of frequency response of op amp amplifier circuit using function generator and DSO.

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

1. Undergo measurements, calibration and error analysis.
2. Design bridge circuits and measure the unknown electrical quantities
3. Study the signals/voltage across components and analyze frequency response using

CRO/DSO.

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COURSE NAME: POWER ELECTRONICS

COURSE CODE: DIE573

SEMESTER-V

Total Contact Hours: 24 Hours **L-T-P: 0-0-2**

Course Objectives:

1. Familiarize students with the operation and characteristics of power electronic devices like SCRs, TRIACs, MOSFETs, and IGBTs.
2. Introduce students to the design and implementation of triggering and protection circuits for power devices.

Course Outcomes: Upon successful completion of the course, students are expected to be able to-

1. Relate theoretical knowledge of power electronics with practical results obtained through experiments.
2. Design and implement triggering and protection circuits for power semiconductor devices.
3. Students will develop practical skills to test and troubleshoot power electronic circuits.

List of Experiments-

1. Study of MOSFET Characteristics.
2. Study of IGBT Characteristics.
3. Study of SCR Characteristics with finding of Latching and Holding Current.
4. Study of Triac Characteristics with finding of Latching and Holding Current.
5. Study of SCR RR/RC- triggering.
6. Study of SCR based Half/Full-wave rectifiers.
7. Design and study of UJT/PUT based relaxation oscillator.
8. Study of Step-up/Step-down Chopper circuit.
9. Study of Half/Full-bridge Inverter circuit.
10. Study of Triac based Dimmer circuit.

COURSE STRUCTURE

AND

SYLLABUS FOR

DIPLOMA PROGRAMMES

in

Animation and Multimedia Technology (AMT)

under

Department of Multimedia Communication and Design

Semester V

(APPLICABLE FROM AY 2024-2025 ADMITTED BATCH ONWARDS)

Semester – 5

Sl. No.	Course Code	Course Name	L	T	P	C
01.	DMD501	Visual Effects & Compositing	2	0	0	2
02.	DMD502	Introduction to Gaming Theory	2	0	0	2
03.	DMD571	Visual Effects & Compositing Lab	0	0	8	4
04.	DMD591	Project – I (Minor Project)	0	0	24	12
05.	DMD51*	Elective – I	0	0	4	2
	Contact Hours: 40		**4**	**0**	**36**	**22**
Elective – I Subjects (Project Based)						
01.	DMD511	(El – I): *Creative Drawing Techniques*	0	0	4	2
02.	DMD512	(El – I): *Anatomy Study*	0	0	4	2
03.	DMD513*	Any other subject offered from time to time	0	0	4	2

Course Title: Visual Effects & Compositing **L-T-P-C: 2-0-8-6**
Course Code: DMD501 / DMD571

Definition, evolution, and categories of VFX (mechanical, optical, CGI), Role of VFX in enhancing narrative and visual storytelling, Concept of compositing and image layering, Alpha channels, mattes, and transparency, Node-based vs. layer-based compositing, Understanding pre-multiplied and straight alpha, Overview of compositing tools: Adobe After Effect, Chroma keying (green/blue screen) and background replacement, Matte extraction and garbage mattes, Rotoscoping tools and spline animation, 2D and 3D tracking for compositing and matchmoving, Integration of CGI elements into live-action footage, Introduction to Maya interface and dynamics module. Concepts of simulation in 3D space: particles, fluids, and rigid/soft bodies, Creating natural phenomena, fire, smoke, rain, explosions, and dust, Basic nCloth and nParticle simulations, Workflow for integrating dynamic simulations with compositing software, Understanding rendering passes (beauty, shadow, matte) for compositing, Principles of colour correction and grading, Light and colour matching for visual integration.

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

Text/Reference Books

1. "The Green Screen Handbook" by Jeff Foster.
2. "Maya Studio Projects Dynamics" by Toddo Palamar.
3. "The Visual Effects Arsenal" by Bill Byrne.
4. "Creative After Effects" by Angie Taylo.

Course Title: Introduction to Gaming Theory **L-T-P-C: 2-0-0-2**
Course Code: DMD502

Introduction to Video Games, History of Video Games, Definition of Play, Games as digital media, Game Studies, Narratology and Ludology, The Classification of video games, Game Types, Game Genres, Game Categories, AAA Games, Indie Games, MMOGs, Player Perspectives, Games and Learning. Introduction to Game Analysis, Cheat Codes and Hacks, Game Rules, Beyond the Rules of the game, Playing with the Rules, Interface and Immersion, Player Experience, Types of players, Hardcore Vs Casual Players, Gaming Identity. Gaming platforms, Gaming Hardware, Fictional Worlds, Games as Simulations, Gaming in Virtual Reality. Game Aesthetics, Criticism and Journalism, Game Culture: Communities, Violence, Nature and Significance of Play as a Cultural Phenomenon, Play and Work.

Text/Reference Books

1. "Understanding Video Games: The Essential Introduction – By Jonas Heide Smith, Simon Egenfeldt-Nielsen and Susana Pajares Tosca.
2. "The Ultimate History of Video Games" – by Steven Kent.
3. "The Art of Video Games: From Pac-Man to Mass Effect."
4. "The Art of the Video Game" – by Josh Jenisch.

Course Title: Project – I (Minor Project) **L-T-P-C: 0-0-24-12**
Course Code: DMD591

Students will be given a small project which may be a short movie, animated or live, graphic design-based project, technical skill-based project. etc. in proper pipeline, which will be executed under specific guide/mentor. The final output should reflect all production stages in details. The final output along with proper documentation and presentation should be submitted in complete form.

SUBMISSION:

- Project Report Documents
- Video of Documentary/Short Movie
- Final presentation

Course Title: Creative Drawing Techniques (Elective - I) **L-T-P-C: 0-0-4-2**
Course Code: DMD511

This course focuses on enhancing students' visual imagination, observational skills, and expressive capabilities through hands-on explorations in creative drawing. Students will engage in experimental and process-based drawing practices using diverse materials, tools, and techniques — including graphite, charcoal, ink, pastels, mixed media, and unconventional drawing instruments. The course encourages observation from life, memory, and imagination to develop an individual drawing language that blends accuracy with artistic expression. Emphasis will be placed on gesture drawing, texture studies, composition, abstraction, and conceptual visualization. Through guided studio sessions and project-based exercises, learners will produce a body of creative works culminating in a thematic portfolio or final project that demonstrates technical skill, creative thinking, and personal style.

Text/Reference Books

1. "Drawing on the Right Side of the Brain" – By Betty Edwards, Tarcher, 2012.
2. "Experimental Drawing, 30th Anniversary Edition: Creative Exercises Illustrated by Old and New Masters" – by Robert Kaupelis.
3. "The Complete Book of Mixed Media Art" – by Walter Foster Creative Team, Walter Foster Publications, 2018.

Course Title: Anatomy Study (Elective - I) **L-T-P-C: 0-0-4-2**
Course Code: DMD512

This purely practical and project-based subject aims to help students understand human and animal anatomy as a foundation for realistic and expressive character design, modeling, and animation. Students will study body proportions, skeletal and muscular structures, joint mechanics, and movement patterns through observational drawing, life studies, and digital anatomy references. The course emphasizes the artistic interpretation of anatomy rather than medical precision, enabling learners to translate anatomical understanding into dynamic poses, gestures, and believable character designs. Through sketching, clay modeling, and digital sculpting exercises, students will develop a strong visual sense of form, balance, and motion.

Projects and Practice:
Students will complete a series of practical assignments including life drawing sessions, muscle and bone studies, gesture drawings, animal motion studies, and anatomical breakdowns of existing animated characters. The course culminates in a final project where students produce a comprehensive anatomy-based character sheet or sculpt that demonstrates both structural accuracy and creative stylization.

Text/Reference Books

1. "Human Anatomy for Artists: The Elements of Form" – By Eliot Goldfinger, Oxford University Press, 1992.
2. "Animal Anatomy for Artists: The Elements of Form" – By Eliot Goldfinger, Oxford University Press, 2004.
3. "Classic Human Anatomy: The Artist's Guide to Form, Function, and Movement" – By Valerie L. Winslow, Watson Guptill, 2008.